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Research Article

Mind-Wandering Across the Age Gap: Age-Related Differences in Mind-Wandering Are Partially Attributable to Age-Related Differences in Motivation

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Abstract

Objectives: A common finding in the mind-wandering literature is that older adults (OAs) tend to mind-wander *less frequently* than young adults (YAs). Here, we sought to determine whether this age-related difference in mind-wandering is attributable to age-related differences in motivation.
Method: YAs and OAs completed an attention task during which they responded to thought probes that assessed rates of mind-wandering, and they provided self-reports of task-based motivation before and after completion of the attention task.
Results: Age-related differences in mind-wandering are partially explained by differences in motivation, and motivating YAs via incentive diminishes mind-wandering differences across these groups.
Discussion: We consider these results in the context of theories on age-related differences in mind wandering, with a specific focus on their relevance to the recently proposed motivational account of such age-related differences.

Keywords: Aging, Mind-wandering, Motivation, Older and young adults, Task-unrelated thought

In the literature on mind-wandering,[1] there is an intriguing finding that has been consistently observed: rates of mind-wandering *decrease* with increasing age (Jordão, Ferreira-Santos, Pinho, & St Jacques, 2019; Maillet & Schacter, 2016). This finding has perplexed researchers because (a) mind-wandering has been commonly construed as an executive-control failure (e.g., McVay & Kane, 2010), and (b) a wealth of research has indicated that OAs tend to have less executive control than YAs (Foster, Cornwell, Kisley, & Davis, 2007). Thus, one might reasonably expect that rates of mind-wandering should *increase*—not decrease—as people age.

Although this age-related difference in mind-wandering continues to puzzle researchers, it may be that OAs experience decreased rates of mind-wandering because they have increased motivation to perform well on laboratory tasks (referred to here as the "motivational account"; e.g., Jackson & Balota, 2012). Consistent with this view, Frank, Nara, Zavagnin, Touron, and Kane (2015) found that, after completing a reading task, OAs

[1] We conceptualized mind-wandering as *task-unrelated thought*, and operationally defined it for participants as such (Seli, Kane, et al., 2018).

reported higher levels of task-based motivation than did YAs, which partially mediated the relation between age and mind-wandering during the task (see also Seli, Maillet, et al., 2017). Here, we tested the motivational account of age-related differences in mind-wandering while improving on prior designs in several important ways. First, we collected data from a much larger pool of participants than did Frank and colleagues (2015), who relied on a relatively small sample (with 36 YAs and 40 OAs). Second, whereas Frank and colleagues only collected post-task motivation levels (raising the possibility that motivation ratings were biased by performance), we collected both pre- and post-task motivation reports. Third, rather than exclusively examine correlations between motivation and rates of mind-wandering (as did Frank and colleagues), we also manipulated participant motivation (via monetary incentives) to determine whether this manipulation affects YA's and OA's rates of mind-wandering.

In addition, our design allowed us to determine whether OAs modulate their mind-wandering as task demands fluctuate. Previous work (Seli, Carriere, et al., 2018) has explored YAs' tendency to modulate their mind-wandering during a task whose demands vary throughout: the Mind-Wandering-Clock-Task (MWCT). For this task, which we employ here, participants view an analog clock and are instructed to press a button each time the clock's hand points at 12 o'clock. Importantly, the clock's hand points at 12 o'clock once every 20 s, which makes this event predictable and creates fluctuations in the momentary demands of the task: during the first 19 s of each revolution, demands are constant and low because participants simply have to view the clock; however, during the 20th second of each revolution, participants have to make a button press within a restricted timeframe, which leads to an increase in demand. Seli, Carriere, et al. predicted that, if participants (in their case, YAs) modulate their mind-wandering on a moment-to-moment basis, then shortly after each critical event, their rates of mind-wandering should be relatively high since the next critical event is expected not to occur for 20 s (i.e., they should be able to mind-wander without consequence because task demands are low). Moreover, they predicted that as the next critical event became more imminent (as the increase in task-demand drew nearer), participants would engage in less mind-wandering to prepare for the critical event. Their results supported these predictions, and also showed that participants who mind-wandered more frequently during the MWCT did not tend to perform more poorly on the task than those who mind-wandered less frequently. Although these results suggest that YAs strategically modulate their mind-wandering as task demands vary, no research to date has examined this possibility in OAs. Here, we explore whether and how OAs modulate their rates of mind-wandering across momentary changes in task demands.

Method

Participants

Participants were recruited via Amazon Mechanical Turk (MTurk) using TurkPrime to preselect participants based on age and having completed at least 100 human intelligence tasks (HITs) with at least an 80% approval rate. Participants and were paid $2 for completing the study, which lasted approximately 25 min. For our "young" groups, participants' age ranged from 18 to 35; for our "older" groups, participants were aged 65 or older. For each of the four groups (young-bonus; young-no-bonus; older-bonus; older-no-bonus), we decided, in advance, to collect data from 120 participants (total N = 480).[2] Separate HITs were launched for each age group and bonus condition. Data from both age groups were collected simultaneously, but the no-bonus and bonus conditions were collected sequentially, starting with the no-bonus condition. Participants who completed any other HIT in the series were restricted from completing any other HITs. As in Seli, Carriere, et al. (2018), it was determined, in advance, that we would exclude from our analyses data from participants whose error rates on the MWCT were three or more interquartile ranges away from the mean. Consequently, we removed data from one participant in the "older-bonus" group, two from the "older-no-bonus" group, seven from the "young-bonus" group, and eight from the "young-no-bonus" group. Postexclusion mean ages and sex distributions were: (a) older-bonus: mean age = 68.96, 73 men, (b) older-no-bonus: mean age = 68.29, 69 men, (c) young-bonus: mean age = 28.88, 55 men, and (d) young-no-bonus: mean age = 29.31, 58 men. This study received approval by the University of Waterloo, Office of Research Ethics.

The Mind-Wandering Clock Task

The primary stimulus for the MWCT was an analog clock face, presented on a black background on a computer monitor, which consisted of a white circle and a line segment extending from the center of the circle and terminating just short of the circle outline (Figure 1). The diameter of the outer clock circle was 192 pixels. Pivoting around the center of the circle, the line segment (i.e., clock hand) rotated clockwise in 18-degree ticks. Thus, a full revolution of the hand from the 12-o'clock position back to the same position took 20 ticks. The

[2] We arrived at this number by considering the maximum amount of money we were comfortable spending while also reasoning that any effects that are too small to be observed with N ~ 480 are not of interest to us. Although we preregistered our design and analyses, after receiving reviewer feedback, we opted to change our analytic approach, and the framing of our article. For the sake of full disclosure, we nevertheless provide a link to the original preregistration plans: https://osf.io/rg9ma/.

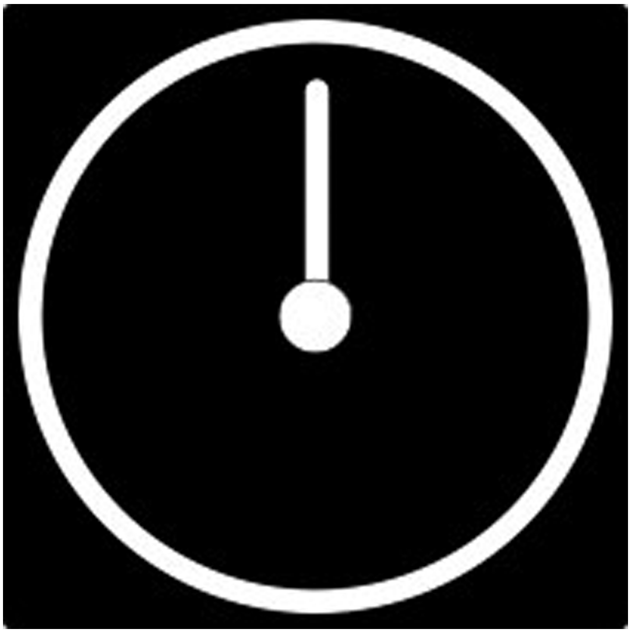

Figure 1. Simplified clock face with hand pointed at the 12 o'clock position. The diameter of the clock face was 192 pixels. The clock's hand made a complete revolution every 20 s.

hand ticked once every second and, during the experiment, the hand made 60 revolutions. Participants were to press the spacebar as quickly as possible each time the hand reached 12-o'clock. At the beginning of the task, the hand appeared in the 12-o'clock position and the movement of the hand was initiated after a 3-s delay. Following the scoring procedure outlined in Seli, Carriere, et al. (2018), responses that occurred in the interval ranging from 50 ms before the hand struck the 12 o'clock position to 500 ms after striking that position were counted as correct responses; this was done to account for both potential momentary errors in timing accuracy of the program (as timing accuracy cannot be strictly controlled in a web browser) and potential anticipatory responses on the part of participants due to the rhythmic nature of the task. Participants in the "bonus" groups (older-bonus, and young-bonus) were also told an additional payment of $0.02 USD was added to their compensation for every correct response (maximum bonus = $1.20).

Thought Probes

Thought probes were presented throughout the MWCT to sample mind-wandering. Twenty probes were pseudorandomly presented such that five probes occurred while the hand travelled through each of the four quadrants of the clock face. Only one probe could appear within a single rotation of the clock and they were forced to appear once in each quadrant before any quadrant could be repeated (see Seli, Carriere, et al., 2018). When a probe was presented, the clock stopped ticking and the participant was presented with the following instruction: "Just now, were your thoughts on or off task? Remember, being off task is thinking about anything unrelated to the task." Participants chose from one of the following response options: (a) On task, (b) Intentionally mind-wandering, or (c) Unintentionally mind-wandering (Seli, Cheyne, Xu, Purdon, & Smilek, 2015). Once the participant responded, the probe disappeared and the clock resumed after a 500-ms delay. (The distinction between intentional and unintentional mind-wandering was included for exploratory purposes and will not be discussed further.[3] Instead, throughout the article, we examine "overall rates of mind-wandering," i.e., the sum of intentional and unintentional reports.)

Self-Reported Motivation and Multitasking

In all four groups, we assessed participants' motivation to perform well during the MWCT. This was done immediately after the practice session with the following question: "Before you begin, how motivated would you say you are to press the spacebar as soon as the hand reaches the 12 o'clock position? Please be as HONEST and ACCURATE as possible." Motivation was again assessed upon completion of the MWCT with the following question: "How motivated were you to press the spacebar as soon as the hand reached the 12 o'clock position? Please be as HONEST and ACCURATE as possible" (Seli, Carriere, et al., 2018). Participants responded by moving a 100-point analog slider scale, which ranged from 0 = "Not at all motivated" to 100 = "Extremely motivated."

For exploratory purposes, after completing the second motivation question, participants completed several questions regarding their media multitasking behavior (Ralph & Smilek, 2017; Seli, Carriere, et al., 2018): (a) "While you completed the clock task do you feel you were regularly multitasking? (e.g., listening to music, watching videos, browsing websites, etc.)"; and (b) "About how much of the time were you multitasking?" (These questions will not be discussed further.)

Procedure

Participants were assigned to one of the four groups: (a) young-bonus, (b) young-no-bonus, (c) older-bonus, and (d) older-no-bonus. Next, they were given instructions to familiarize them with the requirements of the MWCT. Additionally, participants were given descriptions of three mental states they might experience during the task: (a) their attention might *remain on task*, defined as thinking about something related to the clock task and nothing else;

[3] Analyses revealed no significant differences between intentional and unintentional mind-wandering, so we report only analyses using overall rates of mind-wandering.

Table 1. Descriptive Statistics for Motivation, Presented Separately for Young and Older Adults, and for the Bonus and No-bonus Conditions

Age group	Bonus	*n*	Motivation	Minimum, Maximum	Skewness	Kurtosis
Older	No	118	**91.23** *(16.51)*	[0, 100]	−3.86*	17.46*
	Yes	119	**92.03** *(16.05)*	[0, 100]	−3.79*	17.56*
Younger	No	112	**78.95** *(27.71)*	[0, 100]	−1.53	1.48
	Yes	113	**87.50** *(19.49)*	[10, 100]	−1.91	3.56

Note: Means (bold) and *SD* (italics), *$p < .05$.

Table 2. Descriptive Statistics for MWCT Errors, Presented Separately for Young and Older Adults, and for the Bonus and No-bonus Conditions

Age group	Bonus	*n*	Errors	Minimum, Maximum	Skewness	Kurtosis
Older	No	118	**0.10** *(0.12)*	[0.00, 0.58]	1.85	3.20
	Yes	119	**0.08** *(0.12)*	[0.00, 0.62]	2.36*	5.38*
Younger	No	112	**0.14** *(0.13)*	[0.00, 0.58]	1.11	0.67
	Yes	113	**0.11** *(0.14)*	[0.00, 0.62]	1.75	2.62

Notes: Means (bold) and *SD* (italics). MWCT = Mind-Wandering-Clock-Task, *$p < .05$.

(b) their thoughts might *intentionally wander*, defined as intentionally choosing to stop focusing on the task; and (c) their attention might *unintentionally wander*, defined as having your thoughts drift away despite your best intentions to stay focused.

Before completing the experimental trials, participants completed two trials (i.e., two revolutions of the clock hand around the clock). Participants were given feedback concerning their accuracy. Next, participants were given the first motivation probe. After responding to the motivation probe, they completed another 60 trials of the MWCT, after which they responded to the second motivation probe.

Primary Measures

Primary performance measures included clock-task errors, overall rates of mind-wandering, and task-based motivation. Errors occurred when participants failed to produce a response within 500 ms of the hand reaching the 12 o'clock position (as noted above, responses occurring within 50 ms prior to the hand reaching the 12 o'clock position were also scored as correct). Rates of overall mind-wandering were calculated, for each quadrant of the clock face, as the proportion of times participants reported intentional or unintentional mind-wandering to the thought probes. Motivation reflected the response to the *pretask* motivation probes.[4]

[4] To avoid Frank et al.'s concern that task performance may bias responses to a motivation probe presented after the task, all analyses were restricted to responses to the pretask motivation probe.

Results

In Tables 1 and 2, we present descriptive statistics for self-reported motivation and MWCT errors, respectively, for each of the four groups (young-bonus; young-no-bonus; older-bonus; older-no-bonus). In Tables 3 and 4, we present descriptive statistics for mind-wandering rates and intentionality rates of mind-wandering episodes in each of the four quadrants of the MWCT for each of the four groups. Because skewness and kurtosis of self-reported motivation exceeded acceptable ranges (skew < 2, kurtosis < 4; Kline, 1998), we used the rank-based inverse normal transform to effectively normalize the data. However, results of analyses including the transformed data did not statistically differ from those including the non-normal data, and thus to retain the natural means and standard deviations, we included the nontransformed data in all analyses reported below. In what follows, we examine self-reported motivation and MWCT error rates across the four groups, followed by an examination of potential differences in mind-wandering rates across the four quadrants of the MWCT among these groups.

Motivation

We examined self-reported motivation across the four groups using a 2 (Age: young, older) × 2 (Bonus: yes, no) ANOVA. There was a significant main-effect of Age, $F(1, 458) = 19.65$, $p < .001$, $\eta_p^2 = .04$, a significant main-effect of Bonus, $F(1, 458) = 6.07$, $p = .01$, $\eta_p^2 = .01$, and a significant interaction between Age and Bonus, $F(1, 458) = 4.18$, $p = .04$, $\eta_p^2 = .01$. Tukey-adjusted pairwise comparisons revealed that, whereas for YAs, motivation was higher in the bonus group ($M = 87.5$, $SD = 19.5$)

Table 3. Descriptive Statistics for Mind-Wandering Across the Four Quadrants, Presented Separately for Young and Older Adults, and for the Bonus and No-bonus Conditions

Age group	Bonus	Quadrant	*n*	Mind-wandering	Minimum, Maximum	Skewness	Kurtosis
Older	No	1	118	**0.28** *(0.30)*	[0, 1]	0.97	0.00
		2	118	**0.32** *(0.32)*	[0, 1]	0.70	−0.68
		3	118	**0.33** *(0.33)*	[0, 1]	0.67	−0.86
		4	118	**0.29** *(0.29)*	[0, 1]	0.92	0.02
	Yes	1	119	**0.22** *(0.25)*	[0, 1]	0.95	0.05
		2	119	**0.30** *(0.29)*	[0, 1]	0.70	−0.47
		3	119	**0.31** *(0.30)*	[0, 1]	0.70	−0.52
		4	119	**0.29** *(0.28)*	[0, 1]	0.76	−0.41
Younger	No	1	112	**0.39** *(0.31)*	[0, 1]	0.43	−0.86
		2	112	**0.47** *(0.35)*	[0, 1]	0.06	−1.30
		3	112	**0.43** *(0.34)*	[0, 1]	0.24	−1.18
		4	112	**0.39** *(0.32)*	[0, 1]	0.38	−1.02
	Yes	1	113	**0.26** *(0.29)*	[0, 1]	1.05	0.23
		2	113	**0.38** *(0.33)*	[0, 1]	0.45	−0.94
		3	113	**0.38** *(0.35)*	[0, 1]	0.44	−1.22
		4	113	**0.29** *(0.31)*	[0, 1]	0.88	−0.20

Note: Means (bold) and *SD* (italics).

Table 4. Descriptive Statistics for Intentionality of Mind-Wandering Episodes Across the Four Quadrants, Presented Separately for Young and Older Adults, and for the Bonus and No-bonus Conditions

Age group	Bonus	Quadrant	*n*	Intentionality	Minimum, Maximum	Skewness	Kurtosis
Older	No	1	118	**0.51***(0.44)*	[0, 1]	−0.03	−1.72
		2	118	**0.50** *(0.43)*	[0, 1]	0.03	−1.69
		3	118	**0.55** *(0.45)*	[0, 1]	−0.19	−1.78
		4	118	**0.45** *(0.42)*	[0, 1]	0.21	−1.61
	Yes	1	119	**0.48** *(0.46)*	[0, 1]	0.09	−1.84
		2	119	**0.40** *(0.41)*	[0, 1]	0.35	−1.53
		3	119	**0.39** *(0.42)*	[0, 1]	0.40	−1.53
		4	119	**0.42** *(0.43)*	[0, 1]	0.33	−1.63
Younger	No	1	112	**0.44** *(0.43)*	[0, 1]	0.23	−1.62
		2	112	**0.42** *(0.40)*	[0, 1]	0.33	−1.45
		3	112	**0.43** *(0.40)*	[0, 1]	0.22	−1.52
		4	112	**0.45** *(0.42)*	[0, 1]	0.16	−1.64
	Yes	1	113	**0.41** *(0.43)*	[0, 1]	0.38	−1.62
		2	113	**0.42** *(0.43)*	[0, 1]	0.27	−1.65
		3	113	**0.40** *(0.42)*	[0, 1]	0.43	−1.50
		4	113	**0.40** *(0.44)*	[0, 1]	0.45	−1.59

Note: Means (bold) and *SD* (italics).

than in the no-bonus group (M = 78.9, SD = 27.7), $t(458)$ = 3.15, SE = 0.03, p = .002, there was no significant difference in OAs between the bonus (M = 92.0, SD = 16.1) and no-bonus (M = 91.2, SD = 16.5) groups, $t(458)$ = .30, SE = 0.03, p = .76. Additionally, while OAs were significantly more motivated than YAs in the no-bonus group, $t(458)$ = .12, SE = 0.03, p < .0001, there was no significant difference in motivation between OAs and YAs in the bonus group, $t(458)$ = .05, SE = 0.03, p = .09.

Errors

We assessed whether there were differences in the frequency of errors on the MWCT across the four groups using a 2 (Age: young, older) × 2 (Bonus: yes, no) logistic mixed-effects model with random intercepts for subject (Bates, Mächler, Bolker, & Walker, 2015). There was a significant main-effect of Age, with YAs (M = 0.13, SD = 0.33) making more errors than OAs (M = 0.09, SD = 0.29), β = −0.25, OR = 0.78, SE = 0.07, z = −3.52, p < .001, a significant main effect of Bonus, with more errors in the no-bonus group (M = 0.12, SD = 0.33) compared to the bonus group (M = 0.09, SD = 0.29), β = 0.24, OR = 1.27, SE = 0.07, z = 3.36, p < .001, and a nonsignificant interaction between Age and Bonus, β = −0.05, OR = 0.95, SE = 0.07, z = −.67, p = .50.

To determine whether age-related differences in errors are accounted for by differences in self-reported motivation levels, we ran a mediation analysis using the *mediation* package in R (Tingley, Yamamoto, Hirose, Keele, & Imai, 2014). Confidence intervals were computed using 1,000 simulations of quasi-Bayesian approximation. This procedure samples a multivariate normal distribution over the maximum-likelihood estimates of the regression parameters to calculate robust confidence intervals without the computational cost of fully Bayesian inference or bootstrapping methods (Tingley et al., 2014). As expected, there was a significant total effect of Age on errors, ATE = 0.042, confidence interval (CI) = [0.018, 0.07], p < .001. However, the average causal mediation effect, ACME = 0.004, CI = [−0.0004, 0.01], p = .074, the proportion mediated, Prop. Mediated = 0.10, CI = [−0.01, 0.32], p = .074, were both nonsignificant, and the average direct effect of Age on errors remained significant, ADE = 0.04, CI = [0.01, 0.06], p < .01, suggesting that motivation does not mediate age-related differences in errors.

Similarly, to determine whether bonus-related differences in error frequency are accounted for by differences in self-reported motivation levels, we ran a parallel mediation analysis. As expected, there was a significant total effect of Bonus on errors, ATE = −0.039, CI = [−0.06, −0.02], p = .002. However, the average causal mediation effect, ACME = −0.003, CI = [−0.01, 0.00], p = .052, and the proportion mediated, Prop. Mediated = 0.06, CI = [−0.001, 0.23], p = .052, were both significant, and the average direct effect of bonus on errors remained significant, ADE = −0.037, CI = [−0.06, −0.01], p < .001, suggesting that motivation does not mediate bonus-related differences in errors.

Mind-Wandering

Finally, we investigated whether there were differences in mind-wandering across the four quadrants of the MWCT between the groups using a 2 (Age: young, older) × 2 (Bonus: yes, no) × 4 (Quadrant: 1, 2, 3, 4) logistic mixed-effects model with random intercepts for subject and successive contrasts for Quadrant. There was a significant main effect of Age, with OAs (M = 0.29, SD = 0.46) mind-wandering less frequently than YAs (M = 0.37, SD = 0.48), β = −0.24, OR = 0.78, SE = 0.08, z = −2.89, p = .004, a significant main effect of Bonus, with the no-bonus groups (M = 36, SD = 0.48) mind-wandering more frequently than bonus groups (M = 0.30, SD = 0.46), β = 0.21, OR = 1.23, SE = 0.08, z = 2.49, p = .01, a significant increase in mind-wandering from Quadrant 1 to Quadrant 2, β = 0.53, OR = 1.69, SE = 0.08, z = 7.02, p < .001, and a significant decrease in mind-wandering from Quadrant 3 to Quadrant 4, β = −0.32, OR = 0.73, SE = 0.07, z = −4.31, p < .001. All other effects and interactions were nonsignificant (ps > .05). Importantly, Tukey-adjusted pairwise comparisons revealed that while OAs were less likely to mind-wander than YAs in the no-bonus condition, OR = 0.51, SE = 0.12, z = −2.87, p = .02, there was no significant difference between OAs in the no-bonus condition and YAs in the bonus condition, OR = 0.94, SE = 0.22, z = −0.28, p = .99, or between OAs and YAs in the bonus condition, OR = 0.75, SE = 0.18, z = −1.22, p = .61, suggesting that the Bonus manipulation eliminated differences in mind-wandering between OAs and YAs.

To determine whether age-related differences in mind-wandering are accounted for by differences in self-reported motivation levels, we conducted a mediation analysis. As expected, there was a significant total effect of Age on mind-wandering, ATE = 0.08, CI = [0.02, 0.13], p < .01. The average causal mediation effect, ACME = 0.02, CI = [0.01, 0.04], p < .001, and the proportion mediated, Prop. Mediated = 0.29, CI = [0.11, 0.97], p < .01, were both significant, suggesting that motivation does mediate age-related differences in mind-wandering. However, the average direct effect of Age on mind-wandering remained significant, ADE = 0.05, CI = [0.0005, 0.11], p = .05, indicating partial mediation.

Similarly, to determine whether bonus-related differences in mind-wandering are accounted for by differences in self-reported motivation levels, we ran another mediation analysis. As expected, there was a significant total effect of Bonus on mind-wandering, ATE = −0.06, CI = [−0.12, −0.01], p = .02. The average causal mediation effect, ACME = −0.01, CI = [−0.03, 0.00], p = .01, and the proportion mediated, Prop. Mediated = 0.2, CI = [0.03, 0.92], p = .03, were both significant, suggesting that motivation does mediate bonus-related differences in mind-wandering. Likewise, the average direct effect of Bonus on mind-wandering was nonsignificant, ADE = −0.05, CI = [−0.10, 0.00], p = .06, indicating a full mediation.

Lastly, we investigated whether there are differences in intentionality of task-unrelated thoughts across the four quadrants of the MWCT between the groups using a 2 (Age: young, older) × 2 (Bonus: yes, no) × 4 (Quadrant: 1, 2, 3, 4) logistic mixed-effects model with random intercepts for subject and successive contrasts for Quadrant. All main effects and interactions in this model were nonsignificant (ps > .05), suggesting that the differences in overall mind-wandering reported above are not attributable to differences in either intentional mind-wandering or unintentional mind-wandering alone.

Discussion

Our study yielded several important findings. First, we replicated the commonly reported age-related difference in rates of mind-wandering and task performance.[5] Second, we replicated prior work (Seli, Carriere, et al., 2018) showing that people modulate their mind-wandering in accordance with changes in task demands. Adding to this replication, our results suggest that YAs and OAs modulate their mind-wandering to the same extent across expected variations in task demands. Third, we replicated work showing that incentives improve performance and reduce mind-wandering (e.g., Seli, Schacter, et al., 2017). Fourth, we found that self-reported motivation differed between young and old, and that this difference may partially explain the relation between age and performance (although results were marginal). Fifth, and most importantly, we found that (a) differences in self-reported motivation across YAs and OAs partially explained the relation between age and mind-wandering, (b) bonus-related differences in mind-wandering are partially accounted for by differences in self-reported motivation levels, and (c) the commonly observed age-related difference in mind-wandering is nonsignificant when motivating YAs.

Our findings support and extend the motivational account of age-related differences in mind-wandering (Frank et al., 2015; Seli, Maillet, et al., 2017), which posits that OAs mind-wander less frequently than YAs because OAs are more motivated to perform well. Adding to this work, we found that differences in motivation across YAs and OAs partially explained the relation between age and mind-wandering, and, critically, that this effect obtained when exclusively examining pretask motivation reports, and with a much larger sample. Providing further evidence for the motivational account, we also found that the age-related difference in mind-wandering was absent when motivating YAs (YA bonus) and comparing their rates of mind-wandering to those of OAs who did not receive a bonus.

Even after accounting for motivation differences, we found that YAs mind-wandered more frequently than OAs. This finding may be viewed as being at odds with executive-control theories, which predict that YAs should engage in *less* mind-wandering compared to OAs. However, in addition to motivation, there are likely other factors that contribute to age-related differences in mind-wandering. For instance, researchers have suggested that OA's increased positive affect, conscientiousness (Frank et al. 2015), and their decreased number of current concerns (McVay & Kane, 2010) may also cause them to mind-wander less frequently than YAs. Future research will be needed to examine these additional factors, which could potentially provide a complete explanation of the thus far puzzling age-related difference in mind-wandering.

[5] "Notably, much of the previous work demonstrating age-related differences in rates of mind-wandering and task performance was conducted in the laboratory (e.g., Frank et al., 2015; Maillet et al., 2017), not via MTurk. However, as reported here, we found these same differences across YAs and OAs with a sample of MTurk participants. Importantly, these findings go some way toward alleviating any concerns that the results of our study are specific to our MTurk sample."

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Conflict of Interest

None reported.

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