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Positively framing mind wandering does not increase mind wandering in older adults

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Abstract

Age-related differences in mind wandering are robust, with older adults reporting less mind wandering compared to younger adults. While several theories have been put forth to explain this difference, one view has received less attention than others. Specifically, age-related differences in mind wandering might occur because older adults are reluctant to report on their mind wandering. The aim of the current study was to explicitly test this hypothesis. Older and younger adults completed a go/no-go task with intermittent thought probes to assess mind wandering. In one condition, participants were provided with standard instructions about how to respond to questions about their thoughts. In a second condition, participants were provided with a positive framing of mind wandering. Mind wandering was assessed both subjectively (i.e., via thought probes) and objectively (i.e., using different behavioral measures from the go/no-go task). The results of the study suggest that positively framing mind wandering did not impact rates of mind wandering or objective indicators of mind wandering for older or younger adults. Older adults reported less mind wandering, regardless of condition, compared to younger adults. Older adults also had generally better performance on the go/no-go task compared to younger adults. Bayesian analyses suggested that the main effect of framing condition, although not significant in Frequentist terms, did provide moderate evidence of an overall effect on mind wandering rates. We interpret the results as evidence against the reluctance hypothesis, consistent with previous work.

Introduction

Mind wandering is commonly defined as “a shift of attention away from a primary task toward internal information” (Smallwood & Schooler, 2006, p. 946; but see Smallwood, 2013 for an updated definition). This shift of attention is often associated with reductions in task performance suggesting that engaging in mind wandering comes with a cost (see

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Declarations

Conflict of interest The authors declare no competing interests.

Compliance with ethical standards This study was approved by the Washington University in St. Louis Institutional Review Board (Protocol # 201208135) and all procedures were performed in accordance with the 1964 Helsinki Declaration ethical principles. All participants provided informed consent at the start of the study.

Open practices Statement This study was not preregistered. Data and analysis files for this project are available on the Open Science Framework (https://osf.io/knfvt/).

Randall et al., 2014 for a review). Quite interestingly, in contrast to typical observations of age-related cognitive decline (Salthouse, 2009) and contrary to prominent theoretical accounts like the inhibitory deficit theory (Hasher & Zacks, 1988), there is clear and robust evidence that older adults report *less* mind wandering compared to younger adults (see Jordão et al., 2019).

Several factors appear to explain this surprising age-related reduction in mind wandering. One factor is an age-related reduction in cognitive resources that, according to some accounts, decreases older adults' ability to engage in mind wandering while successfully completing an ongoing task (e.g., Smallwood & Schooler, 2006). This cognitive resource account has also been supported, and expanded, by recent work proposing a neurocognitive perspective of age-related reductions in mind wandering (e.g., Martinon et al., 2019). Older adults have been shown to have reduced functional connectivity in parts of the brain frequently associated with spontaneous cognition and mind wandering, such as the Default Mode Network (DMN). Further, these changes in connectivity were correlated with performance in an Unusual Uses Task among older adults, but not younger adults. Thus, reductions in mind wandering with age could be attributed to both reductions in resources and structural changes in the brain.

Other factors include those that are dispositional, like levels of affect, conscientiousness, motivation and interest, and trait mindfulness. In many cases, these factors can at least partially, and in some cases fully, explain why older adults report less mind wandering (e.g., Fountain-Zaragoza et al., 2016; Fountain-Zaragoza et al., 2018; Frank et al., 2015; Jackson & Balota, 2012; Nicosia & Balota, 2021; Seli et al., 2021). That is, older adults are typically more motivated or have higher levels of conscientiousness/mindfulness corresponding with fewer reported instances of mind wandering during ongoing tasks.

An alternative possibility, however, is that older adults might be reluctant to report their mind wandering because it might reflect poorly on them, which we refer to as the reluctance hypothesis (Einstein & McDaniel, 1997; Giambra, 1989; Zavagnin et al., 2014). Only a few studies have examined this possibility, and the findings have challenged this hypothesis (e.g., Frank et al., 2015; Giambra, 1973; McVay et al., 2013). In one study, Giambra (1973) surveyed younger and older adults on their experience and views of mind wandering. Surprisingly, older adults reported having a more positive view of mind wandering. Such a view is inconsistent with the expectation that older adults might be more reluctant to report mind wandering.

More recent work has provided behavioral data that also challenge the "reluctance" hypothesis. McVay et al. (2013) examined age-related differences in mind wandering during a go/no-go task (Study 1) and an *n*-back task (Study 2). In both studies older adults reported less mind wandering, on average, compared to younger adults, as is typical. However, critically, when examining in-the-moment associations between performance and thought reports, older and younger adults showed similar patterns. Both age groups had worse accuracy before mind wandering reports (compared to on-task reports). Additionally, both age groups showed pre-mind wandering speeding in the go/no-go task (a common way to highlight the "mindless" responding associated with mind wandering). Furthermore, there

was no difference in the amount of time the two age groups took to make their mind wandering responses at each thought probe. Based on the striking similarities in these behavioral indices for younger and older adults, McVay et al. concluded that older adults are not unable (or reluctant) to report on their subjective experiences of mind wandering (see also Frank et al., 2015 for converging support for this conclusion using eye-tracking measures). The logic underlying this interpretation was as follows: If participants, and specifically older adults, are reluctant to report mind wandering, then one would expect that on some number of thought probes they would not report mind wandering, even though they were in fact off-task. Such misreporting, if it occurred, should lead to weak linkages between patterns of behavior before or after thought reports. Yet, McVay et al. found lower accuracy and more speeding of reaction time before a mind wandering report than an on-task report for both age groups (e.g., Bastian & Sackur, 2013; Kane et al., 2021; McVay & Kane, 2009).

While these previously described studies provide some evidence that older adults willingly and accurately report on their mind wandering experiences, there are some methodological and theoretical limitations. First, regarding methodological limitations, Giambra (1973) relied on survey measures of mind wandering, while McVay et al. (2013) and Frank et al. (2015) both relied on correlational analyses. Thus, it is hard to make strong claims about the possible causal nature of older adults' possible reluctance in reporting mind wandering as a contributor to the robust age-related differences. A unique approach of the current study is that we manipulated the instructions we provided participants about mind wandering. By framing mind wandering positively, that is, as a natural and even desirable occurrence for ongoing task performance, we aimed to mitigate any reluctance older adults might have to report mind wandering.

Second, these previous studies also do not appear to separate reluctance from ability to accurately report. That is, it is unclear if either reluctance or older adults' possible inability to accurately report on mind wandering (i.e., a lack of awareness of their on-going thoughts) should lead to weaker, or different, behavioral patterns before reports of mind wandering vs. on-task reports. A strength of our study design is that our manipulation does not conflate reluctance and reporting ability. That is, we believe our manipulation shouldn't have any effect on older adults' awareness of their mind wandering, so any observed effect should be more closely related to reluctance, if in fact reluctance plays a role.

As Weinstein's (2018) review highlighted, there are various ways in which mind wandering questions and response options have been framed across the field. It is possible that framing mind wandering differently (i.e., as a more positive process) might be a way to overcome older adults' reluctance, in which case reports of mind wandering may increase for older adults and age-related differences might be reduced, or even eliminated. Recent empirical work has examined how framing effects impact rates of mind wandering in younger adults (e.g., Robison et al., 2019; Schubert et al., 2020; Weinstein et al., 2018). Most relevant to the current study is an experiment reported by Robison et al. (2019 Experiment 3). Robison et al. posited that participants might come into research studies with different ideas about mind wandering being a bad (or good) thing to do, which might alter how they experience or report these off-task states when asked. To test this, participants completed a sustained

attention to response task (SART), which is a go/no-go task frequently used in studies of mind wandering, with intermittent thought probes to assess mind wandering. Prior to beginning the SART, participants were given one of three framing manipulations. In the neutral condition, the instructions described that "… It is perfectly normal for your thoughts to drift off-task every now and then. When you are asked to report your thoughts, please do so honestly," (p. 405). The positive condition instructions explained that "… It is perfectly normal for your thoughts to drift off-task every now and then. *Previous research has shown that off-task thoughts can actually help people plan, problem solve, and be more creative*. (italics added). When you are asked to report your thoughts, please do so honestly," (p. 405). Finally, the negative condition instructions stated "… It is perfectly normal for your thoughts to drift off-task every now and then. *However, previous research has shown that off-task thoughts are bad for task performance. Do your best to resist all types of off-task thoughts so you can maximize your performance.* (italics added). But when you are asked to do so, please try to honestly assess your thoughts." (p. 405). The results of the experiment indicated that this framing manipulation had no effect on overall rates of subjective mind wandering reports or behavioral indicators of mind wandering (see below) for younger adults.

A unique aspect of the SART is that one can also measure reaction time (RT) and accuracy during the task as objective approaches to assessing mind wandering. Using both subjective (i.e., mind wandering reports) and objective measures has allowed researchers to show converging evidence that attentional lapses have occurred. Different objective indicators have been proposed to reflect distinct forms of attentional lapses that are related to subjective indicators of mind wandering (see Cheyne et al., 2009; Unsworth et al., 2021; Welhaf & Kane, 2023). For example, increased trial-to-trial variability in RT is presumed to reflect moment-to-moment inconsistencies and disengagement of attention. Commission errors, or responding on a no-go trial, might reflect a more habitual, mindless, response style whereby participants are not fully processing the stimulus and instead are just "going with the flow" of the task (see Cheyne et al., 2009; Manly et al. 1999; Robertson et al., 1997; Smallwood et al., 2004). Not only do older adults typically report less mind wandering, but they also tend to show fewer instances of objective sustained attention failures (see Vallesi et al., 2021 for a meta-analysis). Collectively, the combination of subjective and objective measures indicates that older adults are more focused during sustained attention tasks like the SART, which may imply that, contrary to the reluctance hypothesis, lower mind wandering rates are not due to older adults' hesitation to report that they were off task. The current study is an opportunity to test the "reluctance" hypothesis more directly via an experimental approach by manipulating the framing of mind wandering experiences in the context of age-related differences in mind wandering.

Current study

The goal of the current study was to examine how the framing of mind wandering affects age-related differences in mind wandering reports. To our knowledge, no studies have directly examined the role that framing has on age-related differences in mind wandering, but based on previous work (e.g., Einstein & McDaniel, 1997) one might expect that framing mind wandering as a positive experience or something that occurs naturally could make

older adults more open to reporting instances of mind wandering. We hypothesized that, if reluctance is one possible driver of age-related differences in mind wandering, then the positive framing manipulation might disproportionally increase mind wandering rates in older adults compared to younger adults (i.e., a significant framing x age interaction; Robison et al., 2019). Such a finding would be informative because it might suggest that there is a mechanism beyond cognitive (e.g., Smallwood & Schooler, 2006) or dispositional factors (such as motivation or conscientiousness, e.g., Nicosia & Balota, 2021) that is responsible for the consistently reduced frequency of off-task thoughts reported by older adults compared with younger adults. Alternatively, if reluctance is not a factor that contributes to age-related differences in mind wandering, then one might not expect any significant effects of an instruction framing manipulation to occur (i.e., null effects). Such null effects would be informative still as they would provide confidence that older adults are not withholding reports of mind wandering, but in fact do experience less mind wandering compared to younger adults. We examined this effect of framing on age-related differences in mind wandering during a SART task by assessing both subjective (i.e., thought reports) and objective (i.e., RT variability or commission errors) indicators of mind wandering.

Methods

Transparency and openness

We report our sample size justification, data exclusion criteria, and all measures and manipulations included in the study (Simmons et al., 2012). All data aggregation and analyses were performed in R (R Core Team, 2020) using *tidyverse* (Wickham et al., 2019). All ANOVAs were conducted using the *afex* package (Singmann et al., 2015) Data visualizations were created using *ggplot2* (Wickham et al., 2016). This study was not preregistered. Data and analysis files for this project are available on the Open Science Framework (https://osf.io/knfvt/).

Participants

A total of 89 students from the undergraduate research pool at Washington University in St. Louis and 67 older adults from the St. Louis Metropolitan area were recruited to participate in this study. Our inclusion criteria for the study were as follows: Younger adults needed to be between the ages of 18 and 25, indicate English as their first language, and currently enrolled in a course at Washington University in St. Louis to receive their participation credits. Older adults needed to be 60 years of age or older, have normal to corrected vision, and indicate English as their first language. Older adult participants from our community research pool tend to be highly educated and in generally good health (see Bugg, 2014; Bugg et al., 2016 for details regarding demographic information for older adults collected for other projects around this time).[1] Younger adults received partial course credit for their participation. Older adults were paid at a rate of $10/hour to complete the study. These data were collected between November 2014 and June 2016. Participants were randomly assigned to one of the two framing conditions (see below).

[1]We were not able to access the demographic information that was collected for participants in this study and therefore specifics regarding age and education levels cannot be provided.

Materials

SART—All participants completed a numeric SART where they were presented with a single digit (ranging from 1 to 9) at the center of the computer screen. Participants were instructed to respond to every digit (via pressing the spacebar) *except* for the digit 3. Digits were presented briefly on screen for 200ms, and then immediately masked for 900ms. Participants completed four practice sets of nine trials (two without thought probes, and two with thought probes). The experimental block consisted of 216 trials in total, lasting approximately five minutes.

We analyzed several objective mind wandering indicators commonly derived from the SART including RT coefficient of variation (CoV), commission errors (i.e., pressing the spacebar on a no-go trial), and omission errors (i.e., forgetting to press the spacebar on a go trial). These measures are proposed to reflect different varieties or degrees of attentional lapses during sustained attention tasks (Cheyne et al., 2009) and are modestly related to mind wandering reports suggesting they might capture a similar underlying construct (e.g., Unsworth et al., 2021; Welhaf & Kane, 2023).

Mind wandering thought probes—During the SART, participants reported on their ongoing thoughts when probes appeared. There were eight probes in total (occurring on 3.7% of all SART trials). At each probe, participants indicated whether their thoughts were on-task or not by pressing the “Y” or “N” key, respectively. Mind wandering rates were calculated as the proportion of probes participants reported being off-task. Following previous work (e.g., Jackson & Balota, 2012) thought probes were allowed to appear after any trial type (go or no-go). Participants were encouraged to ask questions during the instruction period to ensure understanding of the probes. If participants did not understand what was considered “mind wandering” they were provided additional instructions prior to the task.

The main experimental manipulation occurred during the instructions of the thought probes. During these instructions, all participants were first given the following instructions:

> Occasionally you will see a probe question. Indicate whether your mind was on task at the time the probe question appeared. You should press the “yes” key if your mind was on task. You should press the “no” key if your mind was not on task.

Next depending on the experimental condition, participants were instructed on the utility of their mind wandering. In the “Standard Instruction” condition, participants saw the following instructions:

> *For example, you might be thinking about shopping, interacting with a loved one, or reflecting on your boredom.…*

In the “Positive Framing” condition participants saw a variation of the Standard Instruction:

> *For example, sometimes our mind refreshes itself to allow us to achieve our best performance on tasks like this one. Our minds do this by drifting off or thinking about other thoughts such as shopping, interacting with a loved one, or reflecting on one’s boredom.*

Participants in the "Positive Framing" condition were then provided with data from a made-up prior study with the following description:

> *Here are data from a prior study. Note that college students reported that their minds were not on task far more frequently than older adults, and college students also performed better on the numbers task*.

Participants were shown a simple bar chart reflecting that younger adults engage in mind wandering roughly 35% of the time whereas older adults engage near 10% of the time (see Fig. 1). The inclusion of this figure was motivated in part by theorizing in another literature that suggests providing data/empirical evidence helps establish new beliefs that motivate changes in behavior (e.g., McDaniel & Einstein, 2020).

Analytic plan

To analyze our data, we used 2 (Age Group: Young vs. Old) × 2 (Condition: Standard Instruction vs. Positive Framing) ANOVAs. We report partial η^2 as a measure of effect size for all ANOVA factors. We also include Bayes Factors (BF) for all terms to provide evidence for the alternative hypothesis (BF_{10}) to supplement traditional frequentist hypothesis testing. BF provide a continuous measure of the relative strength of evidence of competing models and can quantify if the data are more likely to be associated with the null over the alternative hypothesis (Dienes, 2014; Rouder et al., 2009). BF were calculated using the default prior settings of the *BayesFactor* package (Morey & Rouder, 2023). For ANOVA models, we report the B F_{10} for the main effects (i.e., Age Group and Condition) which favors inclusions of that term over an intercept only model. For interactions, we contrasted the full interaction model with a model that only contains the additive main effects to provide evidence of adding the interaction beyond the main effects. In the case of follow-up comparisons, we used t-tests and report Cohen's *d* (and 95% Confidence Intervals [CI]) and BF for those comparisons.

We follow recommendations of previous research such that a B $F_{10} < 0.01$ provides "extreme" evidence in favor of the null, a $BF_{10} = 0.01–0.03$ provides "very strong" evidence in favor of the null, a $BF_{10} = 0.03–0.10$ provides "strong" evidence in favor of the null, a $BF_{10} = 0.10–0.33$ provides "moderate" evidence in favor of the null, a B $F_{10} = 0.33–1$ provides "anecdotal" evidence in favor of the null, a $BF_{10} = 1–3$ provides "anecdotal" evidence in favor of the alternative, a $BF_{10} = 3–10$ provides "moderate" evidence in favor of the alternative, a B $F_{10} = 10 - 30$ provides "strong" evidence in favor of the alternative, a $BF_{10} = 30–100$ provides "very strong" evidence in favor of the alternative, a $BF_{10} > 100$ provides "extreme" evidence in favor of the alternative (Jeffreys, 1961; Rouder et al., 2009; Lee & Wagenmaker, 2013).

Results

RT processing

Before calculating the RT CoV score for each participant, we processed the RT data to remove outlying trials. First, we removed RT to incorrect trials and RTs that were < 200 ms as these reflect anticipatory responses in which the participant could not fully process

the stimulus before responding. We next removed RTs following errors and probe trials to account for post-error slowing and post-probe restart costs. Finally, for each participant, we calculated their median RT and IQR of their remaining RTs. We set an outlier cutoff equal to the median RT + 3*IQR, any values outside of that cutoff were replaced with the cutoff value. This resulted in < 0.10% of RTs being affected in the full sample.

Does framing affect rates of mind wandering?

The ANOVA on mind wandering reports revealed a main effect of Age Group, $F(1, 153) = 33.90$, partial $\eta^2 = 0.181$, $p < 0.001$, $BF_{10} > 100$. There was a trend for the main effect of Condition, $F(1, 153) = 3.79$, partial $\eta^2 = 0.024$, $p = .053$, $BF_{10} = 3.975$ indicating moderate evidence for the alternative hypothesis. Critically, the Age by Condition interaction was not significant, $F(1, 153) = 0.43$, partial $\eta^2 = 0.003$, $p = 0.511$. For the comparison of an interaction model to a main effect only model, B $F_{10} = 0.294$ suggested moderate evidence for the null hypothesis (e.g., exclusion of the interaction term). As seen in Fig. 2, older adults ($M = 0.11$; $SD = 0.16$) reported less mind wandering than younger adults ($M = 0.33$; $SD = 0.25$) regardless of how mind wandering was framed, $t(150.70) = -6.463$, $p < 0.001$, Cohen's d [95% CI] = − 0.98 [–1.32, − 0.65], $BF_{10} > 100$.

Does framing affect objective indicators of mind wandering?

We next conducted several ANOVAs on objective indicators of mind wandering that are commonly derived in the SART. For "Go" trial CoV, there was a significant main effect of Age Group, $F(1, 153) = 4.07$, partial $\eta^2 = 0.026$, $p = .045$, $BF_{10} = 1.093$, suggesting only anecdotal evidence for the alternative hypothesis. There was no main effect of Condition, $F(1, 153) = 0.16$, partial $\eta^2 = 0.001$, $p = .686$, $BF_{10} = 0.177$ suggesting moderate evidence for the null hypothesis. The interaction was also not significant, $F(1, 153) = 0.05$, partial $\eta^2 < 0.001$, $p = .818$. The comparison of an interaction model to a main effect only model yielded a $BF_{10} = 0.248$, again suggesting little evidence favoring inclusion of the interaction term. As seen in Fig. 3, older adults ($M = 0.25$; $SD = 0.08$) were slightly more variable in performance compared to younger adults ($M = 0.23$; $SD = 0.07$), $t(136.97) = 1.98$, $p = .049$, Cohen's d [95% CI] = 0.32 [0.00, 0.64], $BF_{10} = 1.093$.

For commission errors (i.e., no-go accuracy), there was again a significant main effect of Age Group, $F(1, 153) = 8.47$, partial $\eta^2 = 0.052$, $p = 0.004$, $BF_{10} = 9.719$, indicating strong evidence for the alternative hypothesis. There was no main effect of Condition, $F(1, 153) = 1.02$, partial $\eta^2 = 0.007$, $p = 0.313$, $BF_{10} = 0.219$, indicating moderate evidence for the null. The interaction was not significant, $F(1, 153) = 0.11$, partial $\eta^2 < 0.001$, $p = 0.746$. The comparison of an interaction model to a main effect only model yielded a $BF_{10} = 0.264$, suggesting moderate evidence favoring the inclusion of the interaction term. As seen in Fig. 4, older adults were better at withholding responses to rare no-go trials ($M = 0.71$; $SD = 0.18$) compared to younger adults ($M = 0.62$; $SD = 0.19$), $t(145.57) = 2.99$, $p = 0.003$, Cohen's d [95% CI] = 0.48 [0.16, 0.80], $BF_{10} = 9.719$.

For omission errors (i.e., "Go" trial accuracy), there was again a significant main effect of Age Group, $F(1, 153) = 5.24$, partial $\eta^2 = 0.033$, $p = .023$, $BF_{10} = 2.633$, suggesting anecdotal evidence for the alternative hypothesis. There was no main effect of Condition,

$F(1, 153) = 1.23$, partial $\eta^2 = 0.008$, $p = .269$, $BF_{10} = 0.269$, suggesting moderate evidence for the null hypothesis. The interaction was also not significant, $F(1, 153) = 0.78$, partial $\eta^2 = 0.005$, $p = .380$. The comparison of an interaction model to a main effect only model yielded a $BF_{10} = 0.367$, suggesting anecdotal evidence favoring the inclusion of the interaction term. As seen in Fig. 5, older adults were less accurate ($M = 0.96$; $SD = 0.18$) compared to younger adults ($M = 0.98$; $SD = 0.19$), $t(107.20) = -2.31$, $p = .023$, Cohen's d [95% CI] = − 0.39 [−0.71, − 0.07], $BF_{10} = 2.633$.[2]

Discussion

The current study tested the reluctance hypothesis by examining whether the framing of mind wandering affects age-related differences in subjective and objective mind wandering indicators in a sustained attention task. We found that providing a "positive" framing for engaging in mind wandering did not alter the robust age-related reduction in mind wandering either in terms of subjective reports or objective performance indicators. Older adults, compared to younger adults, engaged in less mind wandering and were also better at withholding responses to rare target trials, despite having slightly more variable RTs. These findings are inconsistent with the reluctance hypothesis, which posits that older adults might experience similar rates of mind wandering compared to younger adults, but because they perceive mind wandering as something that would reflect poorly on them, they choose not to report it as often. Instead, the findings replicate several studies suggesting that older adults are better at maintaining attention from moment-to-moment and thus their minds wander less (see Jordão et al., 2019, Vallesi et al., 2021 for reviews). Such a pattern is consistent with resource theories of mind wandering (Smallwood & Schooler, 2006) as well as accounts that attribute the age-difference to differences in other dispositional factors (e.g., conscientiousness, motivation).

Several theories have been put forth to explain why older adults report less mind wandering compared to younger adults. Cognitive process theories, such as the executive control view (e.g., Smallwood & Schooler, 2006), argue that because mind wandering requires executive resources, and older adults have fewer resources, they are not able to effectively perform the ongoing task and engage in mind wandering. Others have argued that age-related differences can be better accounted for by dispositional factors (e.g., Jackson & Balota, 2012; Nicosia & Balota, 2021). Specifically, older adults are typically more motivated to perform tasks like the SART and tend to have higher levels of conscientiousness and overall higher affect. These factors have been found to partially explain the age-related reduction in mind wandering, and in some studies can fully account for these differences. The findings from the current study are also important to consider in light of recently developed neurocognitive perspectives on age-related reductions in mind wandering (e.g., Maillet et al., 2019; Martinon et al., 2019). Specifically, this view suggests that age-related reductions in mind wandering are due to structural changes in the brain (i.e., functional connectivity of areas associated with DMN). From this perspective, then, motivational manipulations that

[2]Previous work (e.g., McVay et al., 2013) examined age-related differences in behavioral indicators such as pre-mind wandering speeding, variability, and accuracy. We intended to also look at these data, however, due to a very small number of observations with usable trials in the preceding four trial window we could not look at these differences.

aim to increase mind wandering in older adults (like the one used in the current study) might have little effect on mind wandering rates.

As noted, the lack of an effect of the framing manipulation on age-related differences in mind wandering does not support the reluctance hypothesis. More generally, the findings suggest that it may be difficult to promote more mind wandering in older adults or younger adults (see also Robison et al., 2019) through manipulations like this one. Studies that have had large success in increasing rates of mind wandering typically use manipulations that either increase attentional task demands (e.g., Randall et al., 2019; Seli et al., 2018) or increase psychological stress or strain on participants (e.g., Banks & Boals, 2017; Jordano & Touron, 2017a; Mrazek et al., 2011). The manipulation in the current study did not place such a heavy psychological or attentional demand on participants which may have hindered our ability to find any effects.

Limitations

The current study was not without limitations. One limitation is that our conclusions rely on null effects of the framing manipulation. However, the Bayesian analysis for mind wandering reports did indicate moderate evidence in favor of the alternative hypothesis that the framing manipulation was effective in increasing mind wandering reports overall, despite a just non-significant p-value ($p = .053$). This raises the possibility that the framing manipulation is effective but requires larger sample sizes to detect an effect. Two caveats merit mention though. One is that this was not the case for the objective mind wandering indicators, which raises the possibility that subjective reports of mind wandering might be more influenced by framing manipulations compared to objective attention lapses. The second is that there was no evidence (either from a Frequentist or Bayesian framework) in support of an interaction between age and framing condition. With respect to the reluctance hypothesis, the key evidence that would have supported this hypothesis is precisely such an interaction. Thus, it does not appear that even with a larger sample size, the hypothesis would have been supported.

Another possible explanation for the null findings of the positive framing manipulation is worth mentioning. We included Fig. 1 during the thought probe instructions to show the typical age-related difference in mind wandering. It is possible that in doing so we minimized any effect of framing because, based on viewing the figure, older adults in the framing condition might have inferred that the expected frequency of mind wandering in older adults is low (i.e., about 10%). That is, older adults may have reported less mind wandering because they felt like they were off-task more often than a “typical” older adult. We did not include a manipulation check to inform us about how participants felt about mind wandering and whether they view it as good or bad, depending on the condition they were in. Previous correlational and experimental research has found that participants do have lay beliefs about mind wandering and that these can be shifted under certain conditions (e.g., Zedelius et al., 2021). However, older adults might have strong(er) lay beliefs about (not) engaging in mind wandering. If so, then we might not expect them to release such views in the face of instructions that suggest they do otherwise.

A third limitation of the current study is that we did not include a probe option for task-related interference (TRI) or evaluative thoughts about ones' performance during the ongoing task (e.g., "I'm doing really well!"). TRI are often included in studies examining age-related differences in mind wandering (see Jordão et al., 2019 for a review) and are considered by some to be a form of mind wandering (e.g., Jordano & Touron, 2017b). Recent work in younger adults has found that when a TRI response option is included, rates of on-task reports are reduced compared to when a TRI option is not included (Kane et al., 2021; Robison et al., 2019). Thus, participants might conflate on-task and TRI reports which might result in some reporting bias, but there seems to be little effect on rates of mind wandering.

A final limitation of the current study pertains to a lingering theoretical and definitional issue in mind wandering research (see e.g., Christoff et al., 2016, Christoff et al., 2018; Seli et al., 2018a, b for lively debates on this issue). As research in mind wandering has surged in the last two decades, definitions and views of mind wandering have also evolved. Mind wandering is a heterogenous construct, and definitions vary from study to study, but also typically contain overlapping features (e.g., Seli et al., 2018a). Thus, our findings might differ if mind wandering was defined as a different form of thought. For example, recent work has viewed mind wandering as a more dynamic, freely flowing, and unconstrained process (e.g., Brosowsky et al., 2021; Christoff et al., 2016; Kam et al., 2021; Mills et al., 2018; O'Neill et al., 2021; Smith et al., 2021) or a form of task-switching (Wong et al., 2022; Wong, Pat et al., 2023; Wong, Willoughby et al., 2023). Future research should account for different definitional views of off-task thought and examine if different forms of mind wandering, and/or potentially age-differences, can be pushed around with framing manipulations like the one used in the current study.

Implications and future directions

Experimental studies of mind wandering often focus on how to reduce mind wandering in participants to improve performance. However, there may be times whereby increasing the opportunity to mind wander might also be important. For example, priming thoughts that elicit emotional satisfaction or are highly meaningful might minimize performance costs and be personally important to both older and younger adults (see Jordão, Pinho, et al., 2019). Future research should not only consider how to reduce mind wandering from occurring (especially when the consequences are high) but how to also increase mind wandering when it is suitable to do so.

Conclusions

Mind wandering is an everyday phenomenon that occupies much of our daily thoughts. Older adults consistently report fewer instances of mind wandering both in laboratory settings and in daily life. The current study employed an experimental approach to test the "reluctance" hypothesis to explain why older adults report less mind wandering compared to younger adults. If older adults are simply reluctant to report mind wandering, then framing mind wandering in a more positive light should *increase* reports of mind wandering and thereby reduce age-differences, providing support for the hypothesis. Contrary to this

prediction, our framing manipulation did not increase subjective reports of mind wandering in older adults or younger adults, and the manipulation did not affect objective indicators of mind wandering. Overall, it appears that it may be difficult to eliminate, or even reduce, robust effects of age-related differences in mind wandering, which aligns with theoretical accounts that attribute these differences to resource limitations or dispositional factors rather than older adults' reluctance or unwillingness to report instances of mind wandering.

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Data availability

This study was not preregistered. Data and analysis files for this project are available on the Open Science Framework (https://osf.io/knfvt/).

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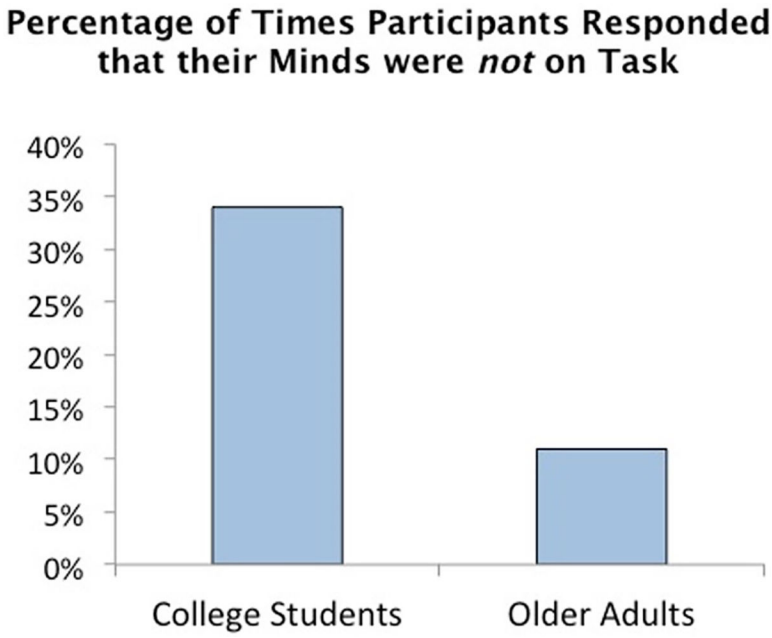

Fig. 1.
Graph shown to participants in the Positive Framing condition to depictage differences in mind wandering

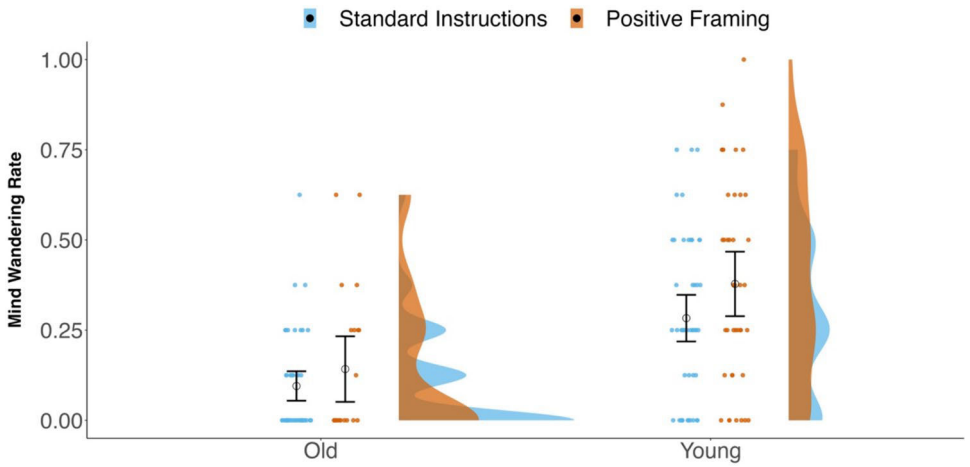

Fig. 2.

Raincloud plots (Allen et al., 2019) depicting mind wandering rates for each Age Group and Condition. Dots represent individual subject means in each Age Group. The open dots represent group-level mean estimates for each Age Group in either the Standard Instructions or Positive Framing condition. The density plots provide a summary of the overall shape of the distribution for each Age Group and Condition. Error bars are 95% confidence intervals

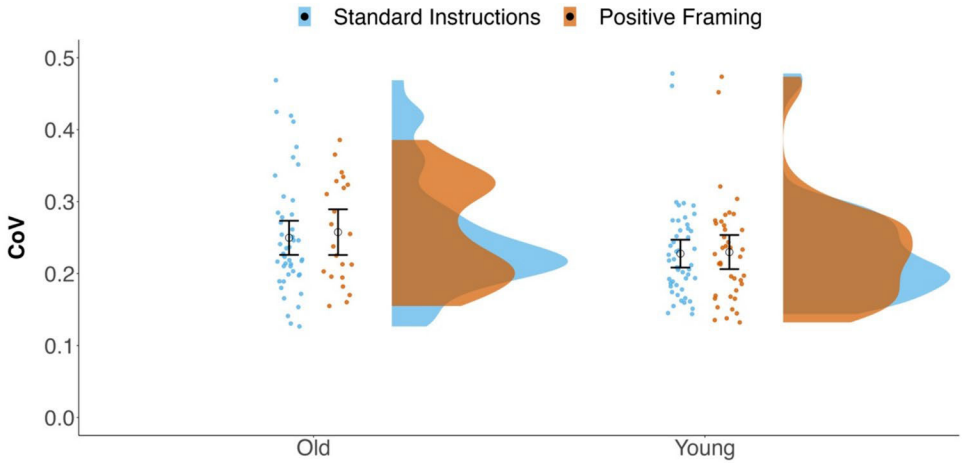

Fig. 3.

Raincloud plots (Allen et al., 2019) depicting CoV for each Age Group and Condition. CoV = Coefficient of Variation. Dots represent individual subject means in each Age Group. The open dots represent group-level mean estimates for each Age Group in either the Standard Instructions or Positive Framing condition. The density plots provide a summary of the overall shape of the distribution for each Age Group and Condition. Error bars are 95% confidence intervals

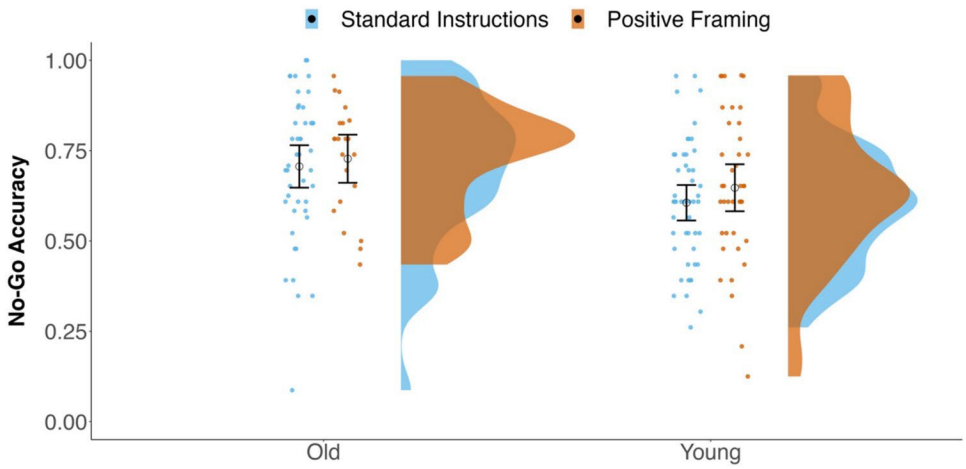

Fig. 4.

Raincloud plots (Allen et al., 2019) depicting No-Go Accuracy for each Age Group and Condition. Dots represent individual subject means in each Age Group. The open dots represent group-level mean estimates for each Age Group in either the Standard Instructions or Positive Framing condition. The density plots provide a summary of the overall shape of the distribution for each Age Group and Condition. Error bars are 95% confidence intervals

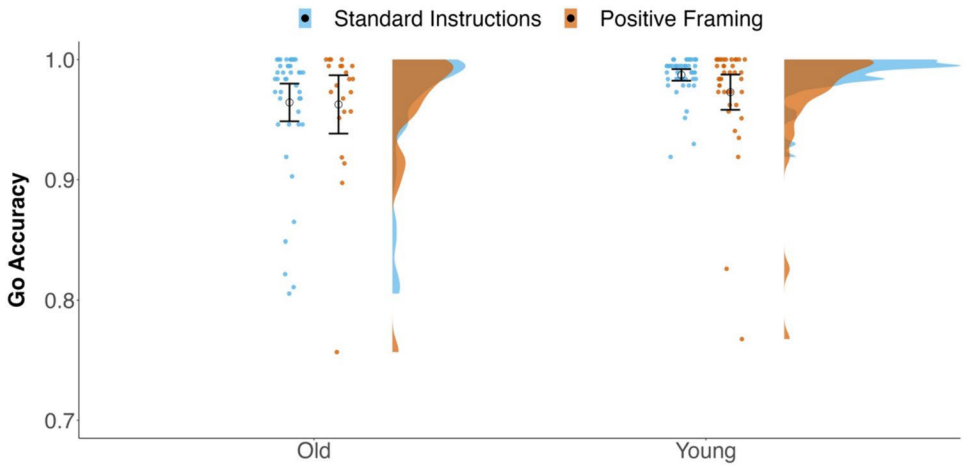

Fig. 5.

Raincloud plots (Allen et al., 2019) depicting Go Accuracy for each Age Group and Condition. Dots represent individual subject means in each Age Group. The open dots represent group-level mean estimates for each Age Group in either the Standard Instructions or Positive Framing condition. The density plots provide a summary of the overall shape of the distribution for each Age Group and Condition. Error bars are 95% confidence intervals