

# The Costs and Benefits of Mind-Wandering: A Review

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Substantial evidence suggests that mind-wandering typically occurs at a significant cost to performance. Mind-wandering-related deficits in performance have been observed in many contexts, most notably reading, tests of sustained attention, and tests of aptitude. Mind-wandering has been shown to negatively impact reading comprehension and model building, impair the ability to withhold automatized responses, and disrupt performance on tests of working memory and intelligence. These empirically identified costs of mind-wandering have led to the suggestion that mind-wandering may represent a pure failure of cognitive control and thus pose little benefit. However, emerging evidence suggests that the role of mind-wandering is not entirely pernicious. Recent studies have shown that mind-wandering may play a crucial role in both autobiographical planning and creative problem solving, thus providing at least two possible adaptive functions of the phenomenon. This article reviews these observed costs and possible functions of mind-wandering and identifies important avenues of future inquiry.

*Keywords:* mind-wandering, reading, attention, creativity, autobiographical planning, mindfulness

Mind-wandering is one of the most ubiquitous of all mental activities. Estimates suggest that the tendency for the mind to stray from the here and now in favor of thoughts unrelated to current external events constitutes as much as 50% of our waking hours (Killingsworth & Gilbert, 2010; Klinger, 1999). Notably, these incessant mental meanderings come at quite a cost, significantly disrupting performance on a great range of activities ranging from the banal (e.g., simple vigilance tasks; Allan Cheyne et al., 2009; McVay & Kane, 2009; Smallwood et al., 2004) to the most demanding (performance on the SAT; Mrazek et al., 2012). This is because most of our activities occur in interaction with the external environment, and mind-wandering is characterized specifically by a decoupling of attention from an immediate task context toward unrelated concerns (Smallwood & Schooler, 2006; Schooler et al., 2011). But what are these detriments and how have they been measured empirically? One aim of this article will be to review the costs that are associated with mind-wandering by examining the effects of mind-wandering as they have been measured with regard to both performance and mood. The negative impact of mind-wandering has been observed primarily within several main types of performance: reading, sustained attention, and working memory and intelligence testing. Thus, we will examine mind-wandering's effects within each of these settings. Additionally, performance measures alone do not encapsulate the negative aspects of mind-

wandering, and as such we will also examine the relationship between mind-wandering and mood (Killingsworth & Gilbert, 2011; McVay, Kane, & Kwapil, 2009).

Because it is intuitively and empirically clear that mind-wandering occurs at some cost (McVay, Kane, & Kwapil, 2009; Reichle, Reineberg, & Schooler, 2010; Allan Cheyne et al., 2009; Smallwood, McSpadden, & Schooler, 2008; Smallwood et al., 2008; Smallwood et al., 2004), this has led to the notion that mind-wandering may be principally described as a failure of cognitive control (McVay & Kane, 2010). Although this may be true to some extent, the prevalence of this phenomenon in our daily lives suggests that it may not be solely erroneous to mind-wander, that mind-wandering may have some benefit for our species (Schooler et al., 2011; Smallwood & Schooler, 2006). We will therefore also review research that has pointed toward the possible utility of mind-wandering, focusing on its role in future thinking/planning and creativity.

## Costs of Mind-Wandering<sup>1</sup>

### Reading

Perhaps the situation in which the disruptive effects of mind-wandering have been most thoroughly explored is that of reading (Schooler, Reichle, & Halpern, 2004; Smallwood, McSpadden, & Schooler, 2008; Reichle, Reineberg, & Schooler, 2010; Smilek, Carriere, & Cheyne, 2010; Franklin, Smallwood, & Schooler, 2011; Smallwood, 2011). In typical examinations of the effect of mind-wandering on reading, participants are given text to read and are periodically probed with questions regarding whether at that moment their thoughts are on or off task. These studies have routinely found that mind-wandering frequency is correlated with

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Dr. Jonathan W. Schooler's research is supported by the John Templeton Foundation under grant No. 24329 and through the Office of Education grant R305H030235. Benjamin W. Mooneyham is supported by a National Science Foundation Graduate Research Fellowship under grant No. DGE-1144085.

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<sup>1</sup> Please refer to Table 1 for a comprehensive list of studies that have directly demonstrated that mind-wandering is associated with detriments in performance, attention, mood, etc.

Table 1  
*A Chronological List of Articles Suggesting Costs of Mind-Wandering*

Study	Type of observed deficit
Teasdale et al. (1995)	Random number generation
Smallwood, Baracaia, Lowe, & Obonsawin (2003)	Memory
Schooler, Reichle, & Halpern (2004)	Reading Comprehension
Smallwood, McSpadden, & Schooler (2007)	Response inhibition
Smallwood, O'Connor, Sudbery, & Obonsawin (2007)	Memory, Mood
Riby, Smallwood, & Gunn (2008)	Memory
Smallwood, Beach, Schooler, & Handy (2008)	External processing
Smallwood, McSpadden, & Schooler (2008)	Reading comprehension
McVay & Kane (2009)	Sustained attention
McVay, Kane, & Kwapil (2009)	Self-reported performance (daily life activities)
Smallwood et al. (2009)	Mood
Killingsworth & Gilbert (2010)	Mood
Reichle, Reineberg, & Schooler (2010)	Reading comprehension, Eye movements
Barron, Riby, Greer, & Smallwood (2011)	Task-relevant processing
Franklin, Smallwood, & Schooler (2011)	Reading comprehension
He, Becic, Lee, & McCarley (2011)	Driving
Hu, He, & Xu (2012)	Sustained attention
Kam et al. (2011)	External processing
Mrazek et al. (2011)	Sustained attention, GRE (math)
Smallwood & O'Connor (2011)	Mood
Smallwood et al. (2011)	Task-relevant/external processing
Stawarczyk et al. (2011)	Sustained attention
Uzzaman & Joordens (2011)	Reading comprehension, Eye movements
McVay & Kane (2012a)	Reading comprehension
McVay & Kane (2012b)	Sustained attention
Mrazek et al. (2012a)	Working memory, gF
Mrazek et al. (2012b)	Working memory, GRE (verbal reasoning)
Risko et al. (2012)	Memory
Schad, Nuthmann, & Engbert (2012)	Reading comprehension, Sustained attention
Unsworth & McMillan (2012)	Reading comprehension

reading comprehension performance (Schooler, Reichle, & Halpern, 2004; Smallwood, McSpadden, & Schooler, 2008), such that participants who are caught mind-wandering more during reading tend to perform worse on subsequent comprehension tests. This comprehension deficit has been shown to occur for information that is presented immediately preceding reports of mind-wandering, demonstrating the online effect of diverting attention away from a reading task, but perhaps more significantly it has also been manifested as an overall deficit in model building. For example, in a study examining whether participants could quickly and accurately detect when a text had switched to gibberish, errors at gibberish detection were associated with probe-caught mind-wandering episodes, suggesting that mind-wandering is related to failures in building propositional models of the text, thus impairing participants' ability to detect meaning-related violations within the text at the sentence level (Schooler, Smallwood, McSpadden, &

Reichle, 2007, as cited in Smallwood, Fishman, & Schooler, 2007). Such model formation errors have also been observed when information is presented over more prolonged intervals. In an investigation of the effects of mind-wandering on situational model building, Smallwood, McSpadden, and Schooler, (2008) had participants read a Sherlock Holmes story (*The Red-Headed League* by Sir Arthur Conan Doyle). In this study, mind-wandering was associated with failures in generating the correct situational model (as indexed by participants' ability to correctly identify the villain in the story) over and above the negative impact of mind-wandering on text-based information retrieval. These findings indicate that participants who mind-wander more during a reading task tend to incur more inference-dependent model-updating failures.

The robust relationship between mind-wandering frequency and reading comprehension has been well-documented (Schooler, Reichle, & Halpern, 2004; Smallwood, McSpadden, & Schooler, 2008) and is augmented by other demonstrations that mind-wandering while reading is also associated with superficial perceptual encoding (Smilek, Carriere, & Cheyne, 2010; Franklin et al., 2012 [under review]) and less modulated motor/verbal output (Franklin, Smallwood, & Schooler, 2011; Reichle, Reineberg, & Schooler, 2010; Franklin et al., 2012 (under review)). For example, it has been shown that the typical strong relationship between words' lexical properties and the amount of time that participants take to process them (Rayner, 1998) is attenuated during periods of mind-wandering. Reichle, Reineberg, and Schooler (2010) had participants read *Sense and Sensibility* by Jane Austen and measured eye movements during reading; they showed that while gaze durations were sensitive to lexical features such as word length and frequency when participants were on-task, this sensitivity diminished in periods preceding off-task reports. A similar effect has been found for RTs in word-by-word reading paradigms (where participants press a key to advance the text to the next word), and Franklin et al. (2011) used this effect (i.e., the reduced coupling between RTs and lexical properties) to accurately predict reports of mind-wandering during a reading session, and furthermore, found that predicted mind-wandering rates in an unprobed condition correlated strongly with actual comprehension rates.

Interestingly, mind-wandering can have a costly influence on more reading-related behavior than just simple RTs. In a recent study in which participants were recorded reading a passage aloud and probed regarding their mind-wandering, Franklin et al. (2012; under review) found subtle but detectable differences in the vocal prosody of participants' vocal output when comparing on-task and off-task reading. Specifically, participants exhibited higher volume speech with less volumetric variability while mind-wandering compared with while on-task.

In sum, it is clear that mind-wandering comes at a cost when reading. It leads to item-specific comprehension deficits as well as model-building deficits (Smallwood, McSpadden, & Schooler, 2008). In addition, mind-wandering is associated with a reduced coupling between motor (and ocular) responses and their lexical determinants. Unfortunately, this disengagement from the external environment that has been observed in reading tasks appears to occur in many other performance settings, with important implications.

## Tests of Cognitive Ability

**The Sustained Attention to Response Task (SART).** The Sustained Attention to Response Task (SART; Robertson, Manly, Andrade, Baddeley, & Yiend, 1997) is a commonly used behavioral index of mind-wandering. The SART is a GO/NOGO task in which stimuli are presented in sequential fashion and participants are tasked with responding as quickly as possible (via key press) to frequent nontarget stimuli and refraining from responding to rare target stimuli. The effects of mind-wandering during performance of the SART can be observed by examining any one of four performance measures: SART errors (failures to omit a response to a target), reaction time (RT) variability (i.e., RT CV), SART omissions (failure to respond to a nontarget), and SART anticipations (automatic, rapid responses to nontargets that occur too quickly to be indicative of focused task performance). Each of these measures is correlated with one another, and most importantly, with self-reported measures of mind-wandering (Allan Cheyne et al., 2009), such that mind-wandering rates are typically positively correlated with SART errors, RT variability, omissions, and anticipations. This effect of mind-wandering within this test of sustained attention is robust and consistent to such an extent that SART-related performance measures are now frequently used as indirect markers of mind-wandering episodes, with SART errors viewed as representing a more pronounced form of task disengagement, whereas another indicator, increased RT CV, is viewed as representing a minimally disruptive form of disengagement (Allan Cheyne et al., 2009; Smallwood et al., 2004; Mrazek, Smallwood, & Schooler, 2012). As such, it is clear that mind-wandering can result in errors of sustained attention, such as failing to notice an infrequent target or engaging in automatic processing instead of focused attentive processing.

**Working memory.** Although all researchers agree that mind-wandering is associated with measures of working memory, there is some contention regarding the implication of this relationship. Some authors have argued that working memory processes are involved in the mental activity of mind-wandering itself (and specifically, with the maintenance of a sustained train of mind-wandering thought; Smallwood & Schooler, 2006); whereas others have argued that working memory is more closely related to the control processes engaged in getting the mind back on track and that mind-wandering does not draw from these executive control resources (McVay & Kane, 2010). Although it is not in the scope of this article to address or resolve this contention, we do encourage the interested reader to compare these two perspectives (cf. Smallwood & Schooler, 2006; McVay & Kane, 2010). Whereas the role that working memory plays in mind-wandering may be of some dispute, the reverse and (until recently) largely overlooked question is more straightforward. If we ask what role mind-wandering plays in the measurement of working memory, the answer unambiguously turns out to be a very substantial one. Mrazek et al. (2012) administered automated versions of three common tests of working memory capacity (the operation span task [OSPAN], the reading span task [RSPAN], and the symmetry span task [SSPAN]) with embedded thought sampling probes to participants and found that probe-caught self-reported mind-wandering scores were (significantly) negatively correlated with scores on each of the WMC tests. Moreover, there was a significant effect of mind-wandering on WMC performance on a trial-

by-trial basis (using the OSPAN; Mrazek et al., 2012, Study 2) even for the “easiest” set sizes within the working memory task, suggesting that mind-wandering did not merely arise as a result of poor performance (such a hypothesis predicts that if individuals struggle to remain engaged due to the difficulty of the task, then mind-wandering should only predict performance on the more difficult portions of the task) and providing further evidence that mind-wandering disrupts performance in tests of working memory.<sup>2</sup> This result helps to explain why WMC has been successfully used to predict mind-wandering in other contexts (e.g., McVay, Kane, & Kwapil, 2009), because mind-wandering during tests of WMC exerts a consistent effect on the WMC estimates themselves.

**General intelligence (gF).** Although the aforementioned WMC results may muddy the waters of the debate about the role of working memory in mind-wandering, they clearly reveal that mind-wandering hampers performance on measures of working memory. This suggests that mind-wandering may have similarly pernicious effects on performance within tests that typically correlate with tests of working memory capacity, such as those that claim to measure general intelligence or aptitude. Consistent with this hypothesis, Mrazek et al. (2012) observed that mind-wandering rates during a test of general intelligence (Raven’s Progressive Matrices) predicted performance on that test. Furthermore, and more troubling still, mind-wandering on this intelligence test also predicted individuals’ performance on the SAT, a test which was taken on average 1–3 years beforehand. As such, these results provide clear evidence that mind-wandering is deleterious when it occurs in the contexts of working memory and/or aptitude measurement. Considering the heavy emphasis that higher learning institutions place on general aptitude measures such as the SAT for college acceptance and scholarships, we face the possibility that mind-wandering may be a strong determinant of academic success or failure.

## Mood

If mind-wandering is such a malignant factor in important measures of cognitive performance, then why do we do it? Perhaps, like many things that are not good for us, we mind-wander because we enjoy doing so. However, although it may be the case that under some situations mind-wandering may serve as a positive alternative to the tedium of a task, when considered across the many circumstances in which it occurs, it cannot be said that mind-wandering is generally an enjoyable activity. In fact, evidence suggests that individuals are generally less happy when they are mind-wandering than when they are not (Killingsworth & Gilbert, 2010). In a study examining thought contents during real-world mind-wandering episodes, Killingsworth and Gilbert (2010) administered random probes to individuals as they went

<sup>2</sup> This trial-by-trial analysis is of particular importance, given the correlational nature of much of the research that has examined costs in performance attributable to mind-wandering. Correlational analyses allow for equal footing to be shared by explanations positing either that mind-wandering leads to poor performance or that poor performance leads to greater mind-wandering, but trial-wise analyses (such as the one performed by Mrazek et al., 2012) help to clarify the directionality of this relationship; future research in this field will benefit from using similar analytic approaches.

about their daily lives (through a web-based cell phone application) and found that people tended to report being less happy when their minds were wandering than when they were not. This effect prevailed across all activities, including even the least enjoyable. Furthermore, even though people were more likely to mind-wander about pleasant topics than unpleasant or neutral topics, there was no difference in happiness ratings between current activity-related thoughts and positive mind-wanderings. Mind-wandering also explained more than twice as much within- and between-person variance in happiness ratings as did the actual nature of people's activities at the time of questioning. Lastly, time-lag analyses suggested that mind-wandering was an antecedent of negative mood and not the other way around (such analyses strengthen the ability to make causal claims about the relationship between mind-wandering and mood, despite the general correlational nature of the results). Although (as will be discussed) there may well be situations where mind-wandering experiences relieve tedium, Killingsworth and Gilbert's findings clearly demonstrate that mind-wandering does not typically provide affective relief, and indeed imposes significant costs to mood as well as performance.

### Benefits of Mind-Wandering<sup>3</sup>

Given the striking costs of mind-wandering, it is hard to imagine that we would engage in such a disruptive activity so often without it having some functionality. While the costs of mind-wandering that have so far been documented in experimental settings (e.g., reading comprehension deficits) may not be of the kind that would have presented roadblocks to reproductive success from an evolutionary standpoint (and which therefore could have allowed a tendency for mind-wandering to have evolved despite a lack of functionality), it is clear that mind-wandering takes place in non-experimental settings and that the costs of mind-wandering in these other contexts can be far more damaging (such as when one fails to stop their vehicle at a stoplight). As such, it is likely that we glean some benefit from our bouts of mind-wandering. In fact, this notion was expressed early on in the mind-wandering literature (and yet has received very little attention until only recently). In their pioneering work examining daydream characteristics, Singer and Antrobus (1963) suggest a "clearly problem-solving, objective, nonpersonal type" of daydreaming which stands in contrast to "the more fantastic, emotional, variegated, anxious, and pleasant" factors that often drive mind-wandering episodes. This "controlled thinking" daydreaming factor identified by Singer and Antrobus, although only one of many, have convey important benefits to us,

and surely warrants scientific examination. Another point that is worth making here is that mind-wandering may be distinguishable into separate types or forms, and that while some types of mind-wandering may be disruptive, others may provide some benefit.<sup>4</sup> Despite this fact, investigations into the benefits of mind-wandering are rare, but not nonexistent: although far less research has been dedicated to the potential upside of mind-wandering, recent research has suggested a functionality of mind-wandering within two very important activities: future thinking and creative thinking. We will now review these findings and address possible alternative functional roles for mind-wandering.

### Future Thinking

A large proportion of the thoughts that occur during mind-wandering episodes are prospective in nature (D'Argembeau, Renaud, & Van der Linden, 2011; Smallwood, Nind, & O'Connor, 2009), especially in cases where task demands permit substantial attentional resources to be directed toward the mind-wandering train of thought (Smallwood, Nind, & Connor, 2009; Baird, Smallwood, & Schooler, 2011). The future-directed orientation of mind-wandering, combined with the fact that spontaneous thoughts are often closely coupled with individuals' current concerns (Klinger, 1999; McVay & Kane, 2010; Smallwood et al., 2004), suggests one possible function of mind-wandering: the anticipation and planning of personally relevant future goals, otherwise known as autobiographical planning.

Mind-wandering clearly produces concurrent deficits in task performance, but this cost could possibly be remunerated, at least in part, by the benefits gained through prospective planning and simulation. For although mind-wandering can and does occur in a damaging fashion for many types of tasks, it also occurs most prevalently during tasks that impose lesser attentional and working memory demands (Teasdale et al., 1993; McVay & Kane, 2010). This suggests that while we may not be entirely able to choose when and where to let our minds wander, we may be most prone to mind-wandering in situations in which concurrent performance is less important and in which we can more afford the cost to reap the benefits of autobiographical planning. In a recent study, Baird, Smallwood, and Schooler (2011) took advantage of the prevalence of mind-wandering episodes during a relatively low-resource-demanding task (a Choice Reaction Time Task; Smallwood et al., 2009) and examined the temporal focus and cognitive orientation (i.e., self-related or goal-directed) of participants' thoughts during the task. Several findings from this study suggest that mind-wandering may function to help individuals plan for the future. First, the temporal focus of participants' thoughts was predominately future-focused when they reported being off-task compared with on-task, demonstrating that people do indeed tend to prospect while mind-wandering. Second, self-related thought was more

Table 2

*A Chronological List of Articles That Suggest Functional Mind-Wandering*

Study	Posited function
Baars (2010)	"Global broadcasting" of conscious thoughts
Baird, Smallwood, & Schooler (2011)	Autobiographical planning
Kaufman & Singer (2011)	Goal-directed thought
Smallwood et al. (2011)	Prospection, Self-reflection
Stawarczyk et al. (2011)	Future planning
Baird et al. (2012)	Creative incubation

<sup>3</sup> Please refer to Table 2 for a (brief) list of studies that have indicated a possible functional role for mind-wandering.

<sup>4</sup> Different "types" of mind-wandering may load differentially onto different "Big Five" personality factors. For instance, Zhiyan & Singer (1997) determined that the "positive-constructive" type of daydreaming correlated positively with the NEO-FFI factor of "Openness," whereas the "guilty-dysphoric" type of daydreaming correlated with both "Neuroticism" and "Negative Emotionality." This further supports the idea that some types of mind-wandering may be more useful than others.



frequently future-focused than present- or past-focused, indicating that these future-focused cognitions tended to be personally relevant. Third, thoughts that involved a combination of both self-related and goal-directed content were more frequently future-focused than present- or past-focused. Finally, those individuals with higher working memory scores were more likely to mind-wander about the future than about the past or present. Together, these results imply that the prospective nature of mind-wandering may be functional: prospective mind-wandering enables planning for and thinking about future goals, and people take advantage of this opportunity when they have the working memory resources to do so.

### Creative Thinking

Anecdotes of creative insights occurring during periods of listless thought pervade the annals of the sciences. From Archimedes sitting in a bath to Poincaré stepping on a bus, legends of ideas popping to mind while individuals were seemingly otherwise occupied are numerous, albeit not scientifically documented. Another common feature of these anecdotes is that solutions are only arrived at after having previously attempted to solve the problem to no avail; in modern terms this means that these problems were subjected to incubation, the effects of which have now been examined empirically. In a recent meta-analysis of incubation effects, [Sio and Ormerod \(2009\)](#) found that across studies incubation intervals tended to be most effective if they were filled with an undemanding task relative to either no task at all or a demanding task. Interestingly, undemanding tasks also happen to be those that maximize the occurrence of mind-wandering ([Smallwood & Schooler, 2006](#)). By pairing these pieces of information together, we can thus hypothesize that mind-wandering may play a role in successful incubation (i.e., in coming up with novel solutions to previously presented problems when presented with them after the incubation period).

[Baird et al. \(2012; in press\)](#) sought to examine this hypothesis by determining whether performance on validated creativity problems (the Unusual Uses Task [UUT]) was facilitated differentially by engaging in either a demanding task, an undemanding task (that maximized mind-wandering), a rest period, or no break between creativity problems. They discovered that relative to the demanding task, rest, and no break conditions, engaging in an undemanding task (a Choice Reaction Time Task) during an incubation period led to significant increases in creative solutions to the target problems. This undemanding task condition was likewise the condition with the highest incidence of mind-wandering, but critically, this condition did not produce a higher incidence of explicit thoughts about the creativity problems themselves. As such, it is evident that the conditions that maximize mind-wandering can also be the most conducive to creative problem solving. It is worth noting, however, that this undemanding task condition did not produce additional benefits for *new* problems (problems presented for the first time *after* the incubation period), indicating that mind-wandering may not lead to a general increase in creativity (although it should also be noted that performance on both the *repeated* and the *new* creativity problems was positively correlated with individuals' general propensity to mind-wander as measured by the Imaginal Process Inventory; [Singer & Antrobus, 1972](#)). In sum, although mind-wandering may or not be conducive to general

creativity, it does appear to be beneficial for conjuring new solutions to old problems.

### Other Possible Functions of Mind-Wandering

Having now provided multiple lines of evidence that suggests an inherent functionality in mind-wandering, we will briefly discuss three additional possible adaptive functions of mind-wandering. When considering alternative functions of mind-wandering, one useful approach is to consider the following: what is it about the nature of our typical activities that makes mind-wandering beneficial? Contemplating this question leads us to propose the following potential functions of mind-wandering: attentional cycling, dishabituation, and relief from boredom.

**Attentional cycling.** It is adaptive for an individual with multiple goal states to be able to cycle through different streams of information (e.g., current sensory environment, prospective planning information, remembered experiences, etc.). Mind-wandering may provide us with the opportunity to frequently switch between streams of thought, thus enabling us to maintain goal-appropriate behaviors for multiple goals at a time.

**Dishabituation.** Learning may be enhanced with distributed practice relative to massed practice ([Underwood & Ekstrand, 1967](#)). The advantage of distributed practice may stem from the benefits in processing that are afforded by dishabituation, and as such, it is possible that mind-wandering during learning tasks in particular may allow for (albeit brief) periods of dishabituation from the task, thus providing the mind with an opportunity to return to the task with a refreshed capacity for attentive processing. One way in which this could feasibly be tested would be to use a version of the Sustained Attention to Response Task (SART) in which the nontargets share a particular category membership and the targets (perhaps indicated by some perceptual feature such as capitalization) are either members of that category or not. By requiring individuals to indicate whether or not the target is a member of the nontarget category, RT could be used as a measure of "semantic satiation" (e.g., [Balota & Black, 1997](#)), such that longer RTs would be indicative of semantic satiation. If mind-wandering enables dishabituation, then one would predict that mind-wandering would reduce semantic satiation effects (by "refreshing" the mental state), and this could be tested by examining RTs differences (for category-congruent targets) between trials in which participants are either mind-wandering or not prior to the presentation of the target (which can be indirectly indexed in SART tasks by measures such as RT CV). We recognize that in many cases mind-wandering undermines performance, but an experiment such as this could potentially provide evidence that mind-wandering can improve performance beyond the level that occurs when individuals are fully on-task.

**Relief from boredom.** When faced with a boring task or situation, our minds tend to wander, sometimes intentionally. This may be adaptive; the ability of our minds to disengage from the current external environment and to engage in an alternative train of thought may have evolved in part to allow us to overcome tedium and disinterest without overtly abandoning a necessary task. Preliminary evidence in support of this relationship comes from a recent study by [Baird et al. \(2010\)](#), in which participants were given a very tedious task to work on for 45 minutes. Comparison of the difference between pre- and posttask assessments of

mood revealed that people were less happy overall after participation in the task, presumably because they found it so boring. However, the magnitude of this drop in mood was reduced the more people mind-wandered. In short, mind-wandering appeared to partially insulate people against the mood costs of engaging in a particularly tedious task.

Mind-wandering may also reduce tedium by helping the time to pass. While boring tasks are typically estimated to last longer than they actually do, mind-wandering episodes have been observed to be accompanied by temporal estimations that are shorter than their on-task counterparts (Mooneyham et al., 2012; unpublished results). As such, mind-wandering may act to “speed up” the perceived flow of time during tedious or boring activities.

### Summary and Conclusions

It is a striking fact that mind-wandering is simultaneously so ubiquitous and so problematic. Mind-wandering does not simply reflect a penchant for the mind to stay busy when not otherwise occupied; on the contrary, even when individuals are engaged in highly demanding tasks such as reading or taking an important test, the mind still exhibits its peculiar tendency to wander off. Although we have documented a host of contexts in which mind-wandering has proven problematic, it seems likely that, given what we know, mind-wandering can disrupt performance on any task that demands executive resources. Given its ubiquity, we can only imagine what price we actually pay for our habitual tendency to think about things unrelated to what we are doing. From mundane events such as missing important elements of conversations to more serious consequences such as traffic accidents, medical malpractice, and military mishaps, mind-wandering in all likelihood plays a significant and insidious role.

The undeniable cost of mind-wandering raises two related questions, one that we have already commented on at some length, and the other that we have left until now. The first question is as follows: Why, if it is so costly, do we mind-wander so often? We have speculated that there may be a host of possible functions of mind-wandering that may help in part to mitigate its costs. These include but are likely not limited to: planning for the future, enabling creative incubation, allowing dishabituation, and relieving tedium. Although promising lines of research have been initiated to explore some of these possible functions, to date, the majority of mind-wandering studies have specifically examined its frequency and costs and have not addressed its functionality; moreover, those studies that have addressed the possible functions of mind-wandering have not provided strong causal evidence to the extent that it has been provided in documenting the costs of mind-wandering. For instance, although mind-wandering has been demonstrated to favor autobiographical thoughts and future-oriented planning, mind-wandering has not been shown to actually improve individuals’ ability to prepare for future events. Clearly, understanding the functionality of mind-wandering is a timely issue greatly deserving of more research attention. As such, additional studies will be required to provide stronger evidence for real (and not just potential) benefits of mind-wandering.

The second question on which we close this discussion is as follows: Are there any things that individuals can do to help reduce the costs of mind-wandering? Fortunately, a recent study suggests that an age-old remedy may still be one of the best strategies for

reducing inopportune drifts of attention. Mrazek et al. (2012; *in press*) compared the effects of two different 2-week interventions on mind-wandering and performance among college students: a mindfulness meditation class and a nutrition class. Strikingly, participation in the mindfulness meditation class reduced mind-wandering during both a GRE reading comprehension test and a working memory test and improved performance on both of these measures. Moreover, for individuals with a penchant for mind-wandering, the improvement in performance was found to be mediated by the reduction in mind-wandering. This study suggests that mindfulness may well be the antidote to mind-wandering. However, it raises yet another vexing issue that must await future research: Might using mindfulness practices to curb the costs of mind-wandering also reduce some of the (albeit less well documented) benefits of mind-wandering? If mind-wandering has some benefits, might mindfulness have some costs? In all likelihood the answer will lie, as in so many things, with finding the right balance. With the right metacognitive strategies it may well be possible to be mindful when the task demands it and to productively mind-wander when the circumstances allow it.

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### Résumé

De multiples preuves suggèrent que, typiquement, la rêverie nuit de façon importante au rendement. Des lacunes dans le rendement attribuables à la rêverie ont été observées dans divers contextes, en particulier en lecture, dans les tests exigeant une attention soutenue et les tests d’aptitude. Il a été montré que la rêverie nuit à la compréhension de lecture, à l’assemblage de modèles réduits, à la capacité de retenir des réponses automatisées et au rendement dans le cadre de tests évaluant la mémoire de travail et l’intelligence. Ces coûts, qui ont été déterminés de façon empirique, ont permis de suggérer que la rêverie pouvait constituer un échec pur de la maîtrise cognitive et ainsi offrir peu d’avantages. Toutefois, des preuves émergentes suggèrent que la rêverie n’est pas entièrement pernicieuse. Des études récentes ont révélé que la rêverie pourrait jouer un rôle déterminant à la fois dans la planification autobiographique et la résolution créative de problèmes, ce qui constituerait au moins deux fonctions adaptatives possibles du phénomène. Cet article examine les coûts constatés ainsi que les fonctions possibles de la rêverie, pour ensuite établir d’importantes voies de recherche futures.

*Mots-clés* : rêverie, lecture, attention, créativité, planification autobiographique, pleine conscience.

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Received July 31, 2012  
Accepted November 27, 2012 ■

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