Are There Age Differences in Intraindividual Variability in Working Memory Performance?

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It has been suggested, primarily based on response time (RT) data, that there is an age-related increase in intraindividual variability. To determine whether older adults show more intraindividual variability in working memory (WM) performance, we had younger and older adults perform three verbal WM tasks of varying complexity as well as a same–different judgment RT task. For both groups, individual performance tended to be more variable on the two complex span tasks than on the simple span task. Although older adults showed greater variability on the RT task, consistent with previous studies, they did not show greater variability on any of the WM tasks. These findings fail to support theories of frontal lobe aging that predict greater moment-to-moment fluctuations in the performance of older adults.

To a large extent, research on cognitive aging has focused on differences in the average performance of younger and older adults. Relatively little is known, however, about age differences in intraindividual variability in performance apart from the well-documented finding of greater variability in the response times (RTs) of older adults, relative to younger adults (e.g., Myerson & Hale, 1993; Rabbitt, 1979, 2000; Salthouse, 1993; Smith, Poon, Hale, & Myerson, 1988). In particular, the possibility of age differences in short-term fluctuations in performance on memory span tasks has received little attention.

Strauss, MacDonald, Hunter, Moll, and Hultsch (2002) suggested that intraindividual variability provides a behavioral index of neurological integrity on the basis of their finding that intraindividual variability in RTs distinguished between older adults with and without dementia. With respect to normal aging, Hultsch, MacDonald, and Dixon (2002) reported age differences in intraindividual variability on four RT tasks after they statistically controlled for differences in mean performance. Importantly, they also found that intraindividual variability in RTs predicted scores on nonspeeded cognitive tasks such as episodic memory and working memory. In a follow-up study, MacDonald, Hultsch, and Dixon (2003) found that the initial measurements of intraindividual variability in RTs predicted change in performance of nonspeeded cognitive tasks over a 6-year period.

Rabbitt, Osman, Moore, and Stollery (2001) found that intraindividual variability in older adults’ RTs is related to higher order cognitive functions. Variability was greater among those with lower intelligence test scores. They also found that individual differences in variability were stable across 36 weekly sessions. In light of this stability, it is of interest that over the 6-year period examined in the study by MacDonald and colleagues (2003), increases in intraindividual variability predicted the degree of cognitive decline.

There is neuropsychological evidence to suggest that frontal lobe damage affects intraindividual variability (Stuss, Murphy, Binns, & Alexander, 2003). Given that the frontal lobes are more sensitive to the effects of aging than other areas of the neocortex (Moscovitch & Winocur, 1992; Raz, 2000), researchers have hypothesized that age-related changes in variability arise from changes in frontal lobe function (Li & Lindenberger, 1999; Li, Lindenberger, & Frensch, 2000; West, Murphy, Armilio, Craik, & Stuss, 2002).

Li and her colleagues reported that several findings in the cognitive aging literature (e.g., lower performance levels, dedifferentiation, and increased susceptibility to interference) can be described by a neural network model that simulates the effects of decreased catecholaminergic levels in the prefrontal cortex and other brain structures (Li & Lindenberger, 1999; Li et al., 2000). Importantly, Li’s catecholaminergic modulation model also leads to the prediction that intraindividual variability increases with age. Manipulation of the model’s gain parameter mimics changes in the signal-to-noise ratio, and decreases in this ratio produce poorer asymptotic performance, greater dedifferentiation, and increased intraindividual variability.

West and colleagues (2002) proposed that age-related declines in prefrontal cortex function produce decreased stability of executive control. These researchers predicted that, as a consequence, a task requiring more executive control would show larger age differences in intraindividual variability than would a task requiring less executive control. To test their frontal lobe hypothesis of cognitive aging, they compared the intraindividual variability of younger and older adults’ RTs on immediate and one-back digit-identification tasks. Consistent with their hypothesis, intraindividual variability was similar for younger and older adults on the immediate identification task, but older adults were more variable than younger adults on the one-back task, which presumably required more executive control.

Working memory tasks provide a convenient means to test hypotheses regarding relations between age, variability, and frontal lobe function. There is a general consensus that the prefrontal cortex plays an important role in working memory (D’Esposito & Postle, 2002), and its susceptibility to aging is well established (Moscovitch & Winocur, 1992; Raz, 2000). Therefore, if intraindividual variability reflects prefrontal cortical function, as the theories proposed by Li and West both assume, then age differences in variability should be observed on working memory tasks.
To test this prediction, in the present study we compared younger and older adults’ performance on three verbal working memory tasks: a simple span task, a complex span task requiring reorganization of memory items, and a complex span task involving a secondary task that interferes with verbal working memory. Participants also performed a same–different judgment RT task.

Li’s catecholaminergic modulation model (Li & Lindenberger, 1999; Li et al., 2000) and West’s frontal lobe hypothesis (West et al., 2002) lead to several predictions pertinent to the present study. Although these theories postulate different mechanisms of age-related change in frontal lobe function, nevertheless they both lead to the prediction that older adults should perform at lower levels and exhibit greater intraindividual variability than younger adults on working memory tasks. West’s frontal lobe hypothesis also leads to the prediction that age-related differences in intraindividual variability should be greater for the complex span tasks than for the simple span task because they require more executive control. Finally, previous findings from studies of age differences in RTs (e.g., Myerson & Hale, 1993; Rabbitt, 1979, 2000; Salthouse, 1993; Smith et al., 1988) suggest that older adults will exhibit greater intraindividual variability than younger adults on the same–different judgment RT task.

Methods

Participants

Thirty younger adults (20 women, 10 men) and thirty older adults (16 women, 14 men) participated in the study. We recruited younger adults (ages 18–22 years; \( M = 19.5, SD = 1.25 \)) from an undergraduate pool maintained by Washington University’s Department of Psychology and older adults (ages 71–81 years; \( M = 76.1, SD = 3.18 \)) from a pool maintained by the department’s Aging and Development Program. The older adults reported more years of education (\( M = 15.8, SD = 2.27 \)) than did the younger adults (\( M = 13.3, SD = 1.12 \)); \( t(54) = 5.27 \) and \( p < .001 \). Younger adults received course credit for participating; remuneration for older adults was $20.

We gave participants a health questionnaire to screen for medical conditions known to affect cognitive performance and excluded them if they reported certain neurological problems (e.g., stroke or Parkinson’s disease), medical problems (e.g., diabetes or thyroid disease), or depression. We tested near visual acuity with a Wormington Test Card (Gulden Ophthalmics, Elkins Park, PA), and we excluded those unable to easily perceive the stimuli for the experimental tasks.

Apparatus

We used Super Lab Pro software (Cedrus Corp., San Pedro, CA) to program computer administration of the working memory tasks and the RT task. We presented stimuli on a 17-in. (43-cm) color monitor positioned at a comfortable viewing distance (approximately 60 cm). For the RT task, participants used a two-button serial mouse to report their decisions (Microsoft Corp., Redmond, WA). Responses for the working memory tasks were vocal, and we recorded them both by hand and with a cassette recorder with a built-in microphone (Model TCM-2000V, Sony Corp. of America, New York City, NY).

Tasks

One potential problem in comparing variability on simple and complex working memory tasks is that performance may be worse on the complex span tasks. If so, and if variability were greater on these tasks, it would be unclear whether the difference in variability was due to the difference in complexity or the difference in difficulty (as indexed by the levels of performance). In the present experiment, therefore, we selected the working memory tasks so as to minimize the potential confound between task complexity and difficulty.

For example, one complex span task used in our laboratory involves having participants name the colors of memory items, and this procedure results in lower spans than when color-naming is not required (e.g., Jenkins, Myerson, Hale, & Fry, 1999). To get around this problem, we made use of a recent finding by Emery, Myerson, and Hale (2002, 2004). They observed that presenting letters and numbers in an organized fashion (numbers in ascending order followed by letters in alphabetical order: e.g., 1, 3, 5, A, F, Z) leads to higher spans for both younger and older adults relative to spans for unorganized letters and numbers, although younger adults benefit more than older adults from this manipulation. These results suggested that complex color-naming spans for organized items might be similar to simple spans for unorganized items, and therefore we used these procedures in the present study. Emery and colleagues also found that, when people reorganized the memory items themselves, this resulted in spans higher than or equal to simple spans for letters and numbers (although again, younger adults benefited more than older adults), making letter–number sequencing an excellent second complex span task for the present purpose.

Simple letter–number span task.—At the beginning of each trial, the center of the monitor showed a red plus sign for 750 ms; for the next 750 ms, the screen was blank. Then a series of alternating digits and letters (excluding 0, I, O, and U) appeared one at a time (e.g., W, 4, Z, 3, A, 6) within a 45 mm × 45 mm square. Each item was presented in black on a light gray screen for 1,750 ms, followed by a 750-ms interstimulus interval. The first item was a letter on half of the trials and a number on the other half of the trials. Following the last item, a green square, 30 mm × 30 mm, appeared in the center of the screen. This cued participants to recall the series of letters and numbers in the order in which they were presented.

Letter–number sequencing span task.—The presentation of stimuli for this task was identical to that for the simple letter–number span task, but participants were instructed to report the numbers first in ascending numeric order, followed by the letters in alphabetical order (e.g., after seeing the series W, 4, Z, 3, A, 6, participants were supposed to say “3, 4, 6, A, W, Z”).

Note that the present task differs from the letter–numbering sequence subtest of the third edition of the Wechsler Adult Intelligence Scale (WAIS-III; see Psychological Corporation, 1997) in several respects, including the visual presentation of memory items, which occurred at a much slower rate than in the WAIS-III subtest.
Color-naming span task.—Presentation of stimuli for this task was identical to that for the simple letter–number span task, except that items were red, blue, or green, and numbers were presented in ascending order, followed by letters in alphabetical order (e.g., 3, 4, 6, A, W, Z). Participants were instructed to say the color of each item as it was displayed, and then to report the items in the order in which they had been presented.

Same–different judgment response time task.—Participants decided if two characters presented on the computer monitor were from the same category. There were two categories: letters (e.g., D, S, and T) and nonletter symbols, including numbers (e.g., 5, *, and &). Participants were instructed to press the right button on the mouse if both characters were from the same category, and the left button if they were from different categories.

A red plus sign presented in the center of the monitor for 750 ms signaled the beginning of each trial. After a variable foreperiod of 500, 750, or 1000 ms, two characters, approximately 20 mm in height, appeared side by side in a 108 mm × 56 mm rectangle. The centers of the characters were separated by approximately 27 mm. After participants responded, the rectangle and characters were replaced with the red plus sign, signaling the beginning of the next trial. On incorrect trials, feedback was provided by means of a brief tone.

Procedure

The experimenter obtained consent, health information, and demographic data from the participants individually and then administered the near visual acuity test. Next, the experimenter read the instructions (which were also displayed on the monitor) for the same-different judgment task aloud. The instructions informed the participants that they were to respond as rapidly and as accurately as possible. Once participants understood this task, they completed 8 practice trials after which, if they had no questions, they completed the experimental trials. Otherwise, the experimenter gave the participants the instructions again and allowed them to repeat the practice trials. There were 80 experimental trials: 40 trials in which one character was a letter and one was a nonletter symbol (requiring a “different” response), 20 trials in which both characters were letters (requiring a “same” response), and 20 trials in which both characters were nonletter symbols (also requiring a “same” response). The computer presented the trials in the same random order to each participant and instructed her or him to respond as rapidly and as accurately as possible.

After the participants were given a short break, they performed the three working memory tasks in one of six orders, counterbalanced across participants. For each task, the experimenter read the instructions (which were also displayed on the monitor) aloud. Once participants understood the task, they completed four practice trials (two with a series length of two characters and two with a series length of three characters). Next, they completed the experimental trials in five blocks of nine trials each. Within each block, each series length (from 2 to 10 items) occurred once, in a random order that varied from block to block. There were breaks of approximately 5 min between the working memory tasks.

RESULTS

Working Memory Span

We calculated each individual’s span for each working memory task by first determining the probability of a correct response for each series length and then regressing the probability of being correct on a series length over the range for which probability was a decreasing function of length. Finally, we solved the resulting regression equation to estimate the series length at which the probability of a correct response was .50, and we took this value as the measure of an individual’s working memory span (Jenkins, Myerson, Joording, & Hale, 2000).

A 2 (age) × 3 (task) repeated measures analysis of variance (ANOVA) indicated significant main effects of age, F(1, 58) = 89.98, p < .001, η² = .45, and task, F(2, 116) = 31.12, p < .001, η² = .28, as well as an Age × Task interaction, F(2, 116) = 9.03, p < .001, η² = .02. We conducted follow-up analyses comparing each complex span task to the simple span task to explicate this interaction. Consistent with previous results (Emery et al., 2002, 2004), our results showed that having to reorganize memory items in the letter–number sequencing span task resulted in increased spans for both groups, both ts > 2.89, both ps < .01, with younger adults showing a larger increase than older adults. Having to name the colors of the items resulted in complex spans that were lower than simple spans for the older adults, t(29) = 5.28, p < .001, but not for the younger adults, whose simple spans were slightly lower than their color-naming spans, although not significantly so, t(29) = 1.92, p = .064. Overall, our attempt to avoid confounding performance with task complexity was mostly successful in that, for both groups, spans on the simple letter–number span task were not higher than those on the complex letter–number sequencing task, and simple spans were not higher than color-naming spans for younger adults, although they were for older adults.

Practice or fatigue effects were a concern because systematic improvements or declines in performance could inflate measures of intraindividual variability. Accordingly, we conducted contrasts based on the proportion of correct trials to test for trends in performance across blocks (see Figure 1). These contrasts revealed no significant linear or quadratic trends such as would be expected if practice or fatigue effects were present. Furthermore, there were no significant interactions with age or task.

Variability in Working Memory

 Measures.—We measured intraindividual variability in working memory performance in two ways. One measure, called Block SD, focused on fluctuations in performance across blocks. To measure Block SD for each individual on each task, we determined the number of correct trials for each of the five blocks, and then we calculated the standard deviation of these scores. The more moment-to-moment variability there was in the processes involved in performing a working memory task, the more fluctuation one would expect to see from block to block. There were breaks of approximately 5 min between the working memory tasks.
block in the number of trials correct, and this fluctuation would be reflected in a larger standard deviation.

The other measure of intraindividual variability focused on the range of series lengths over which an individual’s performance was inconsistent. We calculated the range measure of variability as the difference between the series length that marked the end of consistently correct recall (i.e., no shorter series were ever incorrectly recalled) and the series length marking the beginning of consistently inaccurate recall (i.e., no longer series were ever correctly recalled). If the processes involved in performing a working memory task were completely reliable, one might expect performance to be consistently accurate until the limits of capacity were reached, at which point performance would drop precipitously. This situation would be manifested as a small range of inconsistency, whereas if the processes involved in the task were less stable, one would expect a larger range of inconsistent performance.

Calculation of the range measure may be explicated by the following example. Imagine two individuals for whom the series length marking the beginning of consistently inaccurate recall was the same (i.e., neither individual could remember a series of eight items or longer). One of these individuals could consistently recall all series up to six items in length, and thus the range of inconsistency for this individual would be 2 (i.e., $8 - 6$). The other individual could consistently recall series up to three items in length, beyond which recall on some larger series became inconsistent, and thus the range of inconsistency for this individual would be 5 (i.e., $8 - 3$).

It should be noted that it would be possible for both of these hypothetical individuals to have the same Block SD (i.e., their performance could be equally variable across blocks, even though it differed in the range of inconsistency). Thus, the range measure can capture information about variability that the Block SD does not, and the reverse is also true (i.e., individuals could have the same range of inconsistency but different Block SDs). Although in the present study the two variability measures were correlated (rs for simple, color-naming, and letter–number sequencing tasks were .427, .475, and .358, respectively; all ps < .005), in principle one might find age differences in one measure but not the other because these correlations were only moderate in strength.

**Variability across blocks (Block SD).**—Intraindividual variability on the three working memory tasks, as assessed with the Block SD measure, is presented in the upper panel of Figure 2. A 2 (age) $\times$ 3 (task) repeated measures ANOVA on the Block SD data indicated a main effect of task, $F(2, 116) = 10.42$, $p < .001$, $\eta^2 = .11$. Neither the effect of age nor the Age $\times$ Task interaction were significant, $F(1, 58) = 2.91$, $p = .09$ and
F(2, 116) = 2.62, p = .08, respectively. We conducted planned comparisons to test the hypothesis that performance is more variable on complex span tasks than it is on simple span tasks. For the younger adults, the mean Block SD on the simple letter-number span task was 0.80, compared with 1.12 on the complex color-naming span task, t(29) = 3.30, p < .01, and 0.87 on the complex letter-number sequencing span task, t(29) = 0.81. For the older adults, the mean Block SD on the simple letter-number span task was 0.68, compared with 0.93 on the complex color-naming span task, t(29) = 2.73, p < .05, and 0.96 on the complex letter-number sequencing span task, t(29) = 4.18, p < .001. In sum, younger adults showed less variability on the simple span task than did they on the complex color-naming span task, and older adults showed less variability on the simple span task than they did on either complex span task.

Range.—Intraindividual variability on the three working memory tasks, as assessed with the range measure, is presented in the lower panel of Figure 2. A 2 (age) × 3 (task) repeated measures ANOVA on the range data indicated a main effect of task, F(2, 116) = 54.60, p < .001, η² = .28. The main effect of age was not significant, F(1, 58) = 0.90, p > .05, but there was a significant Age × Task interaction, F(2, 116) = 7.90, p = .001, η² = .05. To explicate the interaction, we conducted post hoc tests on the three working memory tasks separately. Younger adults were more variable than were older adults on the complex color-naming span task, t(28) = 3.50, p < .005, but there was no significant age difference on the other two tasks. Planned comparisons indicated that for both age groups, performance was more variable on the two complex span tasks than on the simple span task. For the younger adults, the mean range was 3.33 on the simple letter–number span task, compared with 6.30 on the complex color-naming span task, t(29) = 8.99, p < .001, and with 4.83 on the complex letter–number sequencing span task, t(29) = 4.31, p < .001. For the older adults, the corresponding values were 3.63 on the simple letter–number span task, as compared with 5.00 on the complex color-naming span task, t(29) = 4.48, p < .001, and with 5.13 on the complex letter–number sequencing span task, t(29) = 4.53, p < .001.

Variability in Response Time

Younger adults’ RTs (M = 986.0 ms) on the same–different judgment task were faster than older adults’ RTs (M = 1533.8 ms), t(58) = 7.20, p < .001. Younger adults were also more accurate (M = 7.2 errors) than older adults (M = 13.5 errors), t(58) = 4.35, p < .001, indicating that their faster RTs were not due to a speed–accuracy trade-off. Younger adults had smaller intraindividual standard deviations than older adults (M = 322.9 vs M = 690.3), t(58) = 5.38, p < .001, but (as may be seen in Figure 3) hierarchical multiple regression revealed that age was unrelated to variability after we statistically controlled for differences in RT, ΔR² < .0005, F(1, 57) = 0.05, ns.

DISCUSSION

The age differences in both RTs and working memory span that we observed in the present study are consistent with previous findings (e.g., Cerella & Hale, 1994; Salthouse, 1994). Although older adults showed greater intraindividual variability in RTs, consistent with previous studies (e.g., Hultsch et al., 2002; Myerson & Hale, 1993; Salthouse, 1993; West, 2002), they did not show greater variability on any of the working memory tasks. Both theoretical frameworks (i.e., the catecholaminergic modulation model and the frontal lobe hypothesis of cognitive aging) evaluated in this study correctly predict the observed age-related decreases in memory span. Both frameworks also predict age-related increases in intraindividual variability in working memory performance, but the present findings failed to support these predictions.

Taken together with the age differences in working memory span, the age differences in both mean RT and intraindividual variability on the same–different judgment task suggest that the older adults in this study were not atypical. Nevertheless, the older adults did not perform more variably than did the younger adults on any of the working memory tasks. Our failure to find age-related increases in intraindividual variability on these tasks appears not to be due to an inability of the measures used to reveal differences, because we did observe significant task differences in variability. For both range and Block SD, individual performance tended to be more variable on the complex span tasks than on the simple span task. The only significant age difference in intraindividual variability in working memory performance was the larger range of inconsistent performance in younger than in older adults on the complex color-naming span task, which is the opposite of what might have been expected.

It may be noted that both intraindividual variability measures assess the absolute amount of variability, not the amount of variability relative to the size of the mean. We have focused on the absolute amount of variability because, except in one case, working memory spans were not correlated with either of the variability measures. It is true that, when measures of mean and variability are correlated, as is the case with RTs, one must consider this relationship when interpreting differences in variability. Moreover, one must take into account any relationship between mean and variability, regardless of whether this relationship is positive or negative. Indeed, one might have expected a negative correlation between memory span and...
variability based on findings with respect to RTs, because poorer performance corresponds to longer RTs on speeded tasks, but it corresponds to lower spans on working memory tasks. Although the choice of measurement scale can be a complex issue, when mean and variability measures are uncorrelated, the implication is that the absolute, rather than the relative, amount of variability is the appropriate measure. Accordingly, we have based our interpretation of the effect of age on variability in memory span performance primarily on the absolute size of age differences in variability, because of the general lack of correlation with mean span.

The one exception to the general lack of correlation concerns older adults’ performance on the color-naming span task. Older adults’ memory spans were lowest on this task, and their individual range measures (but not their Block SDs) were positively correlated with their memory spans, whereas this was not true for the younger adults. These results are consistent with a floor effect in the older adult color-naming variability data, which could explain why younger adults were more variable in this condition. Another possibility is that the younger adults adopted a different strategy on the color-naming span task, one that was more variable than that used by the older adults.

The fact that younger adults had equivalent simple and color-naming spans whereas older adults had color-naming spans that were lower than their simple spans may appear to support the different-strategies interpretation. However, previous findings in our laboratory (Emery et al., 2002, 2004) suggest a different interpretation. Recall that for the simple span task, randomly selected letters alternated with randomly selected numbers, whereas for the complex color-naming span task, numbers were presented in ascending order followed by letters in alphabetical order. We had the memory items for the complex color-naming span task presented in this way because such organization facilitates memory performance. As noted previously, however, Emery and colleagues found that younger adults benefit more than do older adults from having memory items organized. As a result, for the younger (but not the older) adults, the effect of organization may have compensated completely for the interference caused by color-naming, giving rise to the observed pattern of memory spans. Regardless of the explanation for the results on the color-naming span task, however, we would stress that there is nothing in the present findings to suggest that older adults are more variable than younger adults when performing working memory tasks.

Why, given the numerous studies reporting age differences in intraindividual variability, did older adults not show greater intraindividual variability than younger adults in working memory performance? As we alluded to earlier, most studies reporting differences in intraindividual variability have used RT measures, whereas the present study is the first to examine intraindividual variability in working memory span. Thus, one possibility is that there is an age-related increase in intrapersonal variability, but that it is restricted to speeded performance. The question then becomes what underlies this restriction, given that there is little reason to believe that speeded tasks rely more heavily on frontal lobe function than do working memory tasks. One potential explanation is that age differences in intraindividual variability in RTs simply reflect the fact that intraindividual variability in RTs, like between-individual variability (e.g., Hale, Myerson, Smith, & Poon, 1988), increases with the mean RT (Myerson & Hale, 1993; Shammi, Bosman, & Stuss, 1998). Thus, age differences in the variability of speeded performance could be a simple consequence of age-related slowing.

Some researchers (e.g., Myerson & Hale, 1993; Shammi et al., 1998) have found that, although older adults show greater intraindividual variability in RTs than do younger adults, controlling for age-related slowing eliminates this difference. Their results are similar to the present finding that controlling for differences in mean RT by use of hierarchical multiple regression eliminated the age difference in intraindividual variability on the same–different judgment task. In contrast, Hultsch and his colleagues (Hultsch et al., 2002, MacDonald et al., 2003) have reported age differences in intraindividual variability on RT tasks that were not eliminated by controlling for age differences in mean levels of performance. Furthermore, on the basis of ex-Gaussian analyses of individual RT distributions, West and colleagues (2002) concluded that older adults’ performance was more variable. There also is evidence that intraindividual variability in RTs may account for unique variance on nonspeeded cognitive tests (e.g., Hultsch et al.; MacDonald et al.; Rabbitt et al., 2001) and for unique variance in fluid, but not crystallized abilities (Li et al., 2004).

Although only further studies can resolve this contradiction, the present results and those of previous studies (Myerson & Hale, 1993; Shammi et al., 1998) at least raise the possibility that age differences in intraindividual variability on RT tasks may be a statistical artifact, and that older adults show no more variability in either RT or working memory span than do younger adults. Regardless of how this issue is resolved, it should be noted that, as in previous studies, in the present study we found greater intraindividual variability in older adults’ raw RTs than we did in those of younger adults. Thus, the present failure to find age differences in variability on working memory tasks seems unlikely to be attributable to sampling error.

In conclusion, we found no evidence that older adults exhibit greater intraindividual variability in performance than do younger adults on any of the working memory tasks, although the complex span tasks (i.e., color-naming span and letter-number sequencing span) tended to yield more variable performance than the simple span task (i.e., letter-number span) for both age groups. The null results regarding age differences in intraindividual variability on working memory tasks have interesting implications for theories that predict such differences. Although we found no age differences in intrapersonal variability in the current project, the working memory tasks were limited to the verbal domain. Given the pattern of differential decline in the verbal and visuospatial domains (e.g., Jenkins et al., 2000; Myerson, Emery, White, & Hale, 2003; Myerson, Hale, Rhee, & Jenkins, 1999), it would be prudent for future researchers to examine the possibility of domain differences in the relationship between age and intrapersonal variability.

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