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What Types of Daydreaming Predict Creativity? Laboratory and Experience Sampling Evidence

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Daydreaming—engaging in an internal stream of thought unrelated to the here and now—is often linked to creativity; but not all daydreams are creative or lead to creative ideas. To better understand the relationship between daydreaming and creativity, we distinguish between types of daydreaming that differ in style or content (future planning, pleasant daydreaming, personally meaningful daydreaming, unaware/unintentional daydreaming, sexual daydreaming, and fantastical daydreaming) and explore how these types relate to creativity. To assess both individual differences in daydreaming style (i.e., as a trait-like disposition) and fluctuations in daydreaming within individuals, we measure daydreaming in the lab and have participants track their daydreaming outside the lab via smartphones over a 5-day experience sampling period. In the laboratory, creativity is assessed via convergent and divergent thinking tasks, self-reports of creative behavior, and a creative writing assignment in which participants write a short fictional story. Outside the lab, participants report their creative behavior and inspiration at the end of each day. Whereas we find no clear evidence that daydreaming is related to divergent thinking, *personally meaningful* daydreaming predicts self-reported creative behavior and daily inspiration, whereas *fantastical* daydreaming predicts creative writing quality and day-to-day creative behavior. Moreover, daily fluctuations in future planning appear to be positively related to day-to-day creative behavior. We discuss the implications of distinctions between trait-level predictors (what “type of daydreamer” a person is) and state-level predictors (what type of daydream one engages in) in relation to creative behavior and inspiration.


Keywords: mind wandering, imagination, creativity, experience sampling, fantastical daydreaming

“Mostly it starts with daydreaming” (Neil Gaiman, Author, on the source of his creative ideas in Rehm & Gaiman, 2015).

The author Neil Gaiman is only one of many artists and inventors who draw inspiration from their daydreams. *Daydreaming*, also referred to as *mind wandering* (e.g., Killingsworth & Gilbert,

2010; McVay, Kane, & Kwapil, 2009; Smallwood & Schooler, 2006), *task-unrelated thought* (e.g., Smallwood & Schooler, 2006), *stimulus-unrelated thought* (e.g., Teasdale et al., 1995) or *self-generated thought* (Andrews-Hanna et al., 2013), is here defined as thinking about something other than the here and now, being disengaged or “decoupled” from one’s surroundings or current activities, and engaged in an internal stream of thought. A person’s internal stream of thought is constrained only by the limits of their imagination. We can dream up intricate alternative realities and project ourselves into fantastical worlds, which lay the foundation for awe-inspiring fantastical stories (as Gaiman does). Or we can mentally play out a myriad of different steps and alternate paths to tackle a complicated problem. It is no wonder daydreaming and creativity have often been treated as intimately linked or overlapping constructs (e.g., Barr, Beaty, & Seli, 2018; Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016; Klinger, 2009; Singer, 1975; Singer & Schonbar, 1961; Singer, 2009; Zedelius & Schooler, 2016; Zhiyan & Singer, 1997).

There is indeed evidence linking daydreaming to creativity. After having worked on a difficult problem and having reached an impasse, taking a break often leads to an unexpected boost in creativity, and lab studies have shown this is especially the case when the break is spent

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doing an undemanding activity that leaves room for frequent periods of daydreaming (compared to a demanding task that prevents daydreaming; Baird et al., 2012; Leszczynski et al., 2017). More evidence for this comes from research conducted outside the lab, tracking the idea generation process of professional creative writers and elite theoretical physicists (Gable, Hopper, & Schooler, 2018). The research found approximately 20% of the writers' and physicists' creative ideas occurred to them during daydreaming episodes, that is, when they were neither engaged in work nor actively pursuing a work-related problem. In addition, a general disposition toward frequent daydreaming has also been associated with increased creativity (Baird et al., 2012; Zedelius & Schooler, 2015), and particularly with spontaneous insights (Zedelius & Schooler, 2015).

But not all daydreams are creative, lead to creative solutions, or provide inspiration for creative stories. Sometimes daydreams are repetitive, obvious, boring, or even distressing. In fact, people much of the time do not take pleasure from their daydreams (Andrews-Hanna et al., 2013; Killingsworth & Gilbert, 2010; Wilson et al., 2014) and the bulk of scientific findings paint a picture of daydreaming as merely distracting, rather than productive (see Mooneyham & Schooler, 2013). Moreover, although some studies have found positive evidence for the connection between daydreaming and creativity, others have found no evidence for it. Individual-differences studies examining how much individuals' mind wandered while taking a break from a creative task, for instance, found mind wandering rates did not predict subsequent creativity or improvements in creativity relative to before the break (Smeekens & Kane, 2016). Indeed, some of the positive evidence that has previously been found can be explained by mechanisms that are not necessarily causal or reverse the connection between daydreaming and creativity. The reason creative solutions often come to creative individuals during periods of daydreaming (see Gable et al., 2018) may be that creative individuals like to daydream about creative problems when idle or when engaged in less stimulating tasks. This would be in line with findings from the individual-difference studies by Smeekens and Kane (2016). Whereas they did not find evidence that mind wandering rates in the lab predicted subsequent creativity, a trait scale measuring daydreaming in everyday life showed a trending correlation with creativity, and this was driven specifically by items describing daydreaming when idle or during uninteresting tasks.

The inconclusive evidence so far raises several interesting questions: (a) Given daydreaming frequency does not robustly predict creative performance, could there be a particular type of daydreaming, a rare subset even, that is creatively productive? In other words, do different types of daydreaming relate differently to creativity? (b) If only particular types of daydreaming predict creativity, is this driven by differences between individuals (i.e., more creative individuals daydream in certain characteristic ways), or is there a within-person association between daydreaming in a particular way and engaging in creative behavior? The present research explores these questions.

Types of Daydreaming and Creativity

Daydreaming has long been recognized as an umbrella term encompassing a variety of types of thought, differing in style and content. The earliest research linking distinct types of daydreaming to different outcomes (Singer & Antrobus, 1963; see also Huba & Tanaka, 1983–1984) proposed daydreamers can be sorted into

three distinct styles of daydreaming: (a) *positive-constructive daydreaming*, characterized by pleasant and captivating daydreams with vivid mental images, typically revolving around future plans and creative ideas; (b) *guilty-dysphoric daydreaming*, revolving around shame and guilt, fear of failure, but also fantasies of heroism and achievements; and (c) *poor attentional control*, summarized as frequent daydreaming and susceptibility to boredom and distraction (Singer & Antrobus, 1963; see also Huba & Tanaka, 1983–1984). Studies have found, among the three styles, positive-constructive daydreaming is related to the personality trait *openness to experience* (Blouin-Hudon & Zelenski, 2016; Zhiyan & Singer, 1997), a trait that correlates strongly with lab measures of creativity, including divergent thinking and idea generation (Furnham & Bachtiar, 2008; King, Walker, & Broyles, 1996; McCrae, 1987; McCrae & Costa, 1997; Silvia, Nusbaum, Berg, Martin, & O'Connor, 2009), and with real-life creative behaviors and achievements (Feist, 1998; Kaufman et al., 2016; McCrae, 1987; Silvia et al., 2009). Thus, this is first—though indirect—evidence that distinct types of daydreaming relate differently to creativity.

It is worth noting, however, that the three daydreaming styles were conceived to be multifaceted patterns of thoughts, attitudes, and behaviors, including not just strictly daydreaming-related tendencies. Positive-constructive daydreaming notably includes interpersonal curiosity and creative thinking, both of which are also characteristics of openness to experience (McCrae, 1987; McCrae & Costa, 1997; Silvia & Sanders, 2010) and creativity. Thus, to better understand how types of daydreaming relate to creativity, it is important to study different contents and styles of daydreaming in isolation, without confounding them with other traits or behaviors, especially ones that are themselves linked to creativity.

Research looking more closely at daydreaming content has found the majority of daydreams involve episodic thought in which the daydreamer projects themselves into a simulated scene (Song & Wang, 2012). Moreover, the majority of daydreams revolve around current concerns (Kane et al., 2007; Kane et al., 2017; Klinger, 1987, 1999; McVay et al., 2009) and *plans* for upcoming tasks and activities (Baird, Smallwood, & Schooler, 2011; Morsella, Ben-Zeev, Lanska, & Bargh, 2010; Smallwood, Nind, & O'Connor, 2009). Thus, when we mentally decouple from our mundane day-to-day activities, we mostly escape to other mundane day-to-day activities. A smaller proportion of daydreams can be described as unusual or “fanciful,” involving hypothetical, unlikely or fantastical scenarios, either as imaginary wish-fulfillment or playful exploration (Klinger, 1978–1979; Klinger, 1987–1988; Klinger, 2009; Singer, 2009). Although conceivably even the most mundane of daydreams might be productive for solving day-to-day problems (e.g., “What to do with children on rainy days?” Singer, 2009), might this rarer type of fanciful or fantastical daydreaming, which can transport us to far-away places and alternative realities, offer a unique source of creative inspiration?

One study that speaks to this question is a week-long experience sampling study that linked different kinds of daydream reports to individual differences in personality (Kane et al., 2017). Participants were probed at random moments throughout the day and asked to rate the contents of their task-unrelated thoughts along several dimensions: Planning (i.e., thinking about things to do), a focus on worries or problems, a focus on things going on in the

immediate surroundings, and fantasy content. Higher fantasy content was associated with greater openness to experiences, which has been treated as a proxy for creativity. Thus, though still indirect, this finding provides evidence that engaging in more fantastical daydreams may be related to greater creativity. Further supporting this possibility, greater ability to vividly imagine *distal scenarios* (e.g., imagine what the world will be like in 500 years; imagine being on the bottom of the ocean) is associated with more creative idea generation and professional creative and artistic achievements (Meyer, Hershfield, Waytz, Mildner, & Tamir, 2019). However, participants were instructed to imagine unlikely or fantastical scenarios, these scenes did not occur to them spontaneously. Thus, it is an open question whether a natural proclivity for fantastical daydreaming in day-to-day life is linked to creativity.

Aside from daydream content, researchers have distinguished between other interesting dimensions, such as affect and awareness. Daydreams can be pleasant or unpleasant (Huba, Aneshensel, & Singer, 1981; Killingsworth & Gilbert, 2010; Kane et al., 2017), more or less personally meaningful (Andrews-Hanna et al., 2013), and the daydreamer can be aware or unaware of the fact that they are daydreaming, that is, they can daydream with or without “meta-awareness” (Christoff, Gordon, Smallwood, Smith, & Schooler, 2009; Schooler, 2002). Moreover, a growing literature now distinguishes between spontaneous and deliberate daydreams (Christoff et al., 2016; Seli, Carriere, & Smilek, 2015; Seli, Risko, & Smilek, 2016).

Most of these dimensions have never been studied in relation to creativity. Only one study has examined deliberate and spontaneous daydreaming in relation to creativity and found a greater tendency for deliberate daydreaming (i.e., agreement with items such as, “I allow myself to get absorbed in a pleasant fantasy”) was associated with increased creative performance, whereas a tendency for spontaneous daydreaming (e.g., “I find my thoughts wandering spontaneously”) was unrelated to creativity (Agnoli, Vanucci, Pelagatti, & Corazza, 2018). This suggests that the type of daydreaming that either leads to creative ideas or is itself the result of creative thinking is more intentional. It is not clear whether this is due directly to intentionality or to potentially related factors, such as the perhaps more pleasant, interesting, or fantastical thought content that could be associated with intentional daydreaming. To better understand which types of daydreaming are particularly related to creativity, we take a slightly different approach, and compare multiple daydream dimensions at the same time, to test which ones independently contribute to predicting differences in creativity.

The Current Research

Daydreaming

An important theoretical and methodological consideration for the present study was that daydreaming can be conceptualized both as a trait-like disposition of an individual (interindividual variation), and as a state differing from one moment to the next, much like emotions (intraindividual variation). These definitions are not necessarily independent—assuming a person’s general disposition reflects a central tendency of an accumulation of states (see Fleeson, 2004). A momentary experience, however, can nonethe-

less be wholly uncorrelated with one’s general disposition (see Hao, Wu, Runco, & Pina et al., 2015). Considering both state and trait aspects can offer unique insights into how daydreaming relates to creativity. Focusing on daydreaming as a state can offer insights into the mechanisms by which engaging in a daydream can affect subsequent creative processes such as idea generation or creative behavior. Treating daydreaming as a trait can offer insights into how being a particular kind of daydreamer relates to longer-term outcomes, such as a history of creative pursuits and achievements. This association might not necessarily be causal but could be caused by other latent variables. Moreover, it is possible that *engaging* in a particular kind of daydream and *being* a particular kind of daydreamer relate differently to the same outcomes, much like, for instance, running increases the risk of heart attack, whereas *being a runner* is associated with reduced heart attack risk. To account for these different levels of effects, we wanted to examine different types of daydreaming both at the trait and at the state level.

Because no existing daydreaming scale was available that could function equally at the trait and state level, we conducted pilot studies to construct a novel daydreaming scale that could do so. The scale had to be short enough to be suitable for experience sampling and strictly describe style and content of daydreaming episodes, as opposed to other types of thinking or personality traits. We then conducted a two-part study, which included a laboratory session and a 5-day experience sampling period, in which we assessed individual differences and within-subjects fluctuations in daydreaming and creativity. These levels of measurement allowed us to distinguish to what degree engaging in a particular type of daydreaming and being a particular type of daydreamer is associated with aspects of creativity.

Creativity

Like daydreaming, creativity is a heterogeneous concept. The literature often defines it in terms of the capacity to generate novel and useful ideas or solve problems by finding uncommon solutions (Boden, 1994; Kamylyis & Valtanen, 2010; Mumford, 2003; Runco, 1988). In keeping with this definition, we included classic measures of idea generation (generating novel uses for common objects) and problem solving (solving compound remote associates problems), as well as self-reports of day-to-day creative behavior and inspiration. Although these are all important aspects of creativity, another, particularly salient and meaningful aspect of creativity is artistic expression. Here we were especially interested in creative writing. There are reasons to suspect creative writing may benefit especially from daydreaming. Coming up with a fictional story, characters, and hypothetical or impossible events are examples of mentally simulating things not currently present. Moreover, compelling creative writing that captivates the reader relies on bringing to life vivid and specific mental images, sounds, smells, and emotions (Tankard & Hendrickson, 1996). Thus, individuals who frequently get absorbed in daydreams, especially the types of unusual or fantastical daydreams involving distal simulations of hypothetical or unlikely events (as opposed to mundane plans for the next upcoming task or the next day), might also be able to strategically harness this ability to bring compelling stories to paper.

In sum, our goal was to get a nuanced view of the relationship between daydreaming and creativity by examining how individuals differ from each other in the way they daydream, as well as how their daydreams can fluctuate from one moment to another, and then linking these differences and fluctuations to differences in idea generation, problem solving, creative behavior and inspiration, and artistic expression in the form of creative writing. We begin by briefly summarizing the findings of our three pilot studies and then present our main study, in which we explored these questions.

Pilot Studies

The studies were approved by the University of California, Santa Barbara's (UCSB's) internal review board and conducted in accordance with the Declaration of Helsinki. To develop a compact trait-and-state-daydreaming scale, we started with a large preliminary scale that included items from widely used existing daydreaming scales: the Short Imaginal Process Inventory (Huba et al., 1981), the Self-Generated Thought Questionnaire (Andrews-Hanna et al., 2013), and the Deliberate Versus Spontaneous Mind Wandering Scale (Carriere, Seli, & Smilek, 2013). We only included items that could function as a descriptor for a trait-like disposition as well as a state. We further included newly generated items we thought addressed gaps in existing scales. In two pilot studies conducted through mTurk (Pilot 1: $N = 195$, Pilot 2: $N = 245$), we asked participants to briefly describe their most recent daydream and then to evaluate the content and style of the daydream using our large preliminary pool of items. (In Pilot 1, this comprised 109 items, in Pilot 2 we expanded the item pool to 135 items based on some of the open-ended reports collected in Pilot 1 and based on the observation that few existing items captured fantastical daydream content).

To reduce the number of items and derive a small number of meaningful dimensions, we conducted an exploratory factor analysis on the data from Pilot 1 and, in an iterative process, eliminated items not loading strongly onto any factor, showed high cross-loadings on several factors, or did not fit for theoretical reasons.

We derived five interpretable factors. In Pilot 2, the same five factors were reproduced, plus one additional factor consisting of the newly added items, which we describe below as "fantastical daydreaming."

To derive a final short scale, we kept only the three highest-loading items per factor, resulting in an 18-item scale (see Table 1 for the full scale) with the following factors: (a) future planning (e.g., "I was thinking about things that might happen a short time from now"), (b) pleasant daydreaming (e.g., "The daydream provided me with pleasant thoughts"), (c) meaningful daydreaming (e.g., "I daydreamed about something that is of great value or importance to me"), (d) sexual daydreaming (e.g., "I daydreamed about somebody I desire sexually"), (e) unaware/unintentional daydreaming ("For a while, I was not aware of the fact that I was daydreaming") and (f) fantastical daydreaming (e.g., "I daydreamed about something supernatural"; note this factor and the corresponding items were not present in Pilot 1).

In Pilot 3, with a sample of 621 American adults matched to the adult population in terms of demographics recruited through the survey platform CriticalMix, we administered a trait-version of the new daydreaming scale, in which items were rephrased to refer to "daydreams" generally (e.g., the item "The daydream provided me with pleasant thoughts" was rephrased as "My daydreams provide me with pleasant thoughts"). We randomly split the sample into two sets and conducted confirmatory factor analyses to reproduce the six factors that had been identified in exploratory factor analyses on items in Pilot 2. The model fit was acceptable in both data sets (Set 1: $N = 310$, $\chi^2 = 303.3$, $CMIN/df = 2.53$, comparative fit index [CFI] = .89, root mean square error of approximation [RMSEA] = .07; set 2: $N = 311$, $\chi^2 = 328.7$, $CMIN/DF = 2.74$, $CFI = .90$, $RMSEA = .08$), thus establishing the trait version of the daydreaming scale. See Table 2 for trait items and factor loadings and Table 3 for covariances.

Our first pilot studies also provided some preliminary evidence for a connection between certain daydreaming styles and creativity. In pilot studies 1 and 2, we also administered the Creative Behavior Inventory (CBI) short form (Dollinger, 2003), a self-

Table 1
State Daydreaming Items

Subscale	Items
Planning	I was thinking about things that might happen a short time from now I was thinking about things that might happen in a few days
Pleasant	I was thinking about the immediate practical consequences of something The daydream provided me with pleasant thoughts The daydreams left me with warm, happy feelings
Meaningful	The daydream contained events that upset me (R) The daydream did not have any significance for me (R) The daydream was very meaningful for me
Unaware	I daydreamed about something that is of great value or importance to me I was hardly aware of the fact that I was daydreaming For a while, I was not aware of the fact that I was daydreaming
Sex	I was daydreaming unintentionally, without necessarily wanting to I was vividly imagining a sexual fantasy I daydreamed about somebody I desire sexually
Fantastical	I was thinking about sex I daydreamed about something supernatural The ideas that came to me during the daydream were funny and bizarre I was imagining fantasy creatures or people

Table 2
Trait Daydreaming Scale (Pilot 3)

Factor	Items	Standardized regression weights sample 1	Standardized regression weights sample 2	Standardized regression weights in main study—lab sample
Planning	I think about things that might happen in the near future	.804	.836	.749
	I think about things that might happen in the next few days	.756	.694	.812
	I think about the immediate practical consequences of things	.256	.453	.563
Pleasant	My daydreams provide me with pleasant thoughts	1.021	.831	.912
	My daydreams leave me with warm, happy feelings	.599	.762	.899
	My daydream contains events that upset me (R)	.204	.069	.059
Meaningful	My daydreams do not have any significance for me (R)	.223	.421	.453
	My daydreams are very meaningful for me	.658	.782	.820
	I daydream about things that are of great value or importance to me	.707	.722	.752
Unaware	While I daydream, I am hardly aware of it	.732	.623	.818
	When I start to daydream, I remain unaware of it for a while	.749	.872	.719
	I daydream unintentionally, without necessarily wanting to	.552	.426	.790
Sex	I vividly imagine sexual fantasies	.837	.885	.914
	I daydream about somebody I desire sexually	.892	.873	.932
	I daydream about sex	.921	.905	.815
Fantastical	I daydream about supernatural things	.673	.714	.732
	The ideas that come to me during daydreams are funny and bizarre	.534	.545	.604
	I imagine fantasy creatures or people	.720	.802	.920

report measure designed for a lay population and assessing creative behaviors and accomplishments in the visual and literary arts, performing arts, and crafts (see Methods for more details). In Pilot 1, a regression analysis predicting creative behavior from the 5 initial daydreaming types (excluding fantastical daydreaming which was not administered) identified meaningful daydreaming ($\beta = .151, p = .048$) and future planning ($\beta = .197, p = .006$) as significant predictors (overall model, $F[5, 189] = 3.45, p = .005$). In Pilot 2, a regression analysis predicting creative daydreaming from all six daydreaming types identified meaningful daydreaming ($\beta = .192, p = .004$) and fantastical daydreaming ($\beta = .195, p = .003$) as significant predictors (overall model, $F[6, 238] = 3.073, p = .006$). Though preliminary, these pilot results were encouraging in suggesting different types of daydreaming do relate differently to creativity—personally meaningful and fantastical daydreaming, as well as daydreaming revolving around future plans, may be promising candidates for daydreaming styles likely to be associated with creativity.

Main Study

The data collection for this study was done in two parts. The first was a laboratory session, in which we assessed trait day-

dreaming and several measures of creativity. Participants completed two performance measures of creativity: the alternate uses task as a measure of divergent thinking and compound remote associates problems as a measure of problem solving or convergent thinking. Performance on both tasks has previously been found to be associated with frequent daydreaming (Baird et al., 2012; Leszczynski et al., 2017; Zedelius & Schooler, 2015). We did not have any hypotheses as to which daydreaming scales might be related to these performance measures. We further administered the same self-report scale of creative behaviors used in our pilot studies. Based on the pilot studies, we predicted meaningful daydreaming, and potentially also fantastical daydreaming and planning, would emerge as predictors of this measure. We further gave participants the chance to express their artistic creativity in the lab by giving them a creative writing assignment: Participants were given 20 min to write a short story based on a writing prompt. We expected creative writing might particularly benefit from fantastical daydreaming, since coming up with a fictional story and vividly bringing it to life would likely rely on similar mental simulation processes as fantastical daydreaming.

After the laboratory session, participants were invited to participate in a 5-day experience sampling period, in which we

Table 3
Covariances Between Factors of Daydreaming. Below Diagonal Is Sample 1, Above Diagonal Is Sample 2

Factor covariance	1	2	3	4	5	6
1. Planning	.134 (.028)	.096 (.023)	.106 (.036)	.044 (.03)	.016 (.013)	
2. Pleasant	.034 (.013)		.205 (.039)	.279 (.059)	.193 (.052)	.006 (.021)
3. Meaningful	.033 (.013)	.079 (.027)		.113 (.04)	.119 (.038)	.026 (.015)
4. Sex	.029 (.023)	.144 (.042)	.07 (.03)		.572 (.091)	.122 (.039)
5. Fantastic	.018 (.019)	.077 (.032)	.065 (.027)	.491 (.09)		.175 (.042)
6. Unaware	.026 (.014)	.01 (.02)	.011 (.013)	.12 (.055)	.215 (.052)	

Note. Bold numbers are statistically significant. Standard errors are in parentheses.

assessed types of daydreaming by probing participants at pseudorandom moments throughout the day via their smartphone. Upon being probed, participants were first asked what they had been doing prior to being probed and whether they had been daydreaming, and then to rate their most recent daydream on a number of items. At the end of each day, participants were asked about their creative behavior that day. Previous experience sampling research in which students were probed repeatedly and asked about their creative behavior throughout the day has shown that students reported doing something creative 22% of the time they were probed (Silvia et al., 2014). Thus, we were confident that participants would be able to report on their day-to-day creative behavior. At the end of each day, we also asked participants how inspired they felt that day. Inspiration is a motivational state that can energize the actualization of creative ideas, and has been linked to various kinds of creative performance and artistic expression (Thrash, Maruskin, Cassidy, Fryer, & Ryan, 2010).

Based on the preliminary results from our pilot studies, we expected that meaningful daydreaming, fantastical daydreaming and planning would be the most likely candidates to predict creative behavior and inspiration. However, it was an open question whether this would manifest at the trait or state level. As we explain in detail below, by analyzing the experience sampling data using a multilevel approach, in which we compare a participant's daydreaming scores to those of other participants as well as to their own scores on other days, we can distinguish between trait- and state-level predictions of different daydreaming types. In other words, we can distinguish, for instance, to what extent both *engaging* in fantastical daydreams and *being* a "fantastical daydreamer" is associated with day-to-day creative behavior and inspiration.

Method

The study was approved by the university's internal review board and conducted in accordance with the Declaration of Helsinki. We report how we determined our sample size, all data exclusions (if any), all manipulations, and all measures in the study (see Simmons, Nelson, & Simonsohn, 2012). Some of the data described in the methods and results have been previously reported in another publication (Zedelius, Mills, & Schooler, 2019, Study 1). That publication describes the validation of the rubric we used to evaluate the creativity of the short stories participants wrote as well as how these evaluations correlate with the other creativity measures in this study.

Participants

For the laboratory component, 133 psychology undergraduate students were recruited from the UCSB campus (88 female, mean age = 19.3, $SD = 1.4$). The UCSB undergraduate student population ranks above average in racial and ethnic diversity (36% white, 28% Chicano/Latino, 28% Asian/Pacific Islander, 5% Black or African American, 1% American Indian or Alaska Native), with 42% of students being on their way to becoming first generation college graduates (University of California, Santa Barbara, n.d.). Participants were compensated with course credit. Of the 133, 89 further took part in the experience

sampling component (61 female, one did not indicate, M age = 19.4, $SD = 1.4$). For experience sampling data analyses, we dropped participants with fewer than 8 thought-probe responses, leaving 65 participants in the final analyses (43 female, M age = 19.41, $SD = 1.4$). Our desired sample size was 130 (similar to or exceeding those of Franklin et al., 2013; Kane et al., 2007; Marcusson-Clavertz, Cardeña, & Terhune, 2016; McVay et al., 2009), but was limited by participants' interest in volunteering in the relatively time intensive experience sampling procedure.

Measures and Procedures

Upon entering the lab, participants were brought into individual rooms where they completed behavioral creativity measures (the alternate uses task and the compound remote associates task; Mednick, 1962) and the CBI short form in fully counterbalanced order (i.e., six orders: ABC, ACB, BAC, BCA, CAB, CBA). This was followed by our trait-daydreaming scale and the Mindful Attention and Awareness Scale. Next, we collected demographic data, then participants performed a creative writing assignment. All measures were completed on the computer.

Trait-daydreaming scale. Participants were provided with the following definition of daydreaming: "Daydreaming is when you stop attending to your current task or environment and start thinking about other things (e.g., things that are absent, in the past or future, or imaginary). Daydreaming is not by definition positive. It can contain positive thoughts as well as negative thoughts or worries. Daydreaming also is not by definition deliberate. You can daydream without meaning to, and sometimes without being aware of it. Daydreaming is very common and normal, not to be confused with anything you would seek treatment for. You will now read a number of statements that describe possible contents and qualities of daydreams. Please indicate for each statement to what extent it applies to your typical daydreams." Participants then responded to the 18 daydreaming items using a 6-point Likert scale, ranging from 1 (*definitely untrue*) to 6 (*definitely true*).

Mindful Attention and Awareness Scale. The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003), a 15-item scale that measures self-reported absent-minded behavior, was included as a measure of daydreaming frequency. The scale was reverse-coded so higher scores reflect greater absent-mindedness. Cronbach's alpha was .90. Although the focus of the current study was on daydreaming styles and contents, we report correlations between the MAAS and our dependent variables.

CBI short form. This 24-item scale was designed to measure common creative behaviors and accomplishments in a lay population. The items describe activities in the visual, literary, and performing arts, and crafts (e.g., "Designed and made your own greeting cards"; "Wrote a play [excluding school or university course work]"; "Had a piece of literature (e.g. poem, short stories, etc.) published in a school or university publication"). Participants responded how often they have done each activity in their adolescent and adult life using a 4-point Likert-type scale, ranging from 1 (*never did this*) to 4 (*more than five times*). Cronbach's alpha was .90.

Alternate uses task (Guilford, 1967; Torrance, 2008). Participants were asked to come up with “as many unusual and creative uses as you can think of” for a tin can and a cardboard box (order counterbalanced), the only restriction being that the uses should be realistically doable (i.e., the object can really be used in the described way) and that they had to be genuine uses (e.g., “throw it into the ocean”, would not be a genuine use, since you can throw anything into the ocean and this action alone isn’t of any use.) Participants were given 90 s per object to generate ideas. After listing uses, participants were also asked to select their most creative idea for each object. Responses were scored subjectively by two independent raters for fluency (the number of valid ideas, i.e., ideas that constituted genuine uses relevant to the object, according to raters) and originality (i.e., whether the raters deemed an idea creative, surprising, or novel, scored as either 0 [*not original*] or 1 [*original*]). Raters were told not to be too strict (e.g., a tin can cut into rings might not make for a very good bracelet, but it can be done). Following the recommendation by Hallgren (2012), the raters first evaluated 30% of the data. After establishing adequate interrater reliability (intraclass correlation [ICC; fluency] = .795, ICC [originality] = .731), one rater continued to evaluate responses for the tin can, the other responses for the cardboard box. Finally, valid ideas and originality scores were summed up to generate total scores for fluency and originality for the entire task. (We did not divide originality by fluency because we did not want to penalize participants for listing a number of uncreative ideas along with creative ideas; see Silvia et al., 2008. Note: Fluency and originality scores were intercorrelated. Fluency correlated with overall originality, $r = .627$, $p < .001$, but not originality of the two responses selected as best ideas, $r = -.084$, $p = .39$.)

Compound remote associates task. On each trial, participants were shown three words (e.g., “board, magic, death”), and were asked to find a fourth word that can be combined with each word in the set to form a compound word or phrase (e.g., “black”, as in, “black board”, “black magic”, “black death”). Participants received 32 problems total. For each problem, they were given 30 s to indicate via button press when they had found the solution. After pressing the button, they had 10 s to type in their answer.

Creative writing assignment. Participants were asked to write a short fictional story based on a writing prompt. The prompt read, “Create a character who has suddenly and unexpectedly attained some sort of power. In the wider perception of the world the level of authority may be small or great, but for this person, the change is dramatic. Write about the moment in which your character truly understands the full extent of his or her newfound power for the first time.” Participants were given 20 min to write and edit their story as they saw fit. The stories were independently evaluated by six raters (including the first author and trained students from the Psychology and English departments) using a rubric that assessed three dimensions: Image, Voice, and Story Originality.

Image describes the degree to which the writing evokes rich, concrete mental images. Writing high in Image contains several vivid and concrete visual images, sounds, smells, physical sensations, emotions, and/or direct thought and speech. (e.g., “I could smell the cigarettes on his breath, which choked the little life out

of my pitiful existence. Time had seemed to stop for me then, and I could feel the pain of the many times before this, where the smell of cigarettes invaded my senses, and I choked as a knife was held against my skin.”) Writing low in Image contains no or very few concrete details and mental images. (e.g., “I could tell he had smoked.”)

Voice describes the degree to which the writer has created their own unique, recognizable voice or style, for instance by using stylistic tools or a unique narrative perspective. Writing high in Voice contains several stylistic tools such as rare words, interesting sentence structures, metaphors or similes, or a unique narrative perspective or attitude such as humor, irony, wittiness, or darkness. (e.g., “It was a pitiful existence, and it led to this day, where blood was meant to leak upon the pavement, and my life was to end. [. . .] I reached out to him, and reaped his soul straight from his body, tearing through his chest with my grim hands, all in a dark mist, which resonated from the ground. The next words came through from a memory long ago: ‘I am death, the destroyer of worlds,’ and with that a scythe materialized in a purple mist, and my eyes grew dark. I realized what I had been given, a power to correct the evils of man, to fight like my uncle did long ago. In my death, the reaper was born.”) Writing low in Voice contains no or very few stylistic tools and does not have an identifiable or unique narrative style.

Story Originality describes the degree to which the story idea or plot is novel and original. An original story does not resemble other stories in the sample or widely known stories from books or movies. Highly original stories were often surprising to the raters and described characters who experienced unexpected events or discovered interesting, unusual realistic or fantastical powers (e.g., political power or the power to communicate with animals). An unoriginal story strongly resembles other known stories or stories from other participants. (e.g., many students wrote about a college student who, during an interaction with a love interest on campus, discovers they suddenly, without reason or explanation, have gained the power to hear other people’s thoughts.)

Stories were rated by each rater as *poor* (coded as 1), *fair* (coded as 2), or *good* (coded as 3) on each dimension. A poor rating was given when the story contained none or very few of the above-listed characteristics (i.e., no or very few concrete details, no or very few stylistic tools, no original idea or a only a minor deviation from a known story), a fair rating was given when the story contained some of the characteristics, and a good rating was given when the story contained many of the characteristics. Raters showed excellent reliability (the ICCs were .93 for Image, .92 for Voice, and .90 for Originality). Scores from all six raters were then averaged to derive three final scores for Image, Voice, and Story Originality per participant that could range between 1 and 3. The rubric and its correlates with the other creativity measures reported here have been previously reported in another publication, in which we used computational linguistic analyses to validate the rubric (see Zedelius et al., 2019, Study 1).

Experience Sampling

After the lab session, participants were invited to also participate in a follow-up experience sampling procedure. This part of the data collection was done via a smartphone application (MetricWire). Participants were shown how to use the application. The experi-

ence sampling procedure started the next day. When receiving a notification or “thought probe” on their phone, participants would hear their usual ring-tone for notifications and see a prompt on their phone screen. They had the option to respond or actively reject the probe. If an initial probe was ignored, another probe was sent after 10 min to prompt another alarm tone. If this probe was ignored, it would disappear from the screen after 10 min.

Participants were probed in this way eight times throughout each day (not counting follow-ups and additional once-a-day prompts—see below) between 9 a.m. and 9 p.m. Each time participants were first asked, “What were you doing before you received this notification?” and then, “Were you daydreaming in the moment before you received this notification?” They were reminded of the definition of daydreaming (“Daydreaming is when you stop attending to your current task or environment and start thinking about other things”) and could respond with *yes* or *no*. They were then instructed as follows: “Think about your most recent daydream. Continue to see a number of statements and indicate how well each statement describes your most recent daydream.”

We instructed participants to rate their “most recent” daydream, regardless of whether they had been daydreaming or not immediately prior to being probed. This was to avoid the temptation for participants to answer “no” to shorten their answer time. We only analyzed data from the times participants answered that they were daydreaming prior to being probed. Using a 5-point Likert scale, ranging from 0 (*definitely untrue*) to 4 (*definitely true*), participants rated their daydream using our 18-item (state) daydreaming scale.

At the end of each day (9:45 p.m.), participants received another prompt with two questions: (a) “How creative were you today? (Being creative includes coming up with novel or original ideas; expressing oneself in an original way, or spending time doing artistic activities (art, music, painting, writing, etc.))” Participants answered on a 4-point Likert scale from 1 (*not at all creative*) to 4 (*very creative*). (b) “How inspired did you feel today?” Participants answered on a 4-point Likert scale from 1 (*not at all*) to 4 (*very much*). Participants could delay responding until the morning.

Results

Laboratory Data (Trait Daydreaming)

Analytic approach and descriptive statistics. For each creativity measure administered in the laboratory that correlated significantly with at least one daydreaming type, we ran a regression analysis with the six daydreaming styles as predictors. (Factor

loadings of the trait daydreaming scale in the current sample are shown in Table 2. Covariances are shown in Table 4. Descriptive statistics, intercorrelations, and reliabilities of the trait daydreaming scale factors are shown in Table 5. Descriptive statistics of the creativity measures and correlations with trait daydreaming types as well as trait daydreaming frequency (as assessed with the MAAS) are shown in Table 6, and intercorrelations between creativity measures in Table 7.)

CBI Short Form. For creative behavior, the overall regression model was significant, $F(6, 126) = 2.752, p = .015, R^2 = .116$. The complete regression results are shown in Table 8. Personally meaningful daydreaming emerged as a significant predictor. Moreover, there was a trend for fantastical daydreaming to predict creative behavior, but this was not statistically significant.

Creative writing. For the creative writing task, we ran separate regression analyses on the evaluation categories Image and Voice as dependent measures (see Table 9). For Image, fantastical daydreaming emerged as the only significant predictor, although the overall model was only marginally significant, $F(6, 126) = 2.104, p = .057, R^2 = .091$. For Voice as the dependent variable, fantastical daydreaming emerged as the only significant predictor, although again the omnibus model including all the nonsignificant predictors was marginally significant, $F(6, 126) = 1.927, p = .081, R^2 = .084$.

Experience Sampling Results

Analytic approach and descriptive statistics. Because the experience sampling data have a hierarchical structure, with multiple observations nested within participants, we used a hierarchical linear modeling approach to analyze the data. This also allowed us to disaggregate two types of statistical effects: (a) effects of differences *between* individuals, for instance, a participant showing a greater tendency toward meaningful daydreaming *compared to other participants* over the course of the experience sampling period (i.e., the effect of *being* a “meaningful daydreamer”); and (b) effects of daily fluctuations within an individual, for instance a participant engaging in more meaningful daydreaming on *one day compared to other days* (i.e., the effect of *engaging in* meaningful daydreams).

To separate these effects, we conducted two multilevel mixed-effects linear regression analyses, one with daily reports of creative behavior and one with daily reports of inspiration as dependent variables. The two dependent variables were correlated; the within-participant correlation was $r = .48, p < .001$, which can be considered a large correlation, but in our opinion

Table 4
Covariances Between Factors of Daydreaming in the Main Study

Factor covariance	1	2	3	4	5
1. Pleasant	.205 (.115)				
2. Meaningful	.417 (.132)	.147 (.102)			
3. Sex	.118 (.101)	.150 (.093)	.315 (.093)		
4. Fantastic	.183 (.103)	.264 (.095)	.20 (.104)	.314 (.089)	
5. Unaware	.297 (.101)	-.080 (.107)	.383 (.099)	.212 (.095)	.254 (.097)

Note. Bold numbers are statistically significant. Standard errors are in parentheses.

Table 5
Descriptive Statistics, Intercorrelations and Reliability for Trait Daydreaming Types (Laboratory Data)

Variable	Cronbach's Alpha	M (SD)	1	2	3	4	5	6
1. Planning	.731	4.52 (0.94)	—	—	—	—	—	—
2. Pleasant	.552	4.13 (0.74)	$r = .016$ $p = .858$	—	—	—	—	—
3. Meaningful	.708	3.84 (1.12)	$r = .277$ $p = .001$	$r = -.115$ $p = .189$	—	—	—	—
4. Unaware	.820	3.65 (1.18)	$r = .217$ $p = .012$	$r = -.170$ $p = .050$	$r = .278$ $p = .001$	—	—	—
5. Sex	.917	3.53 (1.41)	$r = .086$ $p = .327$	$r = .010$ $p = .910$	$r = .240$ $p = .005$	$r = .188$ $p = .030$	—	—
6. Fantastical	.787	2.94 (1.25)	$r = .160$ $p = .066$	$r = .071$ $p = .418$	$r = .160$ $p = .066$	$r = .219$ $p = .011$	$r = .267$ $p = .002$	—
7. MAAS (frequency)	.897	3.246 (0.918)	$r = .182$ $p = .036$	$r = -.099$ $p = .259$	$r = .265$ $p = .002$	$r = .524$ $p < .001$	$r = .268$ $p = .002$	$r = .206$ $p = .018$

Note. MAAS = Mindful Attention and Awareness Scale.

not large enough to consider these measures redundant (see Gignac & Szodorai, 2016). As there are multiple daydreaming reports within each day, but only one end-of-day response per participant, this means varying daydreaming reports throughout one day predicted identical end-of-day responses for said day. Each model was estimated with restricted maximum likelihood estimation and included the following predictors: the person means (calculated over the entire experience sampling period) and person-mean centered individual observations of participants' scores for the six daydreaming types (see Curran & Bauer, 2011; Hoffman & Stawski, 2009). To person-mean center individual observations, we likewise used the person mean for the entire experience sampling period. We further included a time variable as a covariate to account for temporal effects. Our time variable was a thought-probe counter, which counted up throughout the study; the counter counted the probes presented to the participant, regardless of whether the participant responded to or ignored any of the probes. We included autoregressive errors. The analysis code is available on the Open

Science Framework (Zedelius, Protzko, Broadway, & Schooler, 2020; see <https://osf.io/njt4b/>).

The equations for both analyses are shown below. Not that the ending_pmc denotes a person mean centered variable and the ending_pm denotes the person mean.

$$\begin{aligned}
 \text{Creative_behavior}_{ij} = & \beta_{0j} + \beta_{1j}\text{Meaning_pmc}_{ij} \\
 & + \beta_{2j}\text{Planning_pmc}_{ij} + \beta_{3j}\text{Unaware_pmc}_{ij} \\
 & + \beta_{4j}\text{Pleasant_pmc}_{ij} + \beta_{5j}\text{Sex_pmc}_{ij} \\
 & + \beta_{6j}\text{Fantastic_pmc}_{ij} + \beta_{7j}\text{Meaning_pm}_{ij} \\
 & + \beta_{8j}\text{Planning_pm}_{ij} + \beta_{9j}\text{Unaware_pm}_{ij} \\
 & + \beta_{10j}\text{Pleasant_pm}_{ij} + \beta_{11j}\text{Sex_pm}_{ij} \\
 & + \beta_{12j}\text{Fantastic_pm}_{ij} + \beta_{13j}\text{probe_counter}_{ij} \\
 & + e_{ij} \tag{1}
 \end{aligned}$$

$$\beta_{0j} = \gamma_{00} + u_{0j}$$

Table 6
Descriptive Statistics of Creativity Measures and Correlations With Trait Daydreaming Types (Laboratory Data)

Variable	M (SD)	Planning	Pleasant	Meaningful	Unaware	Sex	Fantastical	MAAS
Story image	1.563 (0.595)	$r = .006$ $p = .943$	$r = -.089$ $p = .309$	$r = .105$ $p = .229$	$r = -.071$ $p = .419$	$r = .114$ $p = .190$	$r = .215$ $p = .013$	$r = -.021$ $p = .807$
Story voice	1.801 (0.640)	$r = -.052$ $p = .550$	$r = .039$ $p = .659$	$r = .123$ $p = .160$	$r = -.036$ $p = .684$	$r = .068$ $p = .437$	$r = .229$ $p = .008$	$r = .059$ $p = .499$
Story originality	1.928 (0.636)	$r = -.123$ $p = .157$	$r = -.065$ $p = .460$	$r = -.091$ $p = .299$	$r = .004$ $p = .964$	$r = .013$ $p = .882$	$r = .046$ $p = .595$	$r = .046$ $p = .599$
CBI	2.030 (0.701)	$r = .124$ $p = .156$	$r = -.050$ $p = .565$	$r = .297$ $p = .001$	$r = .114$ $p = .192$	$r = .100$ $p = .253$	$r = .207$ $p = .017$	$r = .199$ $p = .022$
AUT fluency	3.571 (1.619)	$r = .158$ $p = .069$	$r = -.116$ $p = .185$	$r = .131$ $p = .132$	$r = -.039$ $p = .657$	$r = -.148$ $p = .088$	$r = -.024$ $p = .788$	$r = -.078$ $p = .374$
AUT originality	1.782 (1.031)	$r = .078$ $p = .370$	$r = -.104$ $p = .233$	$r = .054$ $p = .539$	$r = -.015$ $p = .864$	$r = -.145$ $p = .096$	$r = .046$ $p = .601$	$r = .017$ $p = .847$
Remote associates	0.539 (0.199)	$r = -.094$ $p = .281$	$r = -.021$ $p = .809$	$r = .112$ $p = .198$	$r = -.107$ $p = .219$	$r = -.018$ $p = .841$	$r = .015$ $p = .862$	$r = -.129$ $p = .140$

Note. MAAS = Mindful Attention and Awareness Scale; CBI = Creative Behavior Inventory; AUT = Alternative Use Task.

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Table 7
Intercorrelations Between Creativity Measures

	Story voice	Story originality	CBI	AUT fluency	AUT originality	CRAT accuracy
Story image	$r = .638$ $p < .001$	$r = .303$ $p < .001$	$r = .222$ $p = .010$	$r = .135$ $p = .120$	$r = .245$ $p = .004$	$r = .179$ $p = .039$
Story voice		$r = .413$ $p < .001$	$r = .226$ $p = .009$	$r = .171$ $p = .049$	$r = .226$ $p = .009$	$r = .223$ $p = .010$
Story originality			$r = .006$ $p = .948$	$r = .110$ $p = .208$	$r = .179$ $p = .039$	$r = .103$ $p = .248$
CBI				$r = .141$ $p = .105$	$r = -.006$ $p = .945$	$r = .197$ $p = .023$
AUT fluency					$r = .627$ $p < .001$	$r = .206$ $p = .017$
AUT originality						$r = .105$ $p = .229$

Note. MAAS = Mindful Attention and Awareness Scale; CRAT = Compound Remote Associates task; CBI = Creative Behavior Inventory; AUT = alternative use task. From “Beyond Subjective Judgments: Predicting Evaluations of Creative Writing From Computational Linguistic Features,” by C. M. Zedelius, C. Mills, and J. W. Schooler, 2019, *Behavior Research Methods*, 51, p. 879. Copyright 2019 by Springer Nature.

$$\begin{aligned}
 \text{Inspiration}_{ij} = & \beta_{0j} + \beta_{1j}\text{Meaning_pmc}_{ij} + \beta_{2j}\text{Planning_pmc}_{ij} \\
 & + \beta_{3j}\text{Unaware_pmc}_{ij} + \beta_{4j}\text{Pleasant_pmc}_{ij} \\
 & + \beta_{5j}\text{Sex_pmc}_{ij} + \beta_{6j}\text{Fantastic_pmc}_{ij} \\
 & + \beta_{7j}\text{Meaning_pm}_{ij} + \beta_{8j}\text{Planning_pm}_{ij} \\
 & + \beta_{9j}\text{Unaware_pm}_{ij} + \beta_{10j}\text{Pleasant_pm}_{ij} \\
 & + \beta_{11j}\text{Sex_pm}_{ij} + \beta_{12j}\text{Fantastic_pm}_{ij} \\
 & + \beta_{13j}\text{probe_counter}_{ij} + e_{ij} \quad (2) \\
 \beta_{0j} = & \gamma_{00} + u_{0j}
 \end{aligned}$$

Over the experience sampling period, participants reported they were daydreaming 63.44% of the time. All analyses are restricted to when participants reported they were daydreaming. Table 10 shows descriptive statistics and intercorrelations for the six types of daydreaming. Moreover, Table 11 shows intercorrelations between participants’ reports of their daydreaming styles during the experience sampling period (averaged over all 5 days) and their reports of the corresponding trait daydreaming styles in the lab. The significant correlations indicate some correspondence between participants’ self-reports in the moment they are being probed and their more removed judgments of their “typical” daydreaming tendencies when asked in the lab.

Creative behavior. Self-reports of day-to-day creative behaviors were predicted only by within-subjects fluctuations in the daydreaming type *future planning*, $b = .103$ $p = .011$, 95% CI [.024, .183]. No other daydreaming type significantly predicted

creative behavior at the within-subjects level. This suggests that the act of daydreaming about future planning predicts self-reported creative behavior. At the between-subjects level, creative behavior was predicted only by individual differences in fantastical daydreaming, $b = .596$ $p = .02$, 95% CI [.092, 1.099]. No other daydreaming style predicted creative behavior at the between-subjects level. This suggests that fantastical daydreamers self-report more creativity than others. All coefficients are shown in Table 12.

Inspiration. Reports of feeling inspired were not significantly predicted by within-subjects fluctuations in any of the daydreaming types. Inspiration was predicted only by between-subjects level differences in personally meaningful daydreaming, $b = .875$ $p = .008$, 95% CI [.204, 1.521]. All coefficients can be seen in Table 13.

Discussion

Daydreaming has often been linked to creativity, but clearly not all daydreams are creative or lead to creative ideas. In the present study, two types of daydreaming emerged as the most strongly related to individual differences in creativity. Those were personally meaningful and fantastical daydreaming. Individuals more often engaging in meaningful daydreaming (relative to others) reported having accumulated more artistic creative behaviors and achievements over their life and reported greater levels of daily inspiration over the course of the experience sampling period. More often engaging in fantastical daydreaming, on the other

Table 8
Regression Results for Daydreaming Styles on Creative Behavior Inventory Scores

Variable	B	SE	β	t	p	95% CI
Planning	0.020	.067	0.027	0.301	0.764	[-0.112, 0.152]
Pleasant	-0.032	0.082	-0.033	-0.386	0.700	[-0.193, 0.130]
Meaningful	0.165	0.058	0.263	2.860	0.005	[0.051, 0.280]
Unaware	-0.003	0.054	-0.006	-0.062	0.950	[-0.111, 0.104]
Sex	-0.004	0.044	-0.008	-0.094	0.925	[-0.092, 0.083]
Fantastical	0.094	0.050	0.116	1.857	0.066	[-0.006, 0.193]
Constant	1.186	0.494		2.400	0.018	[0.208, 2.164]

Table 9
Regression on Creative Writing (Image and Voice)

Variable	B	SE	Beta	<i>t</i>	<i>p</i>	95% CI
Image						
Planning	-0.014	0.057	-0.022	-0.246	0.806	[-0.127, 0.099]
Pleasant	-0.101	0.070	-0.125	-1.435	0.154	[-0.240, 0.038]
Meaningful	0.050	0.050	0.093	0.996	0.321	[-0.049, 0.148]
Unaware	-0.089	0.047	-0.177	-1.909	0.059	[-0.181, 0.003]
Sex	0.028	0.038	0.066	0.730	0.467	[-0.048, 0.103]
Fantastical	0.112	0.043	0.234	2.578	0.011	[0.026, 0.197]
Constant	1.751	0.425	0	4.117	0.000	[0.909, 2.593]
Voice						
Planning	-0.075	0.062	-0.110	-1.215	0.227	[-0.197, 0.047]
Pleasant	0.019	0.076	0.022	0.257	0.798	[-0.131, 0.169]
Meaningful	0.084	0.054	0.146	1.559	0.122	[-0.023, 0.190]
Unaware	-0.055	0.050	-0.101	-1.092	0.277	[-0.155, 0.045]
Sex	-0.002	0.041	-0.004	-0.047	0.962	[-0.083, 0.079]
Fantastical	0.126	0.047	0.245	2.694	0.008	[0.033, 0.219]
Constant	1.575	0.459		3.431	0.001	[0.667, 2.484]

hand, was predictive of higher-quality creative writing in the lab and reports of daily creative behavior over the experience sampling period. Looking at intraindividual fluctuations in daydreaming over the course of several days, we found that only fluctuations in the daydreaming type we labeled planning appeared to predict creative behavior. That is, on days when participants reported more daydreams revolving around plans than usual, they also reported more creative behavior. Interestingly, being more of a “planner,” compared to others, was unrelated to creative behavior.

These findings provide first insights into the types or contents of daydreaming that may be more creatively productive. They also illustrate the value of differentiating between operational definitions of daydreaming as trait-like tendencies and states that fluctuate within a person. The fact that day-to-day creative behavior and inspiration were predicted by individual differences in fantastical and meaningful daydreaming, respectively, but not by intraindividual fluctuations, suggests these relationships are driven by characteristics of the daydreamer, not the process of engaging in fantastical or meaningful daydreams. That is, the kind of person who is inclined to daydream in a way that is highly meaningful or fantastical is likely to report high levels of creative behavior and inspiration, but engaging in unusually high levels of meaningful or

fantastical daydreaming on a given day does not boost creativity. This suggests the association between these daydreaming types and creativity is not causal, but because of other latent variables, for instance, differences in personality. Alternatively, these forms of daydreaming may contribute to more temporally extended creative achievement. They may lead to creative solutions, but their value may take a while to be integrated and thus is not reflected in daily fluctuations in creativity.

For planning, on the other hand, we found the opposite pattern. A general tendency toward daydreams revolving around plans is not associated with creativity, but higher than usual reports of planning were associated with a boost in creative behavior. This could suggest this type of daydreaming can perhaps help motivate creative behavior or turn ideas into actual creative pursuits. This fits with Klinger’s current concerns hypothesis, according to which daydreaming serves to pursue personal goals and concerns (Klinger, 1999). It might also be that the daydreaming is a consequence of current goals and concerns, rather than an instrumental part in the goal pursuit. That is, on days on which people are more focused on achieving goals, this goal striving may also cause them to daydream more about their goals and plans.

Table 10
Descriptive Statistics and Intra-Individual Correlations Between State Daydreaming Types (Experience Sampling Data)

Variable	<i>M</i> (<i>SD</i>)	1	2	3	4	5
1. Planning	1.95 (1.13)	—	—	—	—	—
2. Pleasant	2.47 (1.05)	<i>r</i> = -.065 <i>p</i> = .109	—	—	—	—
3. Meaningful	2.16 (1.02)	<i>r</i> = .246 <i>p</i> < .001	<i>r</i> = .143 <i>p</i> < .001	—	—	—
4. Unaware	1.98 (1.23)	<i>r</i> = .191 <i>p</i> < .001	<i>r</i> = .080 <i>p</i> = .046	<i>r</i> = .091 <i>p</i> = .024	—	—
5. Sex	1.04 (1.29)	<i>r</i> = .025 <i>p</i> = .541	<i>r</i> = .318 <i>p</i> < .001	<i>r</i> = .170 <i>p</i> < .001	<i>r</i> = .086 <i>p</i> = .032	—
6. Fantastical	0.82 (0.98)	<i>r</i> = -.074 <i>p</i> = .066	<i>r</i> = .076 <i>p</i> = .060	<i>r</i> = -.120 <i>p</i> = .003	<i>r</i> = .084 <i>p</i> = .037	<i>r</i> = .102 <i>p</i> = .011

Note. Data represent only episodes when participants reported they were daydreaming at the moment prior to being probed.

Table 11
Correlations Between Trait Daydreaming Styles in the Laboratory and State Daydreaming (Person Means) During the Experience Sampling Period

Daydreaming style	Trait-state correlation
Planning	$r = .108, p = .394$
Pleasant	$r = .535, p < .001$
Meaningful	$r = .488, p < .001$
Unaware	$r = .394, p = .001$
Sex	$r = .488, p < .001$
Fantastical	$r = .393, p = .001$

Note. State daydreaming data represent only episodes when participants reported they were daydreaming at the moment prior to being probed.

To more definitively determine the possible role of meaningful, fantastical and planning forms of daydreaming, future studies should examine the outcome of experimental manipulations that systematically encourage these types of daydreaming. Research might also investigate how exactly meaningful or fantastical daydreamers differ from people who do not identify with those daydreaming types. The personality trait openness to experience is a candidate that might mediate the relationship between fantastic daydreaming tendencies and creative pursuits. Research has shown openness to experiences, including a subscale describing enjoyment of daydreams, unguided thoughts, and fantasies, correlates with creative performance (Smeekens & Kane, 2016; Study 2). Future research could investigate whether certain daydreaming tendencies or enjoyment of daydreaming are an active ingredient in openness that mediates its association with creativity.

Future research might also be usefully directed to further exploring differences between types of daydreaming and aspects of creativity. Notably, none of the daydreaming types we measured here predicted performance on the idea generation and convergent thinking tasks. One explanation could have to do with the mea-

Table 12
Within- and Between Subject Predictors of end-of-Day Creative Behavior

Predictor	<i>b</i>	<i>p</i>	95% CI
Level 1 predictors			
Time (probe)	.011	.263	[−.008, .031]
WS-meaning	−.001	.975	[−.082, .080]
WS-unaware	.026	.514	[−.053, .106]
WS-planning	.103	.011	[.024, .183]
WS-pleasant	.003	.943	[−.074, .080]
WS-sex	−.040	.394	[−.133, .052]
WS-fantastical	.028	.593	[−.074, .129]
Level 2 predictors			
BS-meaning	.365	.292	[−.314, 1.043]
BS-unaware	.234	.165	[−.304, 1.027]
BS-planning	.056	.836	[−.476, .589]
BS-pleasant	.362	.287	[−.304, 1.027]
BS-sex	−.078	.672	[−.442, .285]
BS-fantastical	.596	.020	[.092, 1.099]
Constant	−1.262	.225	[−3.300, .776]

Note. Data represent only episodes when participants reported they were daydreaming at the moment prior to being probed. BS = between subjects; WS = within subjects.

Table 13
Within- and Between Subject Predictors of End-of-Day Inspiration

Predictor	<i>b</i>	<i>p</i>	95% CI
Level 1 predictors			
Time (probe)	.015	.126	[−.004, .034]
WS-meaning	.045	.192	[−.023, .113]
WS-unaware	.034	.310	[−.032, .100]
WS-planning	.039	.243	[−.027, .106]
WS-pleasant	.025	.443	[−.039, .089]
WS-sex	−.025	.536	[−.103, .053]
WS-fantastical	.034	.439	[−.051, .119]
Level 2 predictors			
BS-meaning	.875	.008	[.203, 1.521]
BS-unaware	.236	.141	[−.078, .550]
BS-planning	−.097	.708	[−.604, .411]
BS-pleasant	.366	.257	[−.267, 1.00]
BS-sex	−.254	.152	[−.601, .093]
BS-fantastical	.004	.986	[−.475, .483]
Constant	−1.020	.304	[−2.963, .923]

Note. Data represent only episodes when participants reported they were daydreaming at the moment prior to being probed. BS = between subjects; WS = within subjects.

surement conditions. For divergent thinking, ideas get more creative over time (e.g., Beaty & Silvia, 2012; Christensen, Guilford, & Wilson, 1957), and the relationship between daydreaming styles and divergent thinking may only be detectible once individuals have moved beyond generating ordinary ideas (which can simply be retrieved from memory) and have started to generate truly creative ideas. Longer trials might have allowed us to detect such a nonlinear effect. A greater emphasis on the quality of ideas over quantity might also have helped shift participants' toward truly creative thinking, which could have revealed a connection between daydreaming and creative ideation, if this connection exists.

Alternatively, it is possible we only identified types of daydreaming predictive of artistic expressions of creative behavior, not necessarily other aspects of creativity. Or daydreaming may be more predictive of participants' creative self-concept and motivation than their actual creative performance. It is worth pointing out, though, that our measures of creative writing (at least the dimensions Image and Voice) correlated with originality on the alternate uses task and the compound remote associates task (the third dimension, Originality, did not consistently correlate with other creativity measures and is perhaps a less valid measure of creative writing). Thus, at least Image and Voice can be considered performance measures of creativity.

It is also possible that daydreaming content and frequency are simply not robust predictors of how well the person performs on idea generation or convergent thinking tasks. Although some previous studies have found a correlation between trait daydreaming frequency and performance on divergent and convergent thinking tasks (Baird et al., 2012; Zedelius et al., 2015), other studies have found that daydreaming frequency measured with thought probes was uncorrelated with subsequent performance on the alternate uses task (Smeekens & Kane, 2016). The current study also fails to observe any correlation between general daydreaming frequency (assessed with the MAAS) and creative task performance. Yet other studies suggest that daydreaming benefits these tasks through

a dynamic process that takes place only after one has reached an impasse on a problem and has to look at information in a new way (Baird et al., 2012), whereas daydreaming during idea generation is counterproductive (Hao et al., 2015). Moreover, the benefits of daydreaming might also be conditional upon problem-related memory representations being kept active (Leszczynski et al., 2017).

Future research might seek to explore how different types of daydreaming immediately prior to, during, or in-between phases of idea generation affect the idea generation process. For example, although general tendencies for fantastical and meaningful daydreaming may not be associated with superior idea generation or problem solving, engaging in fantastical daydreaming in a moment when one is stuck might have a unique benefit. There might also be types of daydreaming not identified here that have unique benefits for idea generation and problem solving. Several lines of research suggest that curious mind wandering about topics on which one has reached an impasse may foster creative idea generation (e.g., Gable et al., 2018; Zedelius & Schooler, 2020). It seems plausible that, whereas meaningful and fantastical mind wandering is associated with artistic creativity, curious mind wandering (i.e., *mind wandering*; Schooler, 2019) might enhance other forms of creativity.

It is interesting to note that the two types of daydreaming that emerged as the most prominent predictors of creativity seem to be distinctive—both in content and frequency. Our data show it is not unusual for daydreams to be highly personally meaningful. Participants frequently reported those types of daydreams, a finding that is congruent with previous research (Andrews-Hanna et al., 2013). This suggests typical daydreaming is by no means a purely trivial, dysfunctional, or disruptive activity, but part of a rich and productive mental life that people find important. In contrast, fantastical daydreaming is a much rarer type of daydreaming, both according to our data and previous studies (Klinger, 2009; Kane et al., 2017). Yet, this rare and, (according to the patterns of correlations we observed) not necessarily highly meaningful or pleasant type of daydreaming, appears to be related to artistic creativity. This finding is in line with previous results linking fantastical daydreaming to openness to experience and the observation that creatively productive individuals, particularly creative writers, do not necessarily have the most cheerful internal lives; successful writers often suffer from stress, depression, and other mood disorders (e.g., Kaufman, 2001; Ludwig, 1994). Interestingly, depression alone does not seem to benefit creative ability, but successful writers often display a combination of stress or depression with a rich imaginative life, perhaps indicative of a productive coping mechanism (Kohányi, 2005; Taylor, 1999). Our results are in line with this idea and suggest that fantastical daydreaming may play a role in this association.

Aside from speaking to the question of how daydreaming relates to creativity, our results also make contributions to methodological questions. Our experience sampling results show that we gain insights from distinguishing between trait and state conceptualizations of daydreaming. Moreover, asking participants to reflect on their “typical” daydreaming using a self-report scale versus using experience sampling may yield different results. We would expect when people are asked to reflect on their “typical” daydreams, the thoughts that come to mind may not be representative. It is conceivable that people have superior memory for unusual or

meaningful daydreams, for instance. Interestingly, we find that, for most daydreaming types, participants’ reports of their “typical” (trait) daydreaming in the lab correlate moderately to highly with their in-the-moment reports during the experience sampling period. Planning is the only notable exception to this. Overall, this gives us some confidence in the validity of our trait scale, but also illustrates we cannot fully rely on the accuracy of participants’ self-reports.

There are several limitations of this study that should be considered. An important constraint is the relatively small sample size of our main study ($n = 133$), especially the experience sampling part ($n = 65$). Comparable previous experience sampling studies have typically used larger samples (e.g., Franklin et al., 2013; Kane et al., 2007; McVay et al., 2009). Thus, our results—especially the experience sampling results—should be interpreted cautiously and replicated with a larger sample. Moreover, we observed a surprisingly high rate of daydreaming—63%, whereas previous studies have found much lower rates (typically around 25–35%, Franklin et al., 2013; Kane et al., 2007, 2017; Marcusson-Clavertz et al., 2016; McVay et al., 2009; Song & Wang, 2012; although Killingsworth & Gilbert, 2010, found a rate of 47%). This could be due to normal sampling variation, or it could be a methodological artifact. The notification tone we used for thought probes was participants’ usual ring tone. Upon hearing their phone ring, participants may have disengaged from their current activity and started to think about who is messaging them, for instance.¹ Using a more distinctive tone would be advisable for future research.

Another methodological limitation is that some of the items of our daydreaming scale, particularly Item 3 of the *pleasant* daydreaming subscale, do not load as strongly on their subscale as expected in the confirmatory factor analyses. Negatively worded and negatively keyed items (like Item 3) often lead to artifacts in factor analysis of measures that are designed to be unidimensional (e.g., Savalei & Falk, 2014; Schmitt & Stuits, 1985). We have repeated all analyses with a modified *pleasant* daydreaming subscale that leaves out the negatively keyed Item 3 to test if it changes the results. It does not. Nonetheless, for future studies, the scale should be further improved.

In conclusion, our findings show that the internal world of our daydreams is rich and diverse, but not all daydreaming leads to creativity. Our findings, though preliminary and in need of replication, suggest there can be at least two distinct routes between daydreaming and creativity. One goes through personally meaningful daydreams, which are surprisingly common and appear to be a source of creative inspiration, behavior, and problem solving. Another route goes through a much rarer, fantastical type of daydreaming. Though seemingly frivolous, fantastical daydreaming may be a significant source of artistic creativity.

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