On the influence of Re-Reading on Mind Wandering

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Abstract

Re-reading has been shown to have a minimal benefit on text comprehension, in comparison to reading only once or other types of study techniques (e.g., testing; self-explanation). In two experiments we examined the effect of re-reading on mind wandering. Participants read two texts during which they responded to intermittent mind wandering probes. One text was read once and the other twice. Consistent with previous findings, there was no effect of re-reading on comprehension even though participants reported feeling more competent when they re-read the text. Critically, participants mind wandered more while re-reading. Furthermore, the effect of re-reading on mind wandering was specific of intentional forms of mind wandering rather than unintentional. The implications of these results for understanding mind wandering and the limited effectiveness of re-reading as a mnemonic are discussed.

Keywords: re-reading, mind wandering, study techniques
**On the influence of Re-Reading on Mind Wandering**

Mind wandering (i.e., the disengagement of attention from the external task to internal thoughts; McVay, Meier, Touron & Kane, 2013; Smallwood, 2013; Smallwood & Schooler, 2006) in educational contexts is frequent and can have detrimental effects on learning (e.g., from lectures; Risko, Anderson, Sarwal, Engelhardt & Kingstone, 2011; Farley, Risko, & Kingstone, 2013; from texts; Feng, D’Mello & Graesser, 2013; Schooler, Reichle, & Halpern, 2004; Smallwood, McSpadden, & Schooler, 2008; Smallwood, Fishman & Schooler, 2007). Thus, understanding how different pedagogical techniques and mnemonic strategies influence the frequency of mind wandering and, in turn, how this influences learning is of critical importance. In addition, this effort has the potential to further our basic theoretical understanding of mind wandering and the mechanisms underlying the relation between pedagogical and mnemonic strategies and learning. In the present investigation, we examine the influence of re-reading, one of the most commonly employed mnemonic strategies (Karpicke, Butler & Roediger, 2009), on mind wandering and the relation between mind wandering and the benefits (or lack thereof) of re-reading for comprehension.

As noted, re-reading is one of the most commonly used mnemonic strategies and this popularity likely derives from student’s belief that re-reading is a useful study technique (Karpicke et al., 2009). Although re-reading does seem to benefit memory for studied material (Bromage & Mayer, 1986; Krug, Davis & Glover, 1990; Rawson, Dunlosky & Thiede, 2000), these benefits are limited relative to other techniques (e.g., testing; Spuznar, Khan & Schacter, 2013; self-explanation; Moss, Schunn, Schneider, & McNamara, 2013) and, at least in some circumstances, re-reading has no benefit
compared to reading a text once (Callender & McDaniel, 2009). For example, Callender and McDaniel (2009) reported a series of four experiments that directly compared reading a text once to massed re-reading on comprehension. They found no difference between reading a text once and re-reading, and this lack of an effect was replicated across four experiments. The authors attributed the ineffectiveness of re-reading to its failure to facilitate the construction of a richer representation of the text on subsequent reads. Specifically, according to the material appropriate difficulty perspective (McDaniel & Einstein, 2005), each re-read of the text is processed in a similar manner, thereby yielding no qualitative change in the representation of the text in memory. Using a design similar to Callender and McDaniel (2009), however, Rawson (2012) reported a benefit of re-reading (see also Rawson & Kintsch, 2005). Rawson (2012) attributed the lack of effect in the Callender and McDaniel (2009) studies to individuals shifting to a “skimming” strategy on the second read. For example, in Callender and McDaniel (2009) participants were approximately 48% faster to re-read when compared to reading a text for the first time and in Rawson (2012) participants were only approximately 22% faster. Thus, according to Rawson (2012), part of the reason for re-reading’s limited benefit is that participants might have adopted a shallower processing style when re-reading.

Both the Rawson (2012) and Callender and McDaniel’s (2009) explanations of re-reading’s sometimes ineffectiveness could be conceptualized in terms of the task (i.e., reading an already read text) not encouraging or actually discouraging the adoption of the kinds of “effortful” reading strategies that lead to good comprehension. The importance of learning activities (e.g., the task individuals perform during learning) for learning has been recognized (e.g., Chi, 2009) and recently extended to mind wandering in
educational contexts (Olney, Risko, D’Mello, & Graesser, in press; Moss et al., 2011; 2013). In particular, Olney et al. (in press) suggested that the amount attentional control demanded by the learning task should be negatively correlated with mind wandering. Thus, re-reading could be viewed as creating an environment ripe for the disengagement of attention by reducing demands on controlled processes.

The importance of task (or context) also plays an important role in Smallwood’s (2013) process-occurrence framework for understanding self-generated thought. For example, the relation between mind wandering and individual differences in executive control (i.e., working memory capacity) are claimed to be moderated by the demands of the situation/task. Higher executive control capabilities should decrease mind wandering in highly attentionally demanding tasks (i.e., they serve to sustain an external focus), but increase it less attentionally demanding tasks (i.e., they serve to sustain an internal focus or mind wandering).

Consistent with a link between task type, attentional control and mind wandering, Moss et al., (2011; 2013) provided evidence consistent with the notion that re-reading puts less demands on cognitive control and also leads to greater mind wandering. Specifically, Moss et al. (2011; 2013) compared comprehension, post-hoc self-reports of perceived mind wandering frequency, and brain activity across three reading strategies: re-reading, paraphrasing, and self-explaining. After completing each reading task, participants were asked how much they felt they mind wandered during the task. Critically, re-reading engaged the neural network implicated in control less than the other tasks and participants retrospectively reported more mind wandering in the re-reading
condition than in the other two conditions. These results are consistent with the existence of a close relation between task type, need for attentional control, and mind wandering.

Present Investigation

Although the Moss et al. (2013) experiment provides evidence consistent with the notion that re-reading leads to greater mind wandering, a number of important issues remain to be addressed. First and foremost the experiment establishing the link between re-reading and mind wandering had two important limitations that could alter the interpretation of the results. First, mind wandering rates during re-reading were compared to paraphrasing and self-explaining rather than the more typical read once condition. This leaves open the possibility that rather than re-reading increasing mind wandering, paraphrasing and self-explaining might decrease mind wandering relative to simply reading. As a result, re-reading may not actually increase mind wandering relative to a read once control condition which would, of course, lead to a different conclusion regarding the links between re-reading and mind wandering. To test this notion, one would need to compare the rates of mind wandering between reading a text once or for the first time versus re-reading a text.

The lack of a read once/first read baseline also complicates the interpretation of the control demands imposed by re-reading. Specifically, in Moss et al., (2011; 2013) the control network was engaged less in the re-reading condition relative to paraphrasing and self-explanation. Thus, again, it is unclear whether re-reading would engage this network less than reading a text for the first time. However, there is good reason to expect this to be the case given the mechanisms proposed by Callender and McDaniel (2009) and Rawson (2012). For example, if we assume that during the first read of the text a situation
model is constructed and on subsequent reads this model is not built upon further and that model construction depends on controlled processes to some extent (Friedman & Miyake, 2000; Radvansky & Copeland, 2001), then it seems plausible that the latter processes would be engaged less during re-reading.

The second limitation of Moss et al. (2013) is that they did not measure mind wandering during reading with thought probes (Risko et al., 2011; Smallwood & Schooler, 2006), but, rather, relied on a subjective estimate of the amount of mind wandering that was retrospectively provided after reading. Retrospective reports have a number of limits in general as reviewed in Schwarz (2007). To address these limitations in the present study, participants read a text once and read a different text twice (re-read) and completed comprehension tests associated with each. They were probed to report mind wandering throughout the reading process. If re-reading encourages mind wandering, then participants should report more mind wandering during the re-read (RR2) compared to both the first read (RR1) of the re-read text and to the text read once (R1).

Assuming for the moment that the effect of re-reading on rates of mind wandering can be put on stronger footing, the mechanism underlying the increase remains unclear. Specifically, researchers interested in mind wandering largely assume that any observed mind wandering is unintentional. Recent work, however, has demonstrated that this is not the case. For example, across a recent series of studies Seli and colleagues (Seli et al., 2014; 2015a; 2015b) have demonstrated that a substantial proportion of self-reported instances of mind wandering are intentional and that intentional and unintentional mind wandering are sometimes differentially related to other key variables (e.g., ADHD
symptomology). The latter result suggests the possibility that these different types of mind wandering might have different cognitive bases. This raises serious questions for research on mind wandering as it suggests that existing research using standard techniques were likely capturing both intentional and unintentional mind wandering. Furthermore, assuming that some manipulation influences mind wandering (e.g., re-reading), the natural question that then needs to be addressed is whether the manipulation influences overall mind wandering via an effect on unintentional, intentional, or both types of mind wandering. Thus, in the present investigation (Experiment 2) we examine the influence of re-reading on both intentional and unintentional mind wandering.

The last issue to be addressed in the present investigation is the relation between re-reading, mind wandering, and comprehension. As noted above, at least in some circumstances, re-reading has no benefit on reading comprehension relative to reading a text once. This is surprising and consequential given students’ belief in the effectiveness of re-reading as a mnemonic strategy (Karpicke et al., 2009). If re-reading increases mind wandering, this provides a potential explanation for the sometimes limited effectiveness of re-reading. In particular, assuming a negative link between mind wandering and comprehension, the increased rates of mind wandering during re-reading would provide a kind of “headwind” against any benefits provided by the re-exposure to the text. Thus, the magnitude of the benefit of re-reading might be (negatively) related to the magnitude of the re-reading effect on mind wandering. Alternatively, the increased rates of mind wandering during re-reading might reflect a symptom of the adoption of a less-control demanding and thus more mind wandering prone reading strategy (e.g., skimming). Thus, the additional mind wandering might not be associated with additional costs over and
above those deriving from the adoption of the less-control demanding reading strategy. Critically, increased mind wandering does not always lead to concomitant performance effects (e.g., Thomson, Besner & Smilek, 2013). For example, if readers on a second read simply set out to extract the same representation (Callender & McDaniel, 2009), devoting more time to mind wandering (relative to the first read) could carry limited costs (i.e., sufficient resources might be available for both to occur in parallel). On this account, re-reading might lead to greater mind wandering without there being a link between the magnitude of the re-reading effect on comprehension and the magnitude of the re-reading effect on mind wandering.

In summary, the present investigation deals with three critical issues (1) we attempt to put the putative relation between re-reading and mind wandering on stronger footing (2) we examine the relation between re-reading and different types of mind wandering (i.e. unintentional and intentional) and (3) we assess the relation between re-reading’s effect on mind wandering and re-reading’s effect (or lack thereof) on reading comprehension. These issues along with a number of subsidiary issues will be addressed across two experiments.

Experiment 1

In Experiment 1 participants read two short research methods texts for comprehension and completed comprehension tests associated with each. One text was read once and the other text was read twice. Participants were probed to report mind wandering throughout the reading process; we did not differentiate between intentional and unintentional mind wandering in this experiment. If re-reading encourages mind wandering, then participants should report more mind wandering during the re-read
(RR2) compared to both the first read (RR1) of the re-read text and to the text read once (R1).

**Methods**

We report how we determined our sample size, all data exclusions (if any), all manipulations and all measures in the study (Simmons, Nelson & Simonsohn, 2012).

**Participants**

Participants were 112 Amazon Mechanical Turk (AMT) workers participating in a session lasting approximately 35 minutes. Out of these workers, 96 workers’ data was usable (i.e., participants were removed if they did not fully complete the study). AMT allows voluntary workers to complete Human Intelligence Tasks (HITs) in return for monetary compensation. AMT has been suggested to be a reliable and valid data source to collect experimental data (Crump, McDonnell & Gureckis, 2013; Mason & Suri, 2012). While the use of AMT necessitates a relinquishment of control over the setting, in the present case, this lack of control would serve to make the context more authentic with respect to how individuals “study” in their day-to-day lives. Participation was voluntary and participants received $5.00 credited to their AMT account. Participation was restricted to U.S. residents whose approval rating was greater than or equal to 50%. We used power of .80 and an effect of size $d = .3$ (selected based on pilot work) to determine the sample size.

**Design**

Reading condition (read once vs. re-read) was manipulated in a within subjects design. Order of reading conditions was counterbalanced across participants. In particular, half the participants completed the read once condition first followed by the
re-read condition, which consisted of reading the same text twice (i.e., ABB), and half did the reverse (i.e., BBA). Texts were assigned to each counterbalance by including text A twice in half the counterbalances and the text B twice in the other half. We did not include an ordering wherein participants first read the to-be-re-read text, following by the read once text, followed by the re-reading of the first text (i.e., BAB). This is because it would introduce an element of distributed practice or spacing to the re-reading condition that is not possible in the read once condition. Given that distributed practice and spacing are known to influence retrieval success (e.g., Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013), this would complicate the interpretation of the results.

Materials

Participants filled out a variety of individual difference measures along with tests of prior knowledge and text comprehension. All materials were presented on the computer using an Adobe Flash® program created for this purpose.

Texts. Two texts on scientific research methods were used in the main reading task. The texts were taken from the electronic textbook that accompanies the educational game Operation ARA! (Halpern et al., 2012). One text was about dependent variables and the other about causal claims. The dependent variable text was 104 sentences long and consisted of 1490 words and the casual claims text was 108 sentences long, consisting of 1491 words. Both texts had a Flesch-Kincaid grade level of 9, indicating moderate difficulty (Klare, 1974). Each text was read one sentence at a time, with participants using the space bar to move to the next sentence. Participants were not permitted to move to a previously read sentence.
**Individual Difference Measures.** To assess individuals’ baseline reading ability, participants read a passage from the Nelson Denny (ND) comprehension test and completed a short comprehension test on the passage (Brown, Fishco & Hanna, 1993). A topic interest measure was adapted from Linnenbrink-Garcia and colleagues (2010) to measure participants’ baseline interest in learning about research methods prior to engaging in the reading task. The measure included questions such as, “I am not at all interested in learning about research methods,” and “I think it is important to know what research methods is all about.” Responses ranged from 1 (strongly disagree) to 6 (strongly agree). In order to provide a brief context for the topic of research methods, participants were given a short (< 500 words) introductory text prior to completing the topic interest measure.

**Perceptions of the Reading Task.** Participants completed a series of single-item measures about their subjective perceptions after reading each text. There were five questions in all: (1) competence (“I think I understood this text very well”), (2) effort (“I put a lot of effort into this”), (3) interest (“I would describe this activity as very interesting”), (4) value (“I believe doing this activity could be beneficial to me”) and (5) difficulty (“I believe the reading level of the text was very difficult”). They rated each of these items on a 6-point scale from (1) Strongly disagree to (6) Strongly agree.

**Mind Wandering Probes.** Mind wandering was tracked via auditory thought probes. A standard description of mind wandering (Smallwood & Schooler, 2006) was employed: “At some point during reading the texts, you may realize that you have no idea what you just read. Not only were you not thinking about the text, you were thinking about something else altogether.” The probe consisted of an auditory beep that occurred
on pseudo-random pages throughout each text. We generated three sets of nine or ten probe locations (for each text) in order for the thought probes to occur at different locations during the three reads. In generating the probe locations, probes could not occur in the first or last ten sentences and could not occur within five sentences of each other. Probes were triggered when participants pressed the space bar to advance to the next sentence. Participants were instructed to press the “y” key if they were mind wandering or the “n” key if they were not. Participants were not able to advance to the next sentence until they had responded to the thought probe.

Comprehension Tests. Comprehension tests adopted a four-alternative multiple-choice format and consisted of two types of questions: text level and inference level. Text level questions were based on factual or surface level characteristics of the text. Inference questions are designed to elicit patterns of reasoning and required participants to use inference or apply a concept to a novel example in order to answer the question correctly (Graesser & Person, 1994). Inference questions were used to assess participants’ conceptual knowledge of the research methods concepts covered in the texts.

A 12 item pre-test was created consisting of 6 inference questions for the dependent variable topic and 6 inference questions for the casual claims topic. An 18-item post-test was created for the dependent variable topic that included 6 inference and 12 text level questions. A 17-item post-test was created for the casual claims topic that consisted of 11 text level questions and 6 inference questions.

Procedure

Participants were presented with a description of the study and given the option to not volunteer. Following electronic consent, participants first completed the pre-test on
the two main texts read in the study. They then read the Nelson Denny passage, completed the Nelson Denny comprehension test, read the short text (either once or twice based on counterbalance) introducing scientific research methods, and completed the topic interest measure. Next, participants were instructed on how to respond to the mind wandering probes after which they began the reading task. After reading each text (after the first read of the text read once and after the second read of the re-read text), participants self-reported their perceptions of the text they just read followed by the comprehension test on that text. After completion of the comprehension test for the second text, participants were debriefed and provided with contact information.

Results

Descriptive statistics for the key outcomes can be found in Table 1. A Greenhouse Geisser correction was used when Mauchly’s test showed that the sphericity assumption was violated. We also replicated the major results below using a subset of the sample that scored above chance on the comprehension tests and who were not less than one standard deviation below the mean in average reading time in order ensure the results were not attributable to participants simply “clicking through” the experiment. Despite these conservative criteria, the results were qualitatively similar.

Mind Wandering. Mind wandering as a function of condition is reported in Table 1 and Figure 1. A repeated measures ANOVA revealed a significant effect of reading condition on percent of mind wandering reports to the thought probes, $F(1.83,173.80) = 6.51$, $MSE = 363.84$, $p = .002$, $\eta = .06$. Follow-up t-tests showed that there was an increase in mind wandering in the RR2 condition compared to the RR1 condition, $t(95) = 3.29$, $SE = 2.44$, $p = .001$, $d = .34$, and the R1 condition, $t(95) = 2.79$, $SE = 3.01$, $p = .006$. 
Re-reading: The influence of mind wandering

$d = .29$. There was no difference in the percentage of mind wandering across R1 and RR1 conditions, $t(95) = .15, SE = 2.41, p = .882, d = 0.02$, thereby suggesting the following overall pattern: RR2 > [RR1 = R1].

As noted above, there were two orders in which participants could complete the experiment (1) read once followed by re-read (ABB) or (2) re-read followed by read once (BBA). The nature of the reading order could bias the results toward an increase in mind wandering in the re-read condition given that mind wandering has been shown to positively correlate with time on task (Risko et al., 2012; 2013) and the re-read condition could never occur in the first position whereas the R1 and RR1 conditions could. To address this potential confound, we restructured the data such that for participants in the AAB order, their R1 condition (last text read) was compared to their RR2 condition (middle text read) and for participants in the BAA order their RR1 condition (middle text read) was compared to their RR2 (last text read). Thus, across participants, position was controlled (i.e., the first reading of text and the second reading of a text appeared in either the middle or last position equally across participants). A 2 (Order: RR1 followed by RR2 vs. RR2 followed by R1) x 2 (Reading Condition: First Read vs. Re-Read) mixed ANOVA was conducted. There was a main effect of reading condition, $F(1,94) = 5.59$, $MSE = 364.87, p = .02, \eta = .06$, a marginal main effect of order, $F(1,94) = 2.88, MSE = 1655.95, p = .09, \eta = .03$, and importantly no order by reading condition interaction, $F(1,94) = 0.77, MSE = 364.87, p = .38, \eta = .01$. Thus, despite the confounding of position and reading condition, the increase in mind wandering in the re-reading condition seems robust. In order to examine the extent to which time on task influenced mind wandering and comprehension we also compared the read once text when it
appeared in the first position (ABB) and the last position (BBA). There was no effect of position on mind wandering (first position: 22.4% vs. last position: 18.6%), $t(94) = .65$, $SE = 5.84$, $p = .52$, $d = .13$ (comparing R1 condition when it appeared first vs. last).

**Comprehension.** Comprehension as a function of condition is reported in Table 1 and Figure 2. A paired samples t-test comparing comprehension scores (percentage of correct responses) across the R1 and RR2 conditions revealed no effect of reading condition, $t(95) = .23$, $SE = 1.71$, $p = .82$, $d = 0.02$, which replicates previous research (Callendar & McDaniel, 2009).

A 2 (Reading Condition: R1 vs. RR2) x 2 (Question Type: Text level vs. Inference) repeated measures ANOVA yielded a significant main effect of question type, $F(1,95) = 319.47$, $MSE = 286.18$, $p < .001$, $\eta^2 = .77$, such that comprehension was lower for the more difficult inference questions relative to the easier text level questions. However, there was no interaction between reading condition and question type, $F(1,95) = .52$, $MSE = 225.86$, $p = .48$, $\eta^2 = .01$. There was no effect of position on comprehension (first position: 60.2% vs. last position: 62.9%), $t(94) = .75$, $SE = 3.61$, $p = .45$, $d = .15$. (comparing R1 condition when it appeared first vs. last).

**Reading Time.** Reading time as a function of condition is reported in Table 1. A repeated measures ANOVA was used to examine total reading time (in minutes after subtracting out time taken to respond to the auditory probes) across the R1, RR1, and RR2 conditions. There was a significant effect of reading condition on reading time, $F(1.76,167.57) = 83.90$, $MSE = 2.02$, $p < .001$, $\eta = .47$. Follow-up tests revealed faster reading times in the RR2 condition than in the RR1 condition, $t(95) = 12.64$, $SE = .17$, $p < .001$, $d = 1.29$, and R1 condition, $t(95) = 9.80$, $SE = .22$, $p < .001$, $d = 1.0$. There was no
difference in reading time between the R1 and RR1 conditions, $t(95) = .45$, $SE = .18$, $p = .65$, $d = .05$.

**Subjective Perceptions.** Subjective perceptions as a function of condition are reported in Table 2. A paired samples t-test comparing perceived competence across R1 and RR2 indicated that there was a significant difference between the two conditions, $t(95) = 3.67$, $SE = .11$, $p < .001$, $d = .37$ (see Figure 1). Participants perceived that they were more competent for the re-read text than the read once text. Paired sample t-tests did not reveal any effect of reading condition on the other subjective assessments [all ts < 1.5, ps > .16, ds < .15].

**Correlational Analyses.** In a first set of correlations we sought to assess the basic relations between the critical dependent variables (i.e., overall, text level, and inference level comprehension, mind wandering, reading time), subjective perceptions, and our individual difference measures (i.e., Nelson Denny, topic interest). See Table 3 for the full correlation matrix. Outside of assessing expected relations between variables (e.g., mind wandering and comprehension) and a priori tests (e.g., relations between re-reading effects), these correlations are provided for the benefit of future research. As expected, mind wandering was negatively correlated with comprehension, stronger in the case of text level comprehension. Reading time was also positively correlated with comprehension, again stronger in the case of text level comprehension. Mind wandering was not related to reading time. Performance on the Nelson-Denny was related to all of the comprehension measures and, interestingly, topic interest was not related to any of the dependent variables (it is unclear why this was the case and was not true in Experiment 2). The correlations with the subjective perceptions measures were largely as expected.
For example, comprehension was correlated with perceived competence\(^1\) and difficulty and mind wandering were negatively correlated with perceived competence, effort, interest, and value.

In the next set of correlational analyses we tested two hypotheses (1) that the influence of re-reading on mind wandering (mind wandering in the RR2 condition minus mind wandering in the RR1 condition) would be related to the influence of re-reading on comprehension (comprehension in the RR2 condition minus comprehension in the R1 condition; for overall comprehension and text level and inference level questions separately) and (2) that the influence of re-reading on reading time (reading time in the RR2 condition minus reading time in the RR1 condition) would be related to the influence of re-reading on comprehension. Given the effect of re-reading on perceived competence that we reported earlier, we also assessed the relation between this effect (competence in the RR2 condition minus competence in the R1 condition) and the other re-reading effects. See Table 4 for the full correlation matrix. Critically, the re-reading effect on comprehension was not related to either the rereading effect on mind wandering or reading time. Topic interest was not related to the re-reading effect on mind wandering, reading time or comprehension, all \(|r| < .05, p > .6\). The pattern of correlations was similar when using a non-parametric approach (Spearman’s Rho).

Discussion

The results from Experiment 1 are straightforward. Individuals mind wandered significantly more while re-reading a text (RR2) than reading a text for the first time (RR1) or reading a text once (R1). These results are consistent with Moss et al. (2013) and put the relation between mind wandering and re-reading on much stronger footing as
it confirms that re-reading increases mind wandering relative to a read once baseline and confirms that the effect can be observed using the traditional probe method rather than retrospective reports. We also found, as in Callender and McDaniel (2009), no comprehension benefit due to re-reading despite the fact that participants felt more competent with the re-read text. While the purpose of the present investigation was not to examine whether or not re-reading benefits comprehension, this result provides another demonstration that its effectiveness is limited. Consistent with Rawson’s (2012) suggestion that the lack of a re-reading effect could reflect a shallower processing approach on the second read, participants also re-read the text much faster the second time than the first (about 43%). Lastly, we found no evidence that the re-reading effect on mind wandering was related to the magnitude of the re-reading effect on comprehension and, similarly, no evidence that the latter was related to the re-reading effect on reading time. In both of these cases, it is important to note that correlating differences scores is fraught with methodological issues (e.g., Peter, Churchill & Brown, 1993) and the lack of an effect should be interpreted with caution. We discuss this issue further in the General Discussion.

Experiment 2

In Experiment 2 we sought to replicate and extend the key findings from Experiment 1. The most critical change was a shift from simply assessing mind wandering in general to distinguishing between intentional and unintentional mind wandering. As noted above, mind wandering researchers have to date largely assumed that observed mind wandering was unintentional (Seli et al., 2014; 2015a; 2015b). Seli et al.’s (2014; 2015a; 2015b) research casting doubt on this assumption makes it imperative
that researchers determine whether a given manipulation that influences mind wandering does so via an effect on intentional, unintentional, or a combination of both types of mind wandering. Thus, in Experiment 2 we assess the extent to which re-reading effects intentional and unintentional mind wandering.

In addition to assessing intentional and unintentional mind wandering as a function of reading strategy, we also made a number of subsidiary changes. In Experiment 1, we collected subjective perceptions of competence, effort, interest, value and difficulty for the read once and re-read text, however, the later was only assessed after the second read. In Experiment 2, we assessed participants’ subjective perceptions of competence, effort, interest, value and difficulty after each read (i.e. three different times). This change will allow for a direct comparison of these subjective measures across the first read and second read of the re-read text. In Experiment 2, we also replaced our reading ability measure with a modified word sum task and added an individual difference measure of self-control. Provided the proposed link between control and mind wandering, individuals higher in self-control should report higher rates of mind wandering. Ivanescu and Danckert (submitted) reported evidence consistent with this prediction using self-report measures of spontaneous (unintentional) and deliberate (intentional) mind wandering. In addition, they reported that the correlation was stronger for the latter than the former. The present investigation will provide an important extension of this work to a behavioral measure of mind wandering (rather than self-report). Lastly, we shifted from a sentence-by-sentence to a paragraph-by-paragraph presentation and replaced or improved some ancillary measures as noted below.

**Methods**
Participants

Participants were 94 Amazon Mechanical Turk (AMT) workers participating in a session lasting approximately 35 minutes. Out of these workers, 87 workers’ data was usable (i.e., participants were removed if they did not fully complete the study). Payment and participant restrictions were the same as Experiment 1. We used power of .80 and an effect size $d = .3$ (selected based on pilot work and Experiment 1) to determine the sample size. Much of the methods were identical to Experiment 1. Changes are described below.

Materials

**Texts.** Rather than sentence-by-sentence, in Experiment 2 each text was read one paragraph at a time, with participants using the space bar to move to the next paragraph. Participants were not permitted to move to a previously read paragraph. There were 26 paragraphs per text.

**Individual Difference Measures.** We replaced the Nelson Denny (ND) comprehension test with a Word Sum task (Barr, Pennycook, Stolz, & Fugelsang, 2015; Huang & Hauser, 1998). A brief version of the Self-Control Scale (Tangney, Baumeister & Boone, 2004) was also added. This scale consists of 12 items asking participants to rate on a five point scale the extent to which various statements are typical of them (e.g., “I wish I had more self-discipline,” “I have trouble concentrating”).

**Perceptions of the Reading Task.** The items used were identical but in Experiment 2 they were administered after each read of each text rather than once per text.
**Mind Wandering Probes.** As in Experiment 1 participant’s’ mind wandering was measured via thought probes. Participants in Experiment 2 were given three options (1) on task (2) intentionally mind wandering and (3) unintentionally mind wandering. Participants were instructed to press the “n” key if they were not mind wandering, the “u” key if they were unintentionally mind wandering, or the “i” key if they were intentionally mind wandering. The number of probes was reduced from 9-10 to 6 per text.

**Comprehension Tests.** The pre-test and post-tests were largely the same as those used in Experiment 1. A few items were altered and one item that was missing from Experiment 1 was added.

**Results**

Descriptive statistics for the key outcomes can be found in Table 5. A Greenhouse Geisser correction was used when Mauchly’s test showed that the sphericity assumption was violated. We also replicated the major results below using a subset of the sample that scored above chance and who were not less than one standard deviation below the mean in average reading time in order ensure the results were not attributable to participants simply “clicking through” the experiment. The results were qualitatively similar despite these conservative criteria.

**Mind Wandering.** Mind wandering as a function of condition is reported in Table 2 and Figure 1. Separate 3-way (Reading Condition: R1 vs. RR1 vs. RR2) repeated measures ANOVAs were conducted for overall mind wandering and the two types of mind wandering (i.e., overall, intentional, unintentional). The ANOVA revealed a significant effect of reading condition on percentage of overall mind wandering reports, \( F(1.7, 144.4) = 6.25, MSE = 463.88, p = .002, \eta = .07 \) (see Figure 3). Follow-up t-tests
showed that there was an increase in mind wandering in the RR2 condition compared to the RR1 condition, \( t(85) = 3.34, SE = 2.83, p = .001, d = .36 \), and the R1 condition, \( t(85) = 2.52, SE = 3.60, p < .05, d = .27 \). There was no difference in the percentage of mind wandering across R1 and RR1 conditions, \( t(85) = .14, SE = 2.56, p = .888, d = 0.01 \).

There was also a significant effect of reading condition on percent of intentional mind wandering reports, \( F(1.76, 149.68) = 6.20, MSE = 314.24, p = .003, \eta = .07 \) (see Figure 3). Follow-up t-tests showed that there was an increase in intentional mind wandering in the RR2 condition compared to the RR1 condition, \( t(85) = 3.18, SE = 2.43, p = .002, d = .34 \), and the R1 condition, \( t(85) = 2.62, SE = 2.95, p < .05, d = .28 \). There was no difference in the percentage of intentional mind wandering across R1 and RR1 conditions, \( t(85) = .01, SE = 2.17, p = .996, d = .00 \). Lastly, there was no effect of reading condition on percentage of unintentional mind wandering reports, \( F(2.170) = .27, MSE = 262.07, p = .76, \eta = .00 \) (see Figure 3).

As in Experiment 1, in order to address the confounding of position of text and reading condition the data were restructured and a 2 (Order: RR1 followed by RR2 vs. RR2 followed by R1) x 2 (Reading Condition: First Read vs. Re-Read) mixed ANOVA was conducted on overall mind wandering, intentional mind wandering, and unintentional mind wandering. There were 2 more participants in the AAB condition. With respect to overall mind wandering, there was a main effect of reading condition, \( F(1.84) = 4.16, MSE = 471.94, p < .05, \eta = .05 \), no main effect of order, \( F(1.84) = .42, MSE = 1523.08, p = .66, \eta = .00 \), and no order by reading condition interaction, \( F(1.84) = .12, MSE = 471.94, p = .73, \eta = .01 \). With respect to intentional mind wandering, there was a main effect of reading condition, \( F(1.84) = 10.73, MSE = 325.39, p < .05, \eta = .11 \), no main
effect of order, $F(1,84) = .01, MSE = 590.92, p = .93, \eta = .00$, and no order by reading condition interaction, $F(1,84) = 2.69, MSE = 325.39, p = .11, \eta = .03$. Thus, despite controlling for position, the effect of re-reading on mind wandering, specifically intentional mind wandering, seems robust.

In order to examine the extent to which time on task influenced mind wandering and comprehension we also compared the read once text when it appeared in the first position (ABB) and the last position (BBA). There was no effect of position on overall mind wandering (first position: 26.6% vs. last position: 27.7%), $t(84) = .20, SE= 5.54, p = .84, d = .04$.

**Comprehension.** Comprehension as a function of condition is reported in Table 5 and Figure 2. A paired samples t-test comparing comprehension scores (percentage of correct responses) across the R1 and RR2 conditions revealed no effect of reading condition, $t(85) = 1.60, SE = 2.35, p = .112, d = .17$ (see Figure 4).

A 2 (Reading Condition: R1 vs. RR2) x 2 (Question Type: Text level vs. Inference) repeated measures ANOVA yielded a significant main effect of question type, $F(1,85) = 38.08, MSE = 280.41, p < .001, \eta=.31$, such that comprehension was lower for the inference questions relative to the text level questions. However, there was no interaction between reading condition and question type, $F(1,85) = 1.42, MSE = 415.46, p = .24, \eta=.02$. There was no effect of position on comprehension for the R1 text (first position: 54.0% vs. last position:54.2%), $t(84) = .05, SE= 4.17, p = .96, d = .01$.

**Reading Time.** Reading time as a function of condition is reported in Table 5. A repeated measures ANOVA was used to examine total reading time (in minutes) across the R1, RR1, and RR2 conditions. There was a significant effect of reading condition on
reading time, $F(2,170) = 76.93, MSE = 2.10, p < .001, \eta = .48$. Follow-up tests revealed faster reading times in the RR2 condition than in the RR1 condition, $t(85) = 11.16, SE = .21, p < .001, d = 1.20$, and R1 condition, $t(85) = 9.89, SE = .24, p < .001, d = 1.10$. There was no difference in reading time between the R1 and RR1 conditions, $t(85) = .03, SE = .21, p = .98, d = .00$.

**Subjective Perceptions.** Subjective perceptions as a function of condition are reported in Table 6. A 3 (Reading Condition: R1 vs. RR1 vs. RR2) repeated measures ANOVA was conducted for each question (i.e., competence, difficulty, effort, interest, and value). There was a significant effect of reading condition on perceived competence, $F(1.46,124.25) = 3.12, MSE = 1.01, p < .05, \eta = .03$, such that participants felt more competent after reading the text for the second time (RR2) compared to reading the same text for the first time (RR1), $t(85) = 2.31, SE = .08, p < .05, d = .25$, and compared to reading the other text once (R1), $t(85) = 2.34, SE = .15, p < .05, d = .25$. There was no difference in perceived competence between the R1 and RR1 conditions, $t(85) = .81, SE = .16, p = .422, d = .09$.

There was also a significant effect of reading condition on perceived effort, $F(2, 170) = 11.93, MSE = .35, p < .001, \eta = .12$, such that participants reported putting less effort into reading the text for the second time (RR2) compared to reading the same text for the first time (RR1), $t(85) = 4.49, SE = .10, p < .001, d = .48$, and compared to reading the other text once (R1), $t(85) = 3.22, SE = .09, p < .01, d = .35$. There was marginally significant difference in perceived effort between the R1 and RR1 conditions, $t(85) = 1.68, SE = .77, p = .10, d = .18$, such that participant’s reported putting more effort into reading the re-read text the first time than reading the read once text.
There was a significant effect of reading condition on perceived interest, $F(1.82,155.16) = 9.73$, $MSE = .56$, $p < .001$, $\eta = .10$, such that participants felt less interested in the text reading it for the second time (RR2) compared to reading the same text for the first time (RR1), $t(85) = 4.74$, $SE = .95$, $p < .001$, $d = .51$, and compared to reading the other text once (R1), $t(85) = 3.26$, $SE = .11$, $p < .05$, $d = .35$. There was no difference in perceived competence between the R1 and RR1 conditions, $t(85) = 1.1$, $SE = .13$, $p = .288$, $d = .11$.

**Correlations.** As in Experiment 1, in a first set of correlations we sought to assess the basic relations between the critical dependent variables (i.e., mean comprehension, mind wandering and reading time) and between those variables and our individual difference measures (i.e., Word Sum, topic interest, and self-control). As in Experiment 1, given the large number of correlations in this and following sections, care should be taken in interpreting each individual correlation. Outside of assessing expected relations between variables (e.g., mind wandering and comprehension) and a priori tests (e.g., relations between re-reading effects), these correlations are provided for the benefit of future research (see Table 7 for the full correlation matrix). Again, mind wandering was negatively correlated with comprehension and reading time was positively correlated with it. Mind wandering was also negatively related to reading time. Performance on the Word Sum task was related to all of the comprehension measures and, unlike Experiment 1, topic interest was negatively correlated with mind wandering. Interestingly, self-control was correlated with mind wandering (marginally in the case of unintentional mind wandering) but not with any comprehension measure or reading time. The correlations with the subjective perceptions measures were largely as expected. For example,
comprehension was correlated with perceived competence\(^2\) and difficulty and mind wandering was negatively correlated with perceived competence, effort, interest and value. The pattern of correlations was similar when using a non-parametric approach (Spearman’s Rho).

In the next set of correlational analyses, we assessed the relations between the re-reading effects on mind wandering, reading time and comprehension. Given the effect of rereading on perceived competence, effort, and interest, we also assessed the relation between these effects and the other rereading effects (see Table 8 for the full correlation matrix). Critically, again, the re-reading effect on mind wandering was not correlated with the re-reading effect on comprehension and there also no correlation between the re-reading effect on reading time and the re-reading effect on comprehension or mind wandering. Interestingly, there was a strong negative correlation \(r = -.38\) between the re-reading effect on effort and the re-reading effect on intentional mind wandering. As the magnitude of the re-reading effect on intentional mind wandering increased individuals further reduced their effort across the first and second reads of the re-read text. Topic interest was related (marginally) to the re-reading effect on overall comprehension, \(r(84) = -.18, p = .096\), and inference level comprehension, \(r(84) = -.22, p = .04\). The pattern of correlations was similar when using a non-parametric approach (Spearman’s Rho).

**Discussion**

The results of Experiment 2 provide a number of important insights. First, all of the critical results from Experiment 1 replicated. Individuals mind wandered more while re-reading and individuals re-read at a much faster rate than reading a text for the first
time. In addition, there was no benefit of comprehension in the re-read condition despite participants reported feeling more competent. Experiment 2 also offered a number of new results, the most important of which is that the re-reading effect on mind wandering appears to be completely driven by intentional mind wandering. Indeed, there was no effect of re-reading on unintentional mind wandering. In addition, the inclusion of subjective report measures after each read of the texts revealed that re-reading reduced perceived effort and interest. Lastly, overall mind wandering as well as intentional and unintentional mind wandering were related to individual differences in topic interest and self-control.

**General Discussion**

The purpose of the present study was to examine the influence of re-reading on mind wandering (during reading) and the extent to which any such putative effect was related to the influence (or lack thereof) of re-reading on comprehension from the text. Critically, individuals mind wandered significantly more while re-reading a text (RR2) than reading a text for the first time (RR1) or reading a text once (R1). This effect replicated across two experiments with different modes of presentation (i.e., sentence-by-sentence vs. paragraph-by-paragraph). Furthermore, Experiment 2 demonstrated that this re-reading effect on mind wandering was predominantly due to a change in intentional instead of unintentional mind wandering. While researchers have typically assumed that all mind wandering reports reflect unintentional mind wandering, the present work demonstrates that this is clearly not the case and, more importantly, manipulations can selectively influence one type of mind wandering. This observation (see also Seli et al., 2014; 2015a; 2015b) might suggest the need to re-evaluate findings in the mind
wandering literature in light of this distinction (i.e., do manipulations that have previously been shown to influence mind wandering do so via an influence on intentional, unintentional, or both types of mind wandering). Lastly, while mind wandering increased during re-reading and mind wandering was negatively associated with comprehension, we found no direct evidence that the effect of re-reading on mind wandering was related to the magnitude of the re-reading effect on comprehension. Furthermore, like in Callendar and McDaniel (2005), we found little evidence that massed re-reading was an effective pneumonic technique but, nevertheless, participants felt significantly more competent with the re-read text. While not the focus on the present investigation, the latter results should contribute to the debate about the relative effectiveness of re-reading compared to other pneumonic strategies. In the remainder of this section, the implications of these results for understanding mind wandering and the influence of re-reading on text comprehension will be considered further.

According to Callender and McDaniel (2009) the limited effectiveness of re-reading is due to its failure to encourage the reader to build a richer representation from the text on subsequent reads. In a similar vein, Rawson (2012) suggested that the benefit of re-reading might be contingent on individuals fully processing the text on the second read. Thus, the limited effectiveness of re-reading, at least in some cases, is a product of re-reading encouraging participants to shift to a “skimming” strategy when re-reading. Consistent with the latter, in both Experiment 1 and Experiment 2, participants speed up considerably when reading the text for the second time (relative to the first). Although not explicit in either of these accounts, it seems plausible that these putative reading “modes” engaged in during re-reading would be associated with less demands on attentional
control. For example, if participants engage in less model construction during re-reading than during the initial read, then this would reduce demands on attentional control (e.g., Friedman & Miyake, 2009). On this account, the increase in mind wandering in the re-reading condition can be interpreted as consistent with the notion that task specific demands on controlled processing influence mind wandering (e.g., Moss et al., 2011; 2013; Olney et al., in press; Thomson, 2013; Smallwood, 2013). Investigating the claim that re-reading puts less demands on controlled processes than reading a text once using fMRI to measure control network activation would (as in Moss et al., 2011; 2013) represent a potentially fruitful next step in this line of research.

In theory, this putative reduction in demand during re-reading could free up resources that are “captured” unintentionally and/or deployed intentionally to internal self-generated thoughts thus leading to mind wandering. Although previous approaches to investigating mind wandering would have left this question unanswered (or assumed it was the former), the results of Experiment 2 clearly demonstrate that the increase in overall mind wandering during re-reading was due to an increase in the amount of intentional mind wandering.

Provided the increase in mind wandering is intentional, it becomes theoretically interesting to consider further how individuals make the decision to intentionally mind wander. One possibility is that the decision is based on a kind of metacognitive assessment of the effort required to achieve their reading goals or “norm of study” (e.g., Dunlosky & Thiede, 1998; Nelson & Leonesio, 1998). Re-reading leads to an increase in experienced fluency and individuals likely hold the belief (theory) that reading a text for a second time will be easier than the first (see Ball, Klein, & Brewer, 2014 for a recent
demonstration that perceived fluency moderates study time). Either of these observations could serve as cues (experience or theory based; Koriat, 2007) that less effort is required when re-reading. Consistent with this account, in Experiment 2 participants self-reported expending less effort on the second read of the text and the magnitude of this re-reading effect on self-reported effort was positively correlated with the magnitude of the re-reading effect on intentional mind wandering. The latter result, however, needs to be considered in light of the fact that effort ratings were made after reading, thus they could have been made based on how much they intentionally mind wandered (such a result would nevertheless be interesting with respect to how individuals interpret their mind wandering behavior). Nevertheless, on the account developed above, when individuals re-read, the metacognitive experience or expectation that less effort is required to achieve a given reading goal leads to an increase in intentional mind wandering. In a similar vein, this decrease in effort could be viewed in terms of motivation (i.e., participants are not motivated to sustain the same level of effort in the second read). These same metacognitions likely lead to the “illusion of competence” (i.e., participants thought they comprehended the re-read text better than the text read once; Karpicke, Butler & Roediger, 2009) observed in both Experiment 1 and Experiment 2. The intentional bases of the increase in mind wandering (and shift in reading strategy) during re-reading also suggests that the effect might be ameliorated via “instruction” or some other intentional strategy (e.g., inoculating students via instruction against the tendency for re-reading to encourage a shallow reading strategy).

Future work investigating the interactions between metacognition and intentional and unintentional mind wandering could lead to further insights into this important
theoretical distinction. For example, this distinction might aid in understanding apparently contradictory patterns across experiments investigating mind wandering in text comprehension. In particular, Feng et al. (2013) demonstrated that individuals mind wandered more while reading a “difficult” text and here we demonstrate that individuals mind wandered more when the task was easier (i.e., reading the a text for the second time). This apparent contradiction could reflect a differential impact of “difficulty” on intentional and unintentional mind wandering. Reading a difficult text could impair the construction of a situation model making it more difficult to sustain attention thus leading to an increase in unintentional mind wandering, whereas re-reading signals to the reader that high levels of attention are not needed thus leading to an increase in intentional mind wandering. Hence, the contradictory patterns might be more apparent than real when the distinction between different types of mind wandering is considered.

The last issue to address is the lack of a relation between the magnitude of the re-reading effect on mind wandering and the magnitude of the re-reading effect on comprehension. If the increase in mind wandering as a function of re-reading caused individuals not to benefit from re-reading, then we would have expected a correlation between the magnitude of the re-reading effect on mind wandering and the magnitude of the re-reading effect on comprehension. We did not. Before providing an explanation of this result it is important to note that (1) it is inherently difficult to detect correlations between difference scores (e.g., Peter, Churchill & Brown, 1993) and (2) all the effect sizes here are small and, indeed, there is no overall re-reading effect on comprehension which might lead to a restriction of range which would also complicate the detection of a relation (i.e., it might be easier to detect a relation in an experiment that produced a
strong re-reading effect on comprehension). That being said, assuming there is no relation between the re-reading effect on mind wandering and the re-reading effect on comprehension, this could reflect the fact that the particular reading mode (Callender & McDaniel, 2009; Rawson, 2012) adopted carries the bulk of the influence on text comprehension. The increase in mind wandering (and decrease in reading time) would be in essence a symptom (as would comprehension) of the reading mode associated with re-reading. This is not to say that mind wandering (and reduced reading time) do not contribute at all to the limited benefits of re-reading, but given the magnitudes of the effect sizes involved detecting such effects might be difficult and functionally the contributions might be negligible. Thus, from an applied perspective, if the goal were to make re-reading more effective, then time would likely best be spent on encouraging a “deeper” or “fuller” reading mode versus trying to reduce mind wandering (theoretically the former should lead to the latter).

In conclusion, the present investigation has provided evidence that re-reading is associated with an increase in mind wandering. Furthermore, this effect was specific to intentional mind wandering, thus providing evidence that mind wandering is not a unitary phenomenon. Future work investigating other common mnemonic techniques and how they interact with attention will provide further insight into both mnemonic techniques and attention during learning.
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Footnotes

1 This correlation was not significant when only the text read once was considered, $r(94) = .14$, $p = .16$.

2 This correlation was significant when only the text read once was considered, $r(84) = .33$, $p = .002$. 
Table 1. Means and Standard Deviations (SD) for comprehension, reading time and mind wandering in the Read Once, Re-Read First Read, and Re-Read Second Read conditions in Experiment 1.

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<td>(2.24)</td>
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<td>Overall</td>
<td>20.47</td>
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<td>20.83</td>
<td>(27.97)</td>
<td>28.88</td>
<td>(33.70)</td>
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Table 2. Means and Standard Deviations (SD) for the subjective reports in the Read Once and Re-Read Second Read conditions in Experiment 1.

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Table 3. Correlations between main dependent variables and individual difference scales in Experiment 1.

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<th>ACC Text</th>
<th>ACC Inference</th>
<th>RT Overall</th>
<th>Topic Interest</th>
<th>Nelson Denny</th>
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<td>.77**</td>
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*Italicics < .05; * < .01; ** < .001

MW Overall = Mean overall mind wandering
ACC Overall = Mean overall comprehension
ACC Text = Mean text level comprehension
ACC Inference = Mean inference level comprehension
RT Overall = Mean reading time overall
Topic Interest = Topic interest scale
Nelson Denny = Reading ability
Competence = Subjective Competence
Difficulty = Subjective Difficulty
Effort = Subjective Effort
Interest = Subjective Interest
Value = Subjective Value
Table 4. Correlations between rereading effects in Experiment 1.

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<th>RR ACC Overall</th>
<th>RR ACC Text</th>
<th>RR ACC Inference</th>
<th>RR RT Overall</th>
<th>RR Competence</th>
</tr>
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<td>.58**</td>
<td>0.12</td>
<td>0.20*</td>
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<tr>
<td>RR ACC Text</td>
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<td>0.03</td>
<td></td>
<td>0.22*</td>
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<td>RR ACC Inference</td>
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<td>RR RT Overall</td>
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<td>0.14</td>
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</tr>
</tbody>
</table>

*Italics < .05; * < .01; ** < .001*

RR MW Overall = Re-reading effect on overall mind wandering (RR2 – RR1)
RR ACC Overall = Re-reading effect on overall comprehension (RR2 – R1)
RR ACC Text = Re-reading effect on text level comprehension (RR2 – R1)
RR ACC Inference = Re-reading effect on inference level comprehension (RR2 – R1)
RR RT Overall = Re-reading effect on reading time (RR2 – RR1)
RR Competence = Re-reading effect on subjective competence (RR2 – RR1)
Table 5. Means and Standard Deviations (SD) for comprehension, reading time and mind wandering in the Read Once, Re-Read First Read, and Re-Read Second Read conditions in Experiment 2.

<table>
<thead>
<tr>
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<th>Re-Read Second</th>
<th></th>
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<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
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<td>Comprehension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>54.07</td>
<td>(19.21)</td>
<td>57.85</td>
<td>(20.19)</td>
<td>36.24</td>
<td>(34.97)</td>
</tr>
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<td>Text Level</td>
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<td>(25.02)</td>
<td>64.73</td>
<td>(24.84)</td>
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</tr>
<tr>
<td>Inference Level</td>
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<td>(23.36)</td>
<td>50.97</td>
<td>(21.44)</td>
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<tr>
<td>Reading Time</td>
<td>5.28</td>
<td>(2.67)</td>
<td>5.28</td>
<td>(2.61)</td>
<td>2.91</td>
<td>(1.77)</td>
</tr>
<tr>
<td>Mind Wandering</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Overall</td>
<td>27.16</td>
<td>(25.54)</td>
<td>26.80</td>
<td>(27.29)</td>
<td>36.24</td>
<td>(34.97)</td>
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<td>(14.54)</td>
<td>6.80</td>
<td>(16.81)</td>
<td>14.54</td>
<td>(26.76)</td>
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<td>(20.77)</td>
<td>20.03</td>
<td>(21.96)</td>
<td>21.75</td>
<td>(24.40)</td>
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Table 6. Means and Standard Deviations (SD) for the subjective reports in the Read Once and Re-Read Second Read conditions in Experiment 2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Read Once Mean</th>
<th>SD (1.43)</th>
<th>Re-Read First Mean</th>
<th>SD (1.30)</th>
<th>Re-Read Second Mean</th>
<th>SD (1.36)</th>
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<tbody>
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<td>Difficulty</td>
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<td>2.88</td>
<td>(1.44)</td>
<td>2.72</td>
<td>(1.35)</td>
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<tr>
<td>Effort</td>
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<td>(1.24)</td>
<td>5.09</td>
<td>(1.07)</td>
<td>4.66</td>
<td>(1.39)</td>
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<tr>
<td>Interest</td>
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<td>(1.60)</td>
<td>3.52</td>
<td>(1.51)</td>
<td>3.03</td>
<td>(1.61)</td>
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<tr>
<td>Value</td>
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<td>(1.54)</td>
<td>3.65</td>
<td>(1.54)</td>
<td>3.49</td>
<td>(1.63)</td>
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Table 7. Correlations between main dependent variables and individual difference scales in Experiment 2.

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<tr>
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<th>MW Intentional</th>
<th>ACC Overall</th>
<th>ACC Text</th>
<th>ACC Inference</th>
<th>RT Overall</th>
<th>Topic Interest</th>
<th>Word Sum</th>
<th>Self Control</th>
<th>Competence</th>
<th>Difficulty</th>
<th>Effort</th>
<th>Interest</th>
<th>Value</th>
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<td>-.38**</td>
<td>- .26</td>
<td>- .41**</td>
<td>- .13</td>
<td>- .28*</td>
<td>- .66**</td>
<td>.25</td>
<td>- .51*</td>
<td>- .54**</td>
<td>- .48**</td>
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<td>MW Unintentional</td>
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<td>- .23</td>
<td>- .16</td>
<td>- .24</td>
<td>-.19</td>
<td>- .31*</td>
<td>-.20</td>
<td>- .09</td>
<td>-.31*</td>
<td>-.23</td>
<td>-.33*</td>
<td>-.29*</td>
<td>- .42**</td>
<td>-.32*</td>
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<td>- .38**</td>
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<td>- .20</td>
<td>-.31*</td>
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<td>- .40**</td>
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<td>.25</td>
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<td>.19</td>
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<td>.38**</td>
<td>.09</td>
<td>.30*</td>
<td>.02</td>
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<td>-.11</td>
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<td>.06</td>
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<td>.28*</td>
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<td>.23</td>
<td>.04</td>
<td>.27</td>
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<td>.38**</td>
<td>.11</td>
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</tbody>
</table>

*italics < .05; * < .01; ** < .001

MW Overall = Mean overall mind wandering
MW Unintentional = Mean unintentional mind wandering
MW Intentional = Mean intentional mind wandering
ACC Overall = Mean overall comprehension
ACC Text = Mean text level comprehension
ACC Inference = Mean inference level comprehension
RT Overall = Reading time overall
Topic Interest = Topic interest scale
Word Sum = Word sum test
Self Control = Brief Self Control Scale
Competence = Subjective Competence
Difficulty = Subjective Difficulty
Effort = Subjective Effort
Interest = Subjective Interest; Value = Subjective Value
Table 8. Correlations between re-reading effects in Experiment 2

<table>
<thead>
<tr>
<th></th>
<th>RR MW Overall</th>
<th>RR MW Unintentional</th>
<th>RR MW Intentional</th>
<th>RR ACC Overall</th>
<th>RR ACC Text</th>
<th>RR ACC Inference</th>
<th>RR RT Overall</th>
<th>RR Competence</th>
<th>RR Effort</th>
<th>RR Interest</th>
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</thead>
<tbody>
<tr>
<td>RR MW Overall</td>
<td>.59**</td>
<td>.57**</td>
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<td>.16</td>
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<td>-.14</td>
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<tr>
<td>RR Effort</td>
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<td></td>
<td>.38**</td>
<td></td>
</tr>
</tbody>
</table>

*Italics < .05; * < .01; ** < .001*

RR MW Overall = Re-reading effect on overall mind wandering (RR2 – RR1)
RR MW Unintentional = Re-reading effect on unintentional mind wandering (RR2 – RR1)
RR MW Intentional = Re-reading effect on intentional mind wandering (RR2 – RR1)
RR ACC Overall = Re-reading effect on overall comprehension (RR2 – R1)
RR ACC Text = Re-reading effect on text level comprehension (RR2 – R1)
RR ACC Inference = Re-reading effect on inference level comprehension (RR2 – R1)
RR RT Overall = Re-reading effect on reading time (RR2 – RR1)
RR Competence = Re-reading effect on subjective competence (RR2 – RR1)
RR Effort = Re-reading effect on effort invested (RR2 – RR1)
RR Interest = Re-reading effect on text interest (RR2 – RR1)
Figure 1. The mean percentage of mind wandering across condition. The error bars denote 95% within-subject confidence intervals (Masson & Loftus, 2004).
Figure 2. The mean comprehension score and mean competence ratings. The error bars denote 95% within-subject confidence intervals (Masson & Loftus, 2004).