In the eye of the beholder: Evaluative context modulates mind-wandering*  
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A B S T R A C T  
We present novel evidence that mind-wandering rates during a reading task are influenced by experimental context. In Experiment 1, participants read a series of passages and we measured their frequency of mind-wandering and their subjective evaluations of passage difficulty/interest. Section length was manipulated, such that some passages were presented in short sections and others were presented in long sections. Importantly, participants were randomly assigned to complete either a within-subject version of the experiment (in which they read some short-section passages and some long-section passages) or a between-subjects design (in which they only read either short-section or long-section passages). We found that the within-subject design yielded significant effects of section length on mind-wandering and on subjective passage evaluations, whereas the between-subjects design yielded null effects. This pattern of results was replicated in Experiment 2. These results provide compelling evidence that mind-wandering rates can be influenced by the experimental design. We conclude that mind-wandering is not only driven by the objective demands of the task, but also by subjective evaluations of those task properties, which are influenced by the context in which the task is evaluated (i.e., the “evaluative context”).

1. Introduction  
A common finding in studies of mind wandering is that mind-wandering tends to decrease as task demands increase (e.g., Antrobus, Singer, & Greenberg, 1966; Filler & Giambra, 1973; Forster & Lavie, 2009; Giambra, 1995; Grodsky & Giambra, 1990; Mason et al., 2007; McKiernan, D’Angelo, Kaufman, & Binder, 2006; McVay, Kane, & Kwapis, 2009; Smallwood, Nind, & O’Connor, 2009; Smallwood, Obonsawin, & Reid, 2003; Sousa, Carriere, & Smilek, 2013; Stuyven & Van der Goten, 1995; Teasdale et al., 1995; Teasdale, Proctor, Lloyd, & Baddeley, 1993; Thomson, Besner, & Smilek, 2013). According to Smallwood and Schooler’s (2006) executive resource theory, an increase in task difficulty means that more resources are needed for the task-at-hand and thus fewer resources are left over for off-task thought. While this inverse relation between mind-wandering rates and task difficulty has been found in many experiments, the context of reading is a notable exception. Contrary to executive resource theory, some studies have shown that mind-wandering rates increase with passage difficulty (Feng, D’Mello, & Graesser, 2013; Mills et al., 2013; Mills, D’Mello, & Kopp, 2015). For example, Feng et al. (2013) had participants read passages (easy or hard) one sentence at a time and assessed mind-wandering using intermittent “thought probes” (see Smallwood & Schooler, 2006). Their participants tended to report mind-wandering more often while reading the hard passages. 

Building on this prior research, we (Forrin, Risko, & Smilek, 2017) recently investigated the relation between reading difficulty and mind-wandering, with the goal of explaining why this effect runs counter to most research on task demands and mind-wandering. We found that the effect of reading difficulty on mind-wandering is largely a function of hard passages being presented as longer sections of text than easy passages when passages are presented one sentence at a time (a consequence of hard passages having longer sentences than easy passages). Specifically, we found that equating section length across easy and hard passages by presenting them across a full page of text eliminated the effect of reading difficulty on mind-wandering. Moreover, when we held reading difficulty constant and manipulated (within-subjects) the length of sections in which passages were presented, individuals mind-wandered more when reading passages with long sections relative to those with short sections.

Intriguingly, even though the content and overall length of the passages was held constant in those experiments, participants rated passages presented as long sections as more difficult and less interesting than passages presented as short passages. This suggests that one way that participants form impressions of a section of text is by its length,
with passages presented as long sections seeming more onerous and less interesting than those presented in short sections. Thus, section length influences participants’ subjective evaluations of passages, which may, in turn, modulate mind wandering rates (for example, by determining the amount of resources or effort devoted to the reading task; see Phillips, Mills, D’Mello, & Risko, 2016).

In the sum, the foregoing results suggest that section length increased mind-wandering rates not because long-section passages were objectively more demanding than short-section passages (reading difficulty was held constant in our section-length manipulation), but rather because participants perceived long-section passages as more demanding (and, perhaps correspondingly, less interesting). It is important to note that this is a significant departure from previous theoretical propositions that have emphasized objective demands (e.g., executive resource theory) and largely ignored the important—potentially central—role that subjective evaluations of task demands play in mind wandering. In the present investigation, we examined the influence of subjective evaluation on mind-wandering in the context of the passage length effect.

1.1. Single vs. joint evaluation

Subjective evaluations are intimately related to the context in which the evaluation is made. For example, Hsee and Zhang (2004; see also Hsee, 1996; Hsee & Leclerc, 1998) found that when individuals directly compare alternatives (in “joint evaluation mode”), easily evaluable differences between the alternatives have an exaggerated impact on individuals’ subjective evaluations relative to when the same alternatives are evaluated in isolation (in “single evaluation mode”), a phenomenon they called the distinction bias. The contrast between single versus joint evaluation provides a unique opportunity to examine the influence of subjective evaluations in on mind wandering. In particular, if mind wandering is intimately tied to subjective evaluations of a task, then mind wandering rates should be sensitive to the context (e.g., single vs. joint evaluation) in which participants are forming their evaluations (i.e., the “evaluative context”).

In the present research, we manipulated the evaluative context by comparing the effect of section length on mind-wandering across within-subject and between-subjects designs. Importantly, participants are able to compare different tasks across conditions in a within-subject design—but not in a between-subjects design. For example, in an experiment in which section length is manipulated within-subjects, participants are able to directly compare several short-section passages and long-section passages (i.e., a form of joint evaluation). In line with the distinction bias (Hsee & Zhang, 2004), section length ought to emerge as a distinctive feature across conditions, and may therefore strongly influence participants’ subjective evaluations and, in turn, their mind-wandering rates. Conversely, in a between-subjects design, section length would not stand out as a distinctive difference (it is constant across passages), and may therefore only weakly influence subjective evaluations and, as a consequence, mind-wandering. Thus, our methodological approach of comparing within-subject and between-subjects design was used to test our theoretical claim that subjective evaluations influence mind-wandering.1

2. Experiment 1

In Experiment 1 we compared the magnitude of the section-length effect in a within-subject design with that in a between-subject design. In the within-subject design, participants read four passages that were presented in short sections (one sentence per screen) and four that were presented in long sections (one page per screen). In the between-subjects design, some participants read eight short-section passages and others read eight long-section passages. Thus, participants read the same total number of passages in each experimental design. In both designs, we assessed mind-wandering via intermittent thought probes. Following each passage, participants rated passage difficulty and interest.

We hypothesized that the effect of section-length on mind-wandering would be larger in the within-subject design than in the between-subjects design, and participants’ passage difficulty and interest ratings would mirror this pattern of results. We expected section length to be strongly influence subjective evaluations of passages in the within-subject design than in the between-subjects design because section length only stands out as a distinct feature in the within-subject design (in line with the distinction bias; Hsee & Zhang, 2004). Assuming that subjective evaluations are related to participants’ tendency to mind-wander, then participants’ mind-wandering rates ought to follow this same pattern of results.

2.1. Method

2.1.1. Participants

The results of Forrin et al. (2017) suggest that the within-subject effect of section length on mind-wandering is medium-sized. None of our previous section-length experiments used a between-subjects design, so an estimate of the between-subjects effect size was not possible. A power analysis using the statistical software G*Power (Erdfelder, Faul, & Buchner, 1996) revealed that running 64 participants in each condition of the between-subjects version of the experiment would achieve adequate statistical power (0.80) to reliably detect a medium-sized effect (d = 0.50). The power in the within-subject version was 0.99. We therefore ran 64 participants in the within-subject version of the experiment and 64 in each of the two conditions of the between-subjects version. In total, then, one-hundred and ninety-two students from the University of Waterloo participated. Participants were reimbursed with course credit.

2.1.2. Reading materials

The pool of passages were the easy versions of the same 12 passages used in Forrin et al. (2017; see Supplemental materials) that were derived from Wikipedia (http://en.wikipedia.org) articles on a wide variety of topics, including the galaxy, Pompeii, and Sartre. In terms of readability, the passages were Flesch-Kincaid (Klare, 1974) grade level 9 (M = 9.00, SD = 0.21). Passage section-length was manipulated such that each passage had a short-section version and a long-section version. Short-section versions of passages were presented one sentence at a time (M = 12.52 words/screen, SD = 1.35 words/screen) and long-section versions of passages were presented one page at a time (M = 257.25 words/screen, SD = 4.49 words/screen). The content and overall length of passages was not affected by this section-length manipulation.

2.1.3. Procedure

Participants were tested in groups of up to 5. Each individual was seated in front of 15” or 17” monitor. Participants were randomly assigned to either the within-subject version of the experiment or to one of the conditions in the between-subjects version. For both versions, participants read eight passages that were randomly selected from the pool of 12 passages.2 In the within-subject version, participants read four short-section passages and four long-section passages in a block-

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1 This methodological approach has also been used by memory researchers to test the account that distinctive processing (see Hunt, 2013, 2006) can aid remembering in a within-subject design but not in a between-subjects design. Consistent with this view, the production effect is larger within-subject than between-subjects (Forrin, Groot, & MacLeod, 2016), as is the generation effect (Begg, Snider, Foley, & Goddard, 1989).

2 Eight passages were presented because pilot testing revealed that some participants could not finish the experiment within the 1-hour time limit if ten or more passages were presented.
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