

CHAPTER 7

Mind Wondering
Curious Daydreaming and Other Potentially Inspiring
Forms of Mind-Wandering

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Anecdotes abound of scientists engaging in seemingly aimless mind-wandering and then suddenly experiencing eureka moments of insight. Poincaré famously described how the solution to Fuchsian functions abruptly popped into his mind while stepping on a bus in 1910. Carey Mullis recounted how the method for replicating DNA suddenly occurred to him while he was driving (Mullis, 1993). Leo Szilard reported that his conception of how splitting an atom could produce an atomic bomb abruptly came to him as he was crossing the street (Rhodes, 1986). Robert Townes reported that his idea for the invention of the maser, a precursor to the laser, arose unexpectedly one day while he was sitting on a park bench admiring the azaleas (Horvitz, 1988). These and many other anecdotes of the arising of scientific innovations share two intriguing properties: they happened while the individuals were casually mind-wandering, and they were accompanied by a profound “Aha!” experience in which the individual suddenly perceived themselves to have made an important conceptual advance.

A recent diary study investigating the context under which creative individuals experienced their creative ideas provides some fodder for anecdotal claims that creative ideas routinely occur during mind-wandering, and that ideas arising in this fashion may be uniquely associated with insight. In two studies, Gable et al. (2019) asked creative writers and physicists to report at the end of every day whether they had had a creative idea that day and, if so, to indicate the situation in which it occurred. Of central interest was the frequency with which ideas sprung to mind in a manner similar to those anecdotally alluded to earlier. Consistent with anecdotal reports, we found that nearly 20 percent of creative individuals’ ideas arose when they were neither at work nor actively

pursuing the problem. Furthermore, these ideas were rated as equally as creative as ideas generated when individuals were at work, and were more likely to be associated with the experience of “Aha!” – the feeling of having an insight. Thus, in keeping with anecdotal reports, this study suggests that a significant proportion of creative individuals’ ideas arise as mind-wanderings (i.e., when they are engaged in activities unrelated to the idea), and that such ideas may be particularly apt to be experienced as insights.

Although Gable et al.’s study and the anecdotes that inspired it suggest an important role of mind-wandering in the creative process overall, studies investigating the relationship between mind-wandering and creativity have provided somewhat mixed support. While a number of studies suggest that mind-wandering can be conducive to creativity (e.g., Baird et al., 2012; Leszczynski et al. 2017), others fail to find such a relationship (e.g., Murray et al., 2021), and some suggest that mind-wandering might even undermine creativity (Hao et al., 2015). So where does this leave us? We propose that the tenuous relationship between mind-wandering and creativity arises because only certain types of mind-wandering are conducive to creative advances.

In the following section, we focus on the emerging investigations into the relationship between mind-wandering and creativity. We first review the evidence that mind-wandering may be particularly associated with creative insights. We then turn to the evidence that mind-wandering is associated with creativity more generally. As will be seen, the potentially promising relationship between mind-wandering and creativity may have been clouded by the tendency of researchers to treat mind-wandering as a singular mental state. Just as Jacobs and Metcalfe discuss distinct kinds of curiosity (Jacobs & Metcalfe, Chapter 6, this volume), the increasing identification of distinct kinds of mind-wandering holds real promise for enabling researchers to more clearly delineate the mechanisms and circumstances by which it may (at least sometimes) be a genuine source of creative inspiration.

The Relationship Between Mind-Wandering and Creative Insights

As noted, an important source of evidence for the relationship between mind-wandering and creative insights comes from Gable et al.’s (2019) diary study, in which they found that creative writers and physicists reported more “Aha!” experiences for ideas that occurred when they were mind-wandering (i.e., not at work or actively pursuing the problem).

One likely contribution to this finding was the further observation that ideas that arose when individuals were mind-wandering were also more likely to entail overcoming impasses. The overcoming of impasses has been associated with insight, as insights routinely entail problem restructuring in which some constraint is relaxed (Knoblich et al., 1999). Consistent with this view, Gable and colleagues found that ideas characterized as involving an “Aha!” experience were also routinely described as overcoming impasses. Taken together, these findings suggest that one way in which mind-wandering may facilitate creative insights is by enabling individuals to consider problems from new vantages. Similar to how impasses can be overcome by “sleeping on it,” mind-wandering may promote creative insights by priming associative networks (Cai et al., 2009), fostering the forgetting of unhelpful mental sets (Smith, Gerken, & Angello, 2017; see also Smith & Beda, Chapter 2, this volume), and enabling the consideration of problems in a new context (Seifert et al., 1994; see also Seifert, Chapter 5, this volume).

Additional evidence for a relationship between mind-wandering and creative insights comes from a set of studies (Zedelius & Schooler, 2015) examining how individuals vary both in their tendency to mind-wander and their proclivity to solve problems in an insightful manner. One measure of convergent creativity is the remote associates task (RAT) (Mednick, 1962), in which participants are given three words (e.g., age, mile, sand) and attempt to identify a common associate (e.g. stone). An intriguing aspect of this task is that solutions can arise either insightfully, with a solution suddenly springing to mind, or analytically, with a systematic exploration of the associates of each word (Bowden & Jung-Beeman, 2007). Zedelius and Schooler (2015) assessed individuals’ reports of insightful versus analytic solutions on the RAT in relation to their general tendency to mind-wander (as indexed by low scores on a mindfulness measure [Brown & Ryan, 2003] known to correlate highly with mind-wandering [Mrazek et al., 2012]). Consistent with the notion that mind-wandering is associated with creative insights, we found that individuals who tend to mind-wander (low mindfulness) were generally more successful when they solved the problems insightfully, but less successful when they solved the problem analytically. Furthermore, since insight solutions in this paradigm tend to be more accurate than analytic ones (e.g., Salvi et al., 2016), high mind-wandering (low mindfulness) participants’ also demonstrated an overall advantage (see Figure 7.1).

The aforementioned studies provide suggestive evidence that mind-wandering may be associated with creative insights; however, it must be

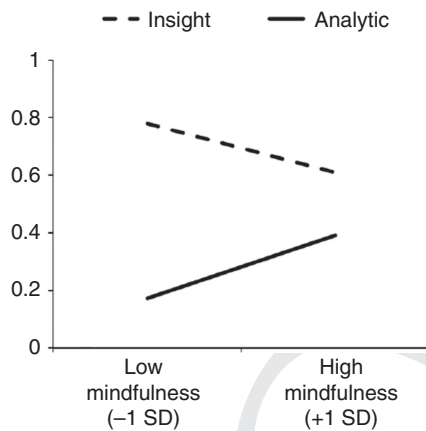


Figure 7.1 Regression lines illustrating the relationship between mindfulness scores and accuracy for compound remote associate (CRA) problems reported to have been approached exclusively with insight and problems reported to have been approached exclusively with analytic strategy (from Zedelius and Schooler, 2015)

noted that our case so far is built on only a few correlational studies. In order to broaden our evidence we turn now to studies investigating mind-wandering and creativity more generally defined.

The Relationship Between Mind-Wandering and Individual Differences in Creative Performance

Before delving into the more extensive research investigating the relationship between mind-wandering and creativity, it is worth briefly commenting on the relationship between the psychological constructs of insight and creativity. Insight is typically characterized as involving the sudden discovery of solutions that require some form of problem restructuring. In the context of laboratory measures, it typically is assessed with so-called “convergent” problems with single solutions, such as what are termed “insight problems” or the already discussed RAT. Creativity is typically characterized as entailing novel (and sometimes also “useful”) creations, and in laboratory contexts typically is assessed by divergent problems with multiple possible solutions, such as the alternate uses test described later in the chapter. Although there are meaningful distinctions between the two constructs there is also substantial overlap, as they both entail “thinking outside of the box.” Moreover, insights are routinely referred to as creative, and creative ideas often entail insight. Given this overlap, it seems likely that an understanding of the role that mind-wandering

plays in fostering creative insights can be informed by reviewing research on the relationship between mind-wandering and creativity.

A number of investigations have examined the relationship between individuals' tendency to mind-wander and their performance on creativity tests, with somewhat mixed findings. In a study elaborated in further detail in the next section, Baird et al. (2012) gave participants the alternate uses test (AUT) – which required participants to generate as many novel uses as they can for an object – and they also gave participants a trait measure of mind-wandering; the imaginal daydreaming subscale of the Imaginal Processes Inventory (IPI) (Singer & Antrobus, 1972). This scale includes questions that query people regarding the frequency with which they find themselves daydreaming, such as “instead of noticing people and events around me I will spend approximately [x] percent of my time lost in thought.” Baird et al. found a modest correlation between individuals' responses to such questions and the uniqueness of the alternate uses that they generated. In a conceptual replication of this study (also further described later in the chapter), Smeekens and Kane (2016) examined the relationship between creativity and the daydreaming subscale but also included the IPI's mind-wandering subscale, which includes items reflecting challenges to maintaining focus, such as “No matter how hard I try to concentrate, thoughts unrelated to my work always creep in.” Notably, while replicating Baird et al.'s finding of a positive correlation between alternate uses and the daydreaming subscale, Smeekens and Kane failed to find such a relationship with the mind-wandering subscale. On the basis of this disparity, they suggested that it may not be off-task thinking in general that is associated with creativity, but rather particular kinds of mind-wandering, noting that “divergent creativity is not associated with simply more off-task thinking, but rather with a certain kind of off-task thinking – namely, one that is mainly positive, intentional and, perhaps also, creative” (2016, p. 26).

Further complicating the relationship between mind-wandering and creativity, another study actually found a negative relationship between creativity and mind-wandering, generally defined. Hao et al. (2015) examined task-unrelated-thought episodes while participants were in the process of generating uses in the AUT. They found that the greater the incidence of mind-wandering during generation, the fewer and less creative the uses people generated. In contrast to the aforementioned studies, Hao and colleagues investigated mind-wandering during the idea-generation period itself, so mind-wandering was directly competing with the creative process. Nevertheless, if task-unrelated thoughts were a fountainhead of creative ideas, then even this study might have been expected to observe creative benefits of mind-wandering, which it did not.

Impact of Experimentally Inducing Mind-Wandering on Creativity

The results presented here were correlational, which necessarily clouds their capacity to inform our understanding of causal directions. Positive relationships between mind-wandering and creativity might arise because creative individuals are simply more likely to be engaged by the ideas that cross their minds. Conversely, neutral or negative relationships could occur because some other correlate of mind-wandering (e.g., reduced executive capacity) shrouds the otherwise positive relationship between creativity and mind-wandering. Experimentally inducing mind-wandering and investigating its impact on creativity thus provides an important alternative approach to understanding how mind-wandering may contribute to creativity.

In this vein, Baird et al. (2012) experimentally investigated the impact of mind-wandering on a creative-incubation task. After generating uses for several objects in the AUT (Guilford, 1967), participants engaged in one of the following activities: a nondemanding (0-back) task that had previously been associated with a high degree of mind-wandering (Smallwood et al., 2009), a more demanding (1-back) task that has been associated with less mind-wandering (Smallwood et al., 2009), no task (sitting quietly), or no interval (participants immediately moved on to the next phase). Participants were then given a second round of the AUT including both items they had worked on before and new items. Only participants whose incubation interval was filled with the nondemanding task showed a significant increase in the uniqueness of their uses between pretest and posttest. Given that the nondemanding task was particularly associated with mind-wandering, these findings were taken to suggest that experimentally encouraging mind-wandering facilitates creative incubation.

A subsequent study provided further, albeit circumscribed, experimental evidence that mind-wandering facilitates creative solutions. Leszczynski et al. (2017) had participants perform two sets of remote-associate problems (finding a target word that is associated with three cue words) with an interpolated activity of a sustained attention to response task (SART), in which participants responded to frequent nontarget words and withheld responses to infrequent targets (nonwords). To understand the role of information recombination in the incubation effect, the authors introduced one additional factor, which they varied between studies. In one study, the nontarget words shown in the SART were words from the remote associate problems that participants had tried to solve just prior (although never solution words). This was done to activate these memory

contents in a context that was likely interspersed with mind-wandering episodes. In a second study, the words were unrelated. Mind-wandering during the incubation task was assessed by intermittently interrupting the task with thought probes. The results of the first study showed that more frequent mind-wandering during the incubation task was associated with a greater number of previously unsolved problems being solved after the task. While enhancing creative solutions, mind-wandering also was associated with detrimental effects of the SART. The second study found that the benefits of mind-wandering during an incubation interval did not occur when the interpolated task omitted semantically related items, suggesting that solution-related material needs to be primed during mind-wandering in order for mind-wandering to exert its positive benefits.

Although several studies have found experimental evidence that inducing mind-wandering facilitates creativity, others have failed to find such evidence. Notably, whereas Baird et al. (2012) found an advantage of mind-wandering without exposing participants to material pertinent to the creativity task, Leszczynski et al. (2017) only observed a benefit of the mind-wandering-inducing activity when it included word associates that were related to the creative solutions. Admittedly Leszczynski and colleagues used a paradigm (the RAT) that is rather different from the AUT employed by Baird et al.; indeed, RAT is theorized to capture convergent thinking processes – the determination of a single valid solution – while AUT captures divergent thinking processes – the generation of multiple potentially valid solutions. However, two other studies investigated the impact of experimentally induced mind-wandering on performance on the AUT (Murray et al., 2021; Smeekens & Kane, 2016) and also failed to find an advantage in the high-mind-wandering condition. Collectively, these studies suggest that experimentally inducing general off-task thinking does not offer a robust method for documenting the creative benefits of mind-wandering. Nevertheless, Leszczynski et al.'s observation of a creative benefit of mind-wandering when engaged in the context of material pertinent to the creativity task again suggests that the manner of mind-wandering may be critical in determining its impact.

Kinds of Mind-Wandering and Their Relationship to Creativity

From the outset of research on mind-wandering, researchers have speculated that certain kinds of mind-wandering may be particularly conducive to creativity (e.g., Singer & Antrobus, 1963). Furthermore, although some evidence suggests a relationship between creativity and mind-wandering – defined broadly as task-unrelated thought – this research intimates that the

relationship may be more robust when mind-wandering is more precisely delimited. Next, we consider the particular elements of mind-wandering that may contribute to facilitating creativity. As will be seen, although more research is needed, evidence suggests that certain types of mind-wandering may be of particular value.

The Factor-Analytic Approach

Our first effort to examine the forms of mind-wandering associated with creativity took a data-driven, factor-analytic approach (Zedelius et al., 2021). We used items from various existing mind-wandering scales and newly generated items and factor-analytically reduced them to a scale that can assess different types of daydreams both as trait-like characteristics of an individual and as a temporary state. We identified six dimensions of daydreaming: pleasant daydreaming (i.e., daydreams are pleasant and warm), meaningful daydreaming (i.e., daydreams revolve around personally significant, valuable, or important things), planning (i.e., daydreams revolve around future plans, events, and consequences), sexual daydreaming (i.e., daydreams about sexual fantasies), unaware/unintentional daydreaming (i.e., daydreams that occur with little awareness or intentionality), and bizarre daydreaming (i.e., daydreams revolve around unusual, bizarre, or fantastical things).

Using these factors in a trait measure, we assessed individuals' self-reported general tendency to engage in each of these forms of daydreaming and related them to assorted creativity measures, including: (1) the creative behavior inventory, which captures their history of engaging in creative and artistic behaviors (e.g., doing crafts projects, writing poetry or plays); (2) divergent creativity (as assessed by the AUT); (3) convergent creativity (as assessed by the RAT); and (4) a creative writing assignment. The results showed that self-reported creative behavior was positively associated with meaningful daydreaming, and the quality of participants' creative writing was positively associated with bizarre daydreaming. Performance on the other creativity tasks was not predicted by any of the other daydreaming qualities. These findings suggest that creative performance, as assessed by more naturalistic tasks (creative everyday behaviors and creative writing), is associated with meaningful and bizarre daydreaming, but not when assessed by more problem-solving types of measures, highlighting the need to investigate the relationship of these measures to creativity in daily life.

A follow-up study used an experience-sampling paradigm to assess participants' self-reported daily creativity and creative inspiration in

relationship to the six-factor daydreaming scale employed both as a trait and state measure. In addition to enabling us to investigate these factors in an everyday context, this study also allowed us to assess whether individuals are more creative on days wherein they engage in particular types of daydreams. Using a smart-phone-based experience-sampling paradigm, we probed participants repeatedly, over a period of five days, about their frequency and qualities of daydreaming. At the end of each day, participants further reported how inspired they felt that day and how much they engaged in creative behaviors.

With respect to the trait measures, we found that both of the factors observed in the earlier study again predicted creativity, with meaningful daydreaming being associated with the frequency of creative inspiration and bizarre mind-wandering associated with creative behaviors. With respect to within-participants fluctuations in mind-wandering, we found that daydreaming about plans was associated with more creativity when assessed as a state; however, as a trait, the frequency of daydreaming about plans was not associated with greater creative behavior (i.e., across subjects). That is, on days wherein individuals reported daydreaming more about future plans and activities, they also reported greater creativity. This suggests that mind-wandering that revolves around future plans and personal goals is productive for realizing one's goals, including goals for creative pursuits.

The Case for Curious Daydreaming (Mind Wondering)

Although promising in showing a relationship between particular types of daydreaming and creativity, our initial data-driven approach (looking at the most common categories of mind-wandering) raised the possibility that we might have overlooked dimensions. In our own experience, mind-wandering episodes that are driven by genuine curiosity seem particularly likely to lead to promising ideas. Certainly, anecdotes of creative individuals happening upon their ideas while mind-wandering also often portray those individuals as deeply curious about the topics that they mind-wandered about. Einstein, for example, said of himself “I have no special talent. I am only passionately curious” (quoted in Isaacson, 2007, p. 548). Indeed, self-reported curiosity is highly correlated with creativity (Gross et al., 2020). Given curiosity's close connection with creativity, it seems plausible that creative individuals' mind-wanderings are particularly apt to explore their curiosities, and, in turn, lead to creative discoveries. We review several indirect sources of evidence for the value of curious

daydreaming (or what we whimsically refer to as “mind wondering”), and then discuss a recent study that provides more direct evidence.

An initial study that hinted, albeit indirectly, at the potential importance of curiosity for facilitating creativity comes from an experience-sampling investigation of the relationship between mind-wandering and mood. As noted, when individuals are randomly probed regarding the status of their thoughts, they report being less happy when mind-wandering than when attending to the situation at hand (Killingsworth & Gilbert, 2010). We (Franklin et al., 2013) replicated this basic paradigm but further asked participants to indicate how interesting, useful, and novel their mind-wandering topic was. Once again, overall, people reported lower positivity when mind-wandering than when on task. However, when mind-wandering about something that they were particularly interested in, participants were actually happier than when they were on task (see Figure 7.2). Although interest and curiosity are not identical constructs, they are closely related (Kashdan & Silvia, 2009), thus suggesting that mind-wandering about topics that one is curious about may be

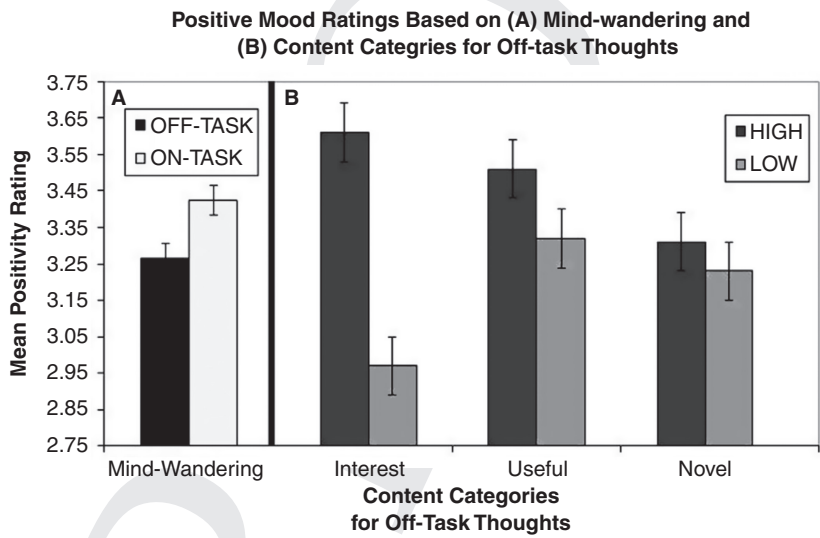


Figure 7.2 (From Franklin et al, 2013) (A) Displays the mean positive mood ratings based on whether participants reported being on- vs. off-task for a given probe and (B) displays the mean positive mood ratings for off-task reports based on the three content categories participants were asked to use to rate their mind-wandering episode on.

particularly pleasurable. Given that creativity is strongly associated with both curiosity (Gross et al, 2020) and positive mood (Baas et al., 2008), this work points to the potential creative value of a mind lost in the clouds but thinking about something it is genuinely curious about.

A second promising line in support of the potential value of curious daydreaming comes from the previously mentioned study by Gable et al. (2019), who asked creative writers and physicists to report at the end of every day whether they had had a creative idea, and if so, to indicate the situation in which it occurred. Gable et al. found that ideas that sprang to mind when individuals were neither at work nor actively pursuing the problem were particularly likely to entail overcoming impasses (i.e., creative problems that they had previously failed to solve). We speculated that creative impasses may fuel mind-wandering via the Zeigarnik effect (Zeigarnik, 1927) – the finding that people have better memory for unfinished tasks relative to ones that they have successfully solved (see Seifert, this volume). Accordingly, impasses on creative problems may increase their subsequent accessibility, thereby fueling mind-wandering about them. Given that not knowing the answer to a recently encountered problem is an important source of curiosity (Loewenstein, 1994), it follows that creative impasses may foster curious daydreaming about the problem. Taken together, this reasoning suggests that impasses may fuel mind wandering, which in turn may lead to creative solutions.

A recent series of studies (Zedelius & Schooler, 2023) provides initial evidence for the value of curious daydreaming about creative impasses. We first developed questions that assessed people's tendency to mind-wander about topics on which they had reached an impasse, including items such as "When I hit a mental roadblock while working on a task or project, I often find myself daydreaming about possible solutions" and "My daydreams revolve around unsolved problems or unanswered questions." We then assessed the relationship between individuals' responses on this trait measure (termed "curious daydreaming") to our previously mentioned six-factor daydreaming scale, as well as to related measures (e.g., rumination) and, most importantly, creative behaviors. Our initial results indicated that the curious-daydreaming measure describes a unique type of daydreaming not captured by our daydreaming scale. Curious daydreaming was associated with personally meaningful and future-directed thinking. Although not necessarily pleasant, it was distinct from rumination. Most importantly, curious daydreaming – along with fantastical daydreaming – emerged as a predictor of creative behavior and achievement. A second study replicated (with slight variations)

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these findings and further demonstrated that curious daydreaming was correlated with epistemic curiosity.

A final experience-sampling study again used the curious daydreaming scale, but this time also included it as a state measure and compared creative writers with education-/age-matched controls. This study also queried individuals at the end of the day regarding their creative achievements and creative inspiration that day. Replicating the first two studies, Study 3 again found that the curious daydreaming scale predicted creative behaviors. Of greatest interest was the experience-sampling data. Here, we found that creative writers reported significantly more curious daydreams than their matched controls, even when accounting for their greater frequency of daydreams overall. We also found that among the control participants, those who more often reported engaging in curious daydreaming also reported more creative accomplishments and more creative inspiration at the end of the day. Most importantly, when we looked at fluctuations in curious daydreaming over time, we found that writers reported being more creative on days in which they also reported more curious daydreaming.

Although still correlational, this initial foray into curious daydreaming provides suggestive evidence of its contribution to creativity. Measured as a trait, creative individuals (as assessed by the creative behaviors inventory, and by comparing writers to nonwriters) report engaging in significantly more curious daydreaming than their less creative counterparts. Assessed as a state using experience sampling, creative writers again evidenced more episodes of curious daydreaming than the matched controls and, critically, reported being more creative on days on which they also reported engaging in more curious daydreaming. Although far from definitive, these findings support the contention that curious daydreaming may foster creative advances.

Future Directions

Consideration of the existing evidence of the relationship between mind-wandering and creativity is simultaneously tantalizing and frustrating. Many strands of evidence suggest that at least certain forms of mind-wandering may contribute to creative advances, yet there are really no findings that can be held up as incontrovertible evidence that it is helpful. In principle, the most compelling evidence would be experimental, and while such studies exist (e.g., Baird et al. 2012; Smeekens & Kane, 2016), several attempted conceptual replications have failed (e.g., Murray et al,

2021, Smeekens & Kane, 2016), and the one semiconceptual replication Leszczynski et al., (2017) was rather circumscribed, only showing benefits of mind-wandering when the incubation period exposed participants to words associated with the creativity task. Correlational evidence between certain kinds of mind-wandering and creativity has proven more promising, but even there the relationships have been somewhat variable, and of course correlational evidence can never truly demonstrate causation. In this final section, we consider further directions that may help to shore up the case for a genuine role of mind-wandering in facilitating creativity.

Kinds of Mind-Wandering

A key theme of this chapter has been that certain topics and/or styles of mind-wandering may be particularly beneficial for enhancing creativity. Although several forms of mind-wandering have shown particular promise, all are in need of further research. We begin by discussing the kinds we have reviewed and then consider several additional aspects of mind-wandering that are also worthy of further research.

Curious daydreaming (mind wondering): Of all of the aspects of mind-wandering that we have investigated, curious daydreaming (or mind wondering) may be the most promising. The tendency to engage in curious daydreaming showed up as a trait predictor of creativity in all three of the studies (discussed earlier) in which this relationship was investigated. Furthermore, for creative writers, fluctuations in the daily frequency of curious daydreaming were predictive of their self-reported creative outputs and creative inspiration.

Though initial efforts are encouraging, more research is clearly needed to understand curious daydreaming and its relationship to creativity. It should be noted that curiosity itself is a multifaceted construct, with at least two somewhat distinct components (Litman, 2008; see also Jacobs & Metcalfe, Chapter 6, this volume): general-interest curiosity, corresponding to the delight people take in discovering new information, and deprivation curiosity, corresponding to the distress that people experience when they don't know a particular piece of information. Although the curious daydreaming that we investigated was equally correlated with both forms of trait curiosity (Zedelius & Schooler, 2022), the items in our daydreaming scale were generally more focused on deprivation-based curiosity (i.e., on thinking about unanswered questions people had been working on). Future investigations should also investigate mind-wandering that reflects more general interest-based curiosity and its relationship to creativity.

In one preliminary study (Schooler & Zedelius, 2017), we found that mind-wandering about general interest topics was also predictive of creative behavior. Overall, these findings suggest that curiosity-driven mind-wandering holds real promise as a source of creative inspiration. However, more research is warranted both to shore up this claim and to investigate how mind-wandering that entails different types of curiosity relates to creativity.

Ultimately, we anticipate that a form of curious daydreaming that we have whimsically termed “mind wondering” will prove particularly conducive to creative advances. Mind wondering might be operationally defined as engaging in thoughts unrelated to the goings on around one that (1) curiously revolve around *questions* that one is genuinely interested in, and (2) that are not excessively oriented toward issues that invoke negative emotions. Topics involving philosophical (e.g., “I wonder if insects are conscious?”), artistic (e.g., “I wonder why that artist made the particular decisions that she did?”), social (e.g., “I wonder if Harry will marry Sally?”), or project-related questions (e.g., “I wonder how I should end that chapter I am working on?”) are just some of the infinitude of thoughts that might fit this characterization. In our personal experience, mind-wandering that entails a lighthearted curiosity is key, but future research might profitably attempt to further pin down the precise characteristics of this potentially inspiring mental state. Indeed, a number of the additional properties listed herein (e.g., topical shifts, freely moving, meaningful, intentional) might also be incorporated into the definition if they are found to regularly co-occur and be predictive of creative thought.

Fantastical daydreaming: Fantastical or bizarre daydreaming has also proven to be a robust predictor of creativity. As a trait, it was predictive of creative performance in every study wherein we investigated it. As a state assessed in experienced-sampling studies, it also differentiated individuals who scored higher versus lower on creativity measures, and creative writers from nonwriters. Of course, creative individuals are likely to have more creative (and thereby more fantastical) daydreams, which could well drive the association between the two. This possibility was supported by an initial study in which no relationship between daily fluctuations in fantastical daydreaming and creative output was found (Zedelius et al., 2021). However, another study did find that nonwriters reported being more creative on days in which they engaged in more fantastical daydreaming (Zedelius & Schooler, 2022), raising the possibility that fantastical daydreaming could fuel creativity. Further research might try to home in on the kinds of topics people fantastically daydream about and the types of

products they are being creative on. It may be that certain types of fantastical daydreaming spurs certain kinds of creativity.

Meaningful daydreaming: In our initial factor-analysis study (Zedelius et al., 2021), meaningful daydreaming correlated with some measures of creativity in all three studies. However, fluctuations in the meaningfulness of daydreams across days did not correspond to fluctuations in creativity. Moreover, we did not find any relationship between meaningfulness and creativity in three other studies conducted by Zedelius and Schooler (2022). It seems possible that this variability may stem from the great range of mind-wandering topics that can be classified as meaningful. Future research may try identify the types of meaningful thoughts that are particularly associated with creativity. For example, there might be a difference between personally meaningful thoughts (“My friend is so special”) and conceptually meaningful thoughts (“Isn’t it remarkable how the moon is visually the same size as the sun?”). It may be that conceptually meaningful thoughts are particularly pertinent to creativity.

Pleasantness: Although positive mood has been tied to creativity, we did not find a relationship between people’s general inclination to daydream about positive topics and creativity. We also did not find a relationship between creativity and pleasantness of daydreams in our experience-sampling studies, again with one exception: writers reported both being more creative and feeling more creatively inspired on days in which they also reported more pleasant daydreams (Zedelius & Schooler, 2022). Perhaps the relationship between pleasantness of daydreams and creativity is only observed for individuals for whom creativity is their profession – a possibility deserving of further research.

Meta-Awareness and Intentionality: Meta-awareness of mind-wandering (i.e., recognizing that one is mind-wandering) can be a potent moderator of the effects of mind-wandering. In many domains, meta-awareness attenuates the negative effects of mind-wandering (Schooler et al., 2011). Nevertheless, none of our studies have found a relationship between people’s reported awareness of daydreams and creativity. That said, there have been some hints that the related – albeit not identical (Seli et al., 2017) – construct of intentionality of mind-wandering may have some bearing on creativity. A recent study relating creativity to trait tendencies to mind-wander deliberately versus spontaneously (Agnoli et al., 2018) found some suggestive evidence that intentional mind-wandering is positively related to creativity whereas nondeliberate spontaneous mind-wandering is negatively related. However, these relationships were not significant on their own, as deliberate mind-wandering was only predictive of creativity when

combined with high levels of the awareness subcomponent of a mindfulness measure. These findings suggest that, although likely complex, the relationship between creativity and both meta-awareness and intentionality of mind-wandering should be further explored.

Topical Shifts: The frequency of topical shifts in everyday thought has been found to predict trait curiosity (Gross et al., 2021). More topical shifts may imply, on average, a greater breadth of topics entertained during any given mind-wandering session and may therefore be particularly conducive to divergent thinking styles associated with creative performance.

Freely Moving Thought: Another dimension of mind-wandering that has been hypothesized to be important for creativity is whether or not it entails freely moving thoughts that are relatively unconstrained by goals or current demands (Christoff et al., 2016). This dynamic framework account of mind-wandering makes strong predictions that freely moving thought may be crucial to the kinds of mind-wandering that contribute to creativity. However, evidence for this conjecture is limited. A series of three experiments using a variety of creativity tasks Smith et al. (2022) found little evidence in support of the creative value of freely moving mind-wandering. Nevertheless, given its theoretical significance, more research investigating this dimension is warranted.

Context of Mind-Wandering: Baird et al. (2012) reported that the benefits of an incubation interval were maximized when it entailed a nondemanding task known to be associated with insight. Although this finding has been difficult to replicate, the basic question of the activities that accompany mind-wandering in order to maximize its value remains important. If, as argued, certain kinds of mind-wandering do foster creativity, it will be helpful to determine the accompanying context (if any) by which mind-wandering is maximally effective. In addition to investigating the impact of variations in the cognitive load associated with any accompanying task, other potentially important contextual features might include: (1) mind-wandering with eyes open versus closed – at least one study found increased creativity on the AUT task with eyes closed (Ritter et al., 2018); (2) mind-wandering while sitting versus walking – evidence suggests that walking can enhance creativity (Oppizzo & Schwartz, 2014), as does exposure to nature (Ratcliffe et al., 2021), which is often encountered while walking; (3) mind-wandering when listening to music versus silently – research indicates that music can have powerful effects on the content of mind-wandering (Koelsch et al., 2019), and music has also been associated with creativity (Ritter & Ferguson, 2017). It thus seems probable that music could impact how mind-wandering relates to creativity.

Additional Ways of Assessing Creativity

One of the biggest obstacles to the investigation of creativity is finding effective ways to measure it. An important innovation in some of the research reviewed here has been the inclusion of daily journal entries asking participants to assess their own creativity each day (Gable et al., 2019). This approach helps to reveal creativity as it unfolds in everyday life and, in particular, to investigate how variations in daily mind-wandering may relate to changes in creativity. While promising, more research is needed to develop and refine measures of everyday creativity reports. For example, in addition to asking creative writers and scientists to assess the creativity of their output on the day it occurred, Gable et al. (2019) asked participants to reassess the creative value of their ideas several months after they were generated. This delayed metric allowed for gauging the longer-term value of the ideas. (Perhaps unsurprisingly, many ideas were evaluated as less creative with the passage of time.) Future research might build on this approach by asking participants to indicate precisely how or where their ideas were used. Judges could also assess fluctuations in the qualities of daily creative outputs. For example, it would be interesting to relate daily fluctuations in the quality of writing in students' short stories (as assessed by judges) with fluctuations in the kinds of mind-wandering that they report. Other areas of creative expression (e.g., painting, music) might similarly be assessed and related to variations in day-to-day mind-wandering. Although challenging, carefully documenting the actual outputs of creative individuals and relating those outputs to their varied mind-wandering activities holds real promise.

Arguably the biggest limitation of investigating links between mind-wandering and creativity has been the dearth of successful experimental studies. Although there have been a few positive experimental findings, they have been limited and difficult to replicate. If correlational evidence further uncovers the value of particular kinds of mind-wandering, then it will be critical to find ways of experimentally manipulating these kinds of mind-wandering. We discuss this possibility in the context of curious daydreaming, but, in principle, similar methods could be used for fostering other kinds of mind-wandering.

A recent experience-sampling study led by Hagtvedt et al. (2019) found that daily experiences of curiosity in artisans were associated with increased creativity the following day. This same article reported a separate study in which a causal link between curiosity and creativity was demonstrated; critically, the effect of curiosity on creativity was

mediated by a phenomenon the authors term *idea linking*: “a cognitive process that entails using aspects of early ideas as input for subsequent ideas in a sequential manner, such that one idea is a stepping stone to the next” (Hagtvedt et al., 2019, p. 1). A parallel line of research suggests that trait curiosity (which is theoretically associated with more frequent daily experiences of curiosity) predicts more meaningful and goal-directed thoughts, while also being associated with more topical shifts during mind-wandering – that is, thoughts jumping from one topic to another (Gross et al., 2021). Together, these findings raise the interesting possibility that curiosity may promote creativity by driving changes in the qualitative features of thought; however, the particular qualities of mind-wandering promoted by curiosity are still to be determined. Given the correlational nature of this research, future experiments are necessary to first determine whether the association between curiosity and qualities of mind-wandering, such as topical shifts, is causal, and then to determine the extent to which such qualities of mind-wandering facilitate creative thinking.

Future research could address this point by examining effects on mind-wandering and creativity following experimental manipulations of curiosity. One promising curiosity induction that might naturally facilitate *mind wondering* is question asking. Indeed, recent findings in our lab (Gross, 2022) suggest that an instruction to generate questions while reading articles leads to increased feelings of curiosity and increased interest in the given topic, as compared to summarizing the main idea of the articles. Furthermore, in a subsequent assessment of mind-wandering, individuals in the question-asking condition reported thinking about more interesting topics. These preliminary findings suggest that encouraging question asking may foster curious states of mind, and may hint at the possibility that question asking could be incorporated into curious daydreaming instructions. Participants instructed in curious daydreaming could then be compared to participants instructed in some other form (e.g., pleasant mind-wandering), and the respective impact on creativity assessed. Similar types of interventions might be developed to experimentally investigate other promising types of mind-wandering.

Closing Remark

Since Archimedes reportedly jumped out of his bath shouting “Eureka!” at having stumbled onto the solution for calculating the volume of the kings’ crown, history has recorded anecdotes of great thinkers’ mind-wanderings

leading to creative advances. The research reviewed in this chapter suggests that such creative insights may not be limited to historical figures, but rather may be a key benefit of at least some forms of mind-wandering. If so, there may be great value in helping people to cultivate the forms of mind-wandering that can foster creative insights.

It was once thought that personality traits were largely immutable and, thus, that penchants for daydreaming and creativity – both key components of the personality trait of openness to experience – might be similarly entrenched. While it remains likely that people’s tendency for creativity and daydreaming will continue to show stability over their lifetimes, increasing evidence indicates that personality traits can be cultivated. Programs have been developed that can increase people’s conscientiousness, extraversion, and, most relevant to the current discussion, openness to experience (Stieger et al., 2021). As we come to better understand the components of mind-wandering that are associated with creativity, we may be able to similarly develop training programs that cultivate personality changes which in turn foster such daydreams. We speculate that promoting curiosity as a trait may be particularly helpful in enabling people to take unfilled moments from their days as opportunities for creative wonder. Rather than simply mind-wandering, people may learn to “mind wonder,” and thus reap the creative insights that such curious flights of fancy may inspire.

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