Out for a Walk
Where the Thoughts Take Flight

– naturalistic experience sampling of mind wandering in an urban blue-green space

Ut på Promenad, Där Tankarna Får Luft Under Vingarna: naturalistisk upplevelseprovtagning av tankevandring i ett urbant blågrönt utrymme

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Swedish University of Agricultural Sciences, SLU
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Abstract

When one wanders in nature, the mind follows the feet and the senses. But at times the mind drifts elsewhere, traveling great distances or to totally different time periods. These episodes may depict memories of things that have happened in the past, but they can also invent something new, far into the future. Crossing a brackish canal over a footbridge, the color of the water catches the eye, and, perhaps without awareness, the thoughts take flight.

That human thought embarks on such spontaneous "mental time travel" of mind wandering is intriguing and raises questions about cognitive experience. Advances in methodology investigating this state have yielded evidence linking mind wandering with creative thinking, involuntary memory, complex social cognition, mood, and environmental dynamics. Recent work in the field of environmental psychology has theorized that mind wandering might explain creativity benefits of nature contact. Other recent evidence has associated mind wandering in outdoor nature with mood improvements. Yet the phenomenon remains under studied in outdoor contexts.

The primary aim of this study was to develop an ecologically valid methodology to track and measure moments of mind wandering as they occurred during outdoor nature contact. Its secondary aim was to test that methodology by describing the unfolding of mind wandering (MW) in one urban blue-green space. This explorative second phase of the study used qualitative and quantitative data to understand the phenomenon as it occurred in the space and to assess validity of the new methodology.

Results revealed that a broad array of mind wandering data could be systematically collected and assessed using the new methodology. The mind wandered readily for most subjects, spread across much of the study area. Participants reported that the largest percentage of thought content related to the present, followed by the past, then the future. Participants reported both verbal and imagery-based MW episodes concerning both the self and others. Possible relationships between the physical characteristics of the blue-green space and mind wandering content were identified and discussed. So too was the relationship between duration of nature contact and frequency of mind wandering. In-depth qualitative analysis of one participant's experience illustrated the diversification of thoughts during the short span of the study period, especially via spontaneous memories. Effects of thought diversification on emotional valence was highlighted. Finally, methodological reflections and suggestions for future research are discussed.

Keywords: Environmental psychology, mind wandering, creativity, experience sampling, methodological development, ecological validity, urban green space, urban blue space, reflection, memory, mental health, mood, rumination

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Abbreviations

Creativity	Whether used by artists, professionals or individuals, creativity involves the generation of new ideas to create something new and useful (Plambech and van den Bosch, 2015). Creative incubation involves the moment in the creative process in which conscious work on the ideation stops, but unconscious work continues (Williams et al., 2018)
Experience Sampling (ES)	The collection of self-report data regarding a subject's ongoing experience (Smallwood and Schooler, 2015)
Mind Wandering (MW)	The moment when the external task or environment no longer command one's thoughts, and attention turns inward (Schooler et al., 2011), often marked by spontaneous, dynamic movement from one thought to another (Christoff et al., 2016).
Nature experience	Nature experience involves an individual perceiving and/or interacting with stimuli from the natural world. (Bratman et al., 2019).
Trigger of MW	Refers to specific events or stimuli within the external environment that cue mind wandering to occur. Mind wandering can also be triggered by internal introspective mental events (Pelagatti et al., 2020). Triggers are associated with the process of ignition of mind wandering, which has been identified as an important area of research regarding the cognitive origins of spontaneous thought (Smallwood & Schooler, 2015).
Urban blue-green space	A planned network of water and vegetation built within the urban context and providing a range of ecosystem services (Wang et al., 2022).

1. Introduction

This chapter starts by wandering. It goes first to a post-industrial urban bluescape in New York City, in the 70's, where a visual artist vividly writes about the mental experience that is the subject of this research study. The section also positions the stakes of studying mind wandering: creativity and mental health within urban natural spaces. The chapter then moves to research and theory of mind wandering from the fields of psychology and neuroscience. It highlights evidence from those fields exploring how the physical environment might shape the process and contents of mind wandering. The neuropsychological research of MW is then joined with the field of environmental psychology by first tracking foundational theorists' ideas of how the physical outdoor environment might affect inward thought patterns. In the outdoor context, this includes concepts of reflection, studies of rumination, and, more recently, the integration of the concept of mind wandering with attention restoration theory. From there, the introduction moves to the physical landscape: evidence and theory of how landscape characteristics might shape or encourage mind wandering. This background then moves towards the research aims of the current study. The first aim is to develop ecologically valid methodology to measure mind wandering in an outdoor setting. The second aim is to then use the new methodology to describe the phenomenon of mind wandering in on urban blue-green space empirically.

1.1.1. Mind wandering in the wild

In 1979, the young artist and AIDS activist David Wojnarowicz wrote in his journal about his thoughts while visiting the abandoned West Side Piers along the Manhattan waterfront. The space evoked a "semblance of memory and associations," he wrote, "of oceans, of sailors, of distant ports and the discreet sense of self among them, unknowing and coasting" (Anderson, 2019, p. 12). In a separate interview, he remembered the way the evening sun hung low over the Hudson River there. His visual field changed in such a way that, "I could dream myself—project myself—all around the world in my imagination by looking at those qualities of light, and by looking at those structures" (Anderson, 2019, p. 3).

The piers were a contrast to much of his life in New York. The city dealt him abuse, poverty, and mental health struggles. But at the edge of the river, the piers

were a muse and a natural sanctuary for Wojnarowicz within the metropolis (Carr, 2012). One of the reasons, as his writing clearly shows, was the way that those waterfront spaces provided a potent setting for his mind to wander away from his current reality and into other possibilities.

This is not a thesis about David Wojnarowicz (though he is a muse). Instead, this research deals with the "unknowing and coasting" quality of thought that he describes in his writing, and the ways it happens in islands of green and blue within the city. Wojnarowicz used those spaces, their quality of light, to escape the constraints of the city and cultivate alternative thoughts that drove his artistic practice. It proved to be a powerful tool. Today the photographs he made from that time, inspired by that urban-natural space, hang in the galleries of the Reina Sofia museum of art in Madrid, and his creations are held by over thirty major art institutions across the world (Wojnarowicz Foundation 2024).

The original impetus of this project was the creative potential of the mind wandering that occurs as one physically moves through natural spaces. It follows research that has increasingly focused on how mind wandering benefits creative thinking and how natural spaces might be ideal for it. Towards this broader aspiration, the current research project aims to develop methodology that can capture the intriguing, flowing phenomenon of mind wandering, as well as the specific environmental contexts in which it occurs.

1.1.2. Mind wandering in the fields of psychology and neuroscience

The vocabulary Wojnarowicz used to describe his mind wandering is remarkably in line with a field of neuropsychological research that has exploded in recent years, enough that some have called it "the era of the wandering mind" (Callard et al., 2013). Seeking to define such a slippery term as mind wandering, Christoff et al. (2016) prioritize mental movement: a transition from one mental state to another that is often spontaneous, dynamic, and "free to move 'hither and tither'" (p. 719). Within the broader framework of spontaneous thought lies dreaming, mind wandering, and creative thinking, and adjacent to it lies rumination and goal-directed thought (Christoff et al., 2016).

Mind wandering is often studied for when it happens and where it leads. Mind wandering marks the moment when the external task or environment no longer command one's thoughts, and attention turns inward (Schooler et al. 2011). When this happens, one's mind is suddenly elsewhere, or in another time, in a past memory or a future idea, hence the term "mental time travel" (Smallwood & Andrews-Hanna, 2013). Research often grapples with this temporal destination of mind wandering, finding that the mind tends to wander more towards the future (called prospection) than it does to the past (retrospection) or present. This has led researchers to speculate that mind wandering is an adaptive state of consciousness,

and that it plays a role in future planning, goal orientation, and self-identity (Song and Wang 2012). So, a wandering mind doesn't start and end with a trivial lapse of attention. These spontaneous thoughts can grow to involve complex scenarios, connecting our present selves to memories of ourselves in the past, and possibilities for ourselves in the future (Smallwood & Andrews-Hanna, 2013). This grows even more complex when mind wandering includes the self in relation to others, which was the case in about 70% of mind wandering reports in one study (Song and Wang 2012). "From an evolutionary perspective, prospection allows us to simulate plausible outcomes to alternative future events, including the emotional states of ourselves and other people in response to such events" (Gilbert and Wilson, 2007, in Smallwood & Andrews-Hanna, 2013, p. 3).

The creative benefits of mind wandering fall within this adaptive, generative area of mind wandering's theorized functions and effects. One of the most discussed benefits of mind wandering is on creativity; that is, the ability to generate new and useful ideas (Christoff et al., 2016; Agnoli et al., 2018; Baird et al., 2012; Fox and Beaty, 2019; Tan et al., 2015), with one study finding that creative problem solving improved *not* by actively thinking about the creative problem, but instead after participants engaged in completely unrelated tasks that allowed their minds to wander (Baird et al., 2012). While some research has found that mind wandering does not improve creative incubation (Steindorf et al., 2021), investigations continue. Recent evidence shows that the free movement and spontaneity of thoughts is the most important mind wandering factor that contributes to creativity, since this movement of thought allows the association and mixing of remote concepts or memories that might otherwise have stayed separate (de Rooij, Atef & Faber, 2024).

That being said, mind wandering is a part of human cognition with a negative reputation. It was once a term reserved for those who are unfocused or idle, and indeed, evidence shows negative and potentially serious costs associated with mind wandering, such as for reading comprehension (Schooler et al., 2004) or lecture focus (Szpunar et al., 2013). It was the biggest predictor of car accident responsibility when victims were surveyed after crashes (Galera et al., 2012). It is generally associated with errors and poor performance on demanding tasks (Smallwood & Schooler, 2015), and professional pilots have been shown to mind wander (Casner & Schooler, 2013). Tendency to mind wander is also associated with depressive rumination (Berman et al., 2010), post-traumatic stress (Ehlers, Hackmann, & Michael, 2004), and a lower mood (Killingsworth & Gilbert, 2010).

"A Wandering Mind is an Unhappy Mind" is the title of the often-cited paper published by Killingsworth & Gilbert (2010) in *Science*, which used a smartphone app to collect nearly 225,000 reports about people's momentary mental states. People's minds were wandering between 30% and 50% of the reports. And analysis showed that people were less happy when their minds were wandering than when

they were mentally engaged in tasks. Moreover, the team found evidence that mind wandering was the cause, rather than the effect of unhappiness. Here is the doleful end to their paper: “In conclusion, a human mind is a wandering mind, and a wandering mind is an unhappy mind. The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost” (Killingsworth & Gilbert, 2010, p. 932).

While Smallwood and Schooler (2015) note the connections between mind wandering and negative mood, they caution that it is complicated by context and content. For instance, past-focused mind wandering is associated with higher levels of unhappiness, but future-based thinking seems to reduce negative mood. They interpret this and other evidence with the conclusion that affective processes are central to the functioning of self-generated thought. So, if mind wandering is to be understood, it must be understood within the context of the emotional systems that it is bound up with.

Researchers acknowledge the mounting evidence for adaptive and non-adaptive aspects of mind wandering but caution that the field hasn’t advanced enough to make conclusions about the adaptive or maladaptive associations of MW (Kugel and Smallwood 2021). Instead, much remains to be gained by understanding the fundamentals of this near-ubiquitous mental process, such as the systems (emotional, attentional, memory) that function together to enact spontaneous thought, and where the boundaries of MW are in the first place. So, regardless of its connections to psychological states or psychopathological states, mind wandering happens, it happens at high rates, it is not likely going anywhere, and, as data, it can readily be collected and used to investigate a very human cognitive phenomenon (Pavlova 2024). This idea was deftly expressed by Smallwood and Andrews-Hannah (2013), in concluding that

> As *experiencers* we may understand mind-wandering as an unintended lapse; as *scientists* we should take the study of self-generated thought seriously because it can reveal core features of how thinking operates (p.4).

Applying the study of mind wandering to nature-based contexts might similarly reveal core features of how thinking operates in certain environmental contexts.

1.1.3. Theories of conscious thought and the natural environment

Wojnarowicz used the Hudson piers to dream; Thoreau went to Walden Pond to contemplate; Newton thought of gravity under an apple tree. While environmental psychologists have only recently begun incorporating mind wandering into theories of human-environment interaction (Williams et al., 2018), the exchange between

inward thought and external environment has long been central to theories of people and place.

Kaplan's (1983) early conceptualizations of the cognitive experience of an outdoor environment emphasized both the external environment and internal environments of mental activity. He prioritized mental reflection in this model as fundamental to the experience of an environment. Reflection included sitting and thinking, ruminating, "getting one's head together", and contemplation (p.317). He painted an intriguing picture of environmental compatibility that incorporated the perceived physical environment, mixed with the non-present environments of one's past and future, mixed with the images and plans that were conjured as people reflected in those places (Kaplan 1983). Kaplan posed reflection as vital, especially for integrating past information with anticipation for the future. And he held that certain types of natural spaces encouraged such reflection.

This early theorizing resulted in the Attention Restoration Theory. It focuses on the interplay between the physical dynamics of environments and how they influence the cognitive dynamics of attention (Kaplan & Kaplan 1989). The theory holds that certain environmental characteristics command an ideal amount of involuntary attention. This lightens the cognitive load and can leave space for other thoughts, encourage reflection and provide an 'invitation for the mind to wander' (Kaplan & Kaplan, 1989, p. 193). This happens when gentle, repetitive stimuli, such as a canopy of leaves moving together in the wind, capture exogenous attention. This gentle command of effortless attention allows endogenous attention to rest and recover. And it is said to leave space in the mind for other concerns. The attention commanded by softly-fascinating stimuli can be contrasted with that of high-intensity stimuli (such as a viral video), which grabs attention and leaves no room for other concerns. Very low-intensity stimuli, on the other hand, might fail to capture attention or provide restoration (Herzog et al., 1997).

In the 40 years since that theorizing, evidence has shown that nature seems to exert an influence on the quality of thoughts that occur there. ART was used to create a research program which found that natural environments were pivotal for coping and restoration of caregivers of people with terminal AIDS (Canin 1991). The research found that this was specifically connected to reflection: natural environments, more than any other setting or activity, provided space that allowed both psychological restoration and the capacity to reflect.

Related research in the field has shown that patterns and quality of thought might differ according to physical environments. Nature contact has been shown to influence rates of rumination – a repetitive, negative, self-referential thought pattern that is associated with mind wandering. Bratman and colleagues (2015a) showed that a 90-minute walk in nature reduced rumination and brain activity in a neural area associated with rumination and mental illness; whereas participants who took a walk through an urban area showed no reduction in either. In another study,

Bratman et al. (2015b) found that anxiety and rumination decreased after a 50-minute walk through nature, but not through urban streets. Then, in a subsequent study that tested cumulative amount of time spent in a natural environment, Bratman et al. (2021) found that the more time people spent in nature, the less they were to ruminate. They were also able to show that rumination mediated both positive affect and (to a greater degree) negative affect, creating a link between nature, rumination, and emotion.

In another study that showed the immediate effects of physical environment on conscious thought, Schertz et al. (2018) periodically sampled people's thoughts in a botanical garden setting and a commercial mall space. In the garden, participants' thoughts were more past-focused, positively-toned and exciting. In the commercial space, participants' thoughts tended to be about the future, and feelings tended to be more impulsive. Another study by Schertz et al. (2022), found associations between thought content and the low-level visual features of a park. The research indicated a causal role of non-straight edges and environmental naturalness on positive reflective thoughts.

1.1.4. Mind Wandering into the field of Environmental Psychology

One of the first mentions of mind wandering theory in environmental psychology literature was from Atchley et al. (2012), who were grappling with results that could not be explained by current theories in people-environment studies. They had found that hikers gained 50% higher scores on a creativity test after four days immersed in nature, far outperforming a control group who had not taken the trip. Attention Restoration Theory alone could not account for the improvement of such higher-level cognitive functions, and the team sought other explanations (Atchley et al., 2012). They proposed that nature contact leads to more introspective thought, which was in line with previous theories, but, seeking further explanation, they proposed that this nature-based introspective thought might be connected to an emerging strain of research on mind wandering and its relationship to divergent thinking (Atchley et al., 2012). Atchley and colleagues (2012) suspected that being in a natural setting, unplugged from external technology, triggered this introspective mode of thought which has been shown to engage the Default Mode Network of the brain. The DMN is a specific set of brain regions shown to be associated with internally-guided mental processes such as remembering, picturing the future, social cognition, and mind wandering (Kucyi et al., 2023). Activity in the DMN (during MW or similar internal thought) increases as directed attention decreases, making mind wandering a mental process that would be relevant to theories of attention in outdoor spaces.

Williams et al. (2018), seeking to explain high-level cognitive effects on creativity after nature contact, articulated a concept that combined ART and mind

wandering. It sought to explain creative incubation, a specific phase in creative mentalizing when new ideas can emerge with little or no conscious effort (Sio & Ormerod, 2015). Williams et al. (2018) proposed that creative benefits occur when soft fascination gives way to mind wandering, and these two states flicker back and forth during certain experiences in nature. So first, attention is attracted exogenously by natural stimuli that are softly fascinating; this then facilitates the gentle shift inwards towards mind wandering. Advances in MW research had shown that the shift towards MW could activate the default mode network, allowing thoughts to "flow across diverse, previously un-associated pieces of information," enabling "access to novel combinations of ideas" and "more flexible structuring of relationships between those ideas." (Williams et al., 2018, p.40).

The concept is largely in line with Kaplan and Kaplan's (1989) model, which theorized that softly fascinating environments eventually led to inward reflection. But it adds new layers to the theory, namely, the addition of the less-conscious (or unconscious) process of mind wandering. And it begs the question of ART: if environments capture attention, then how, why, and when exactly does attention shift inwards? Does soft fascination build up and then shift permanently towards inward consciousness (Williams et al., 2018)? The question is important considering there is a large cognitive difference between the externally-captured attention of ART and the internally-directed attention of self-reflection (Joye and Dewitte, 2018). Atchley et al. (2012) proposed that a longer period in a restorative environment eventually gave way to a more stable state of mind wandering or reflection. Williams et al. (2018) proposed that attention moves back and forth: from directed towards the environment, then gently inwards via mind wandering, then softly back to the external environment, and so forth.

There is also the question of how much nature exposure might be required to lead to this deeper level of reflection. Kaplan and Kaplan (1989) proposed that a brief visit to near nature could clear the head, but longer periods in high quality environments were necessary to achieve deeper reflection and mental clarity. Williams et al. (2018) agree, proposing soft fascination and mind wandering would both occur during extended nature experience. But they acknowledge that much remains unknown about the temporal dynamics of mind wandering, and they call for research into this temporal aspect of mind wandering.

Showing the spatial and temporal oscillation of attention might also help resolve another outstanding question regarding Attention Restoration Theory. That is: restoration in nature is thought to occur after it unfolds over some extended time of involuntary attention/fascination towards environmental stimuli. However, it has been shown that involuntary, bottom-up command of attention by external stimuli is a brief affair and that it is triggered by individual elements within a scene (Joye and Dewitte 2018). So, within an entire environment (made up of various scenes

with thousands of elements), how do periods of individual bottom-up attention combine or connect to create a restorative experience (Joye and Dewitte 2018)?

It wasn't until 2022 that "mind wandering" itself was assessed experimentally within the field of Environmental Psychology, and environmental characteristics were also shown to shape the character of thought. Macaulay et al. (2022a) interviewed 20 participants after a 20-minute unguided work break in an outdoor space, aiming to understand how people engaged cognitively with the spaces. Mind wandering was one of the most common forms of engagement (other forms included mindfulness, heightened sensory stimulation, negative judgement of experience, etc). MW was associated with movement from indoors to outdoors, as well as sensory stimuli, and a broader physical environmental scope. For one participant, seeing distant trees, sky, and a helicopter allowed his thoughts to travel in a way that they couldn't when he was surrounded by four walls during work. "*And I think that that seems to align with letting my thoughts go further,"* he said (Macaulay et al., 2022a, p.6).

1.1.5. Internal thought and the physical characteristics of environment

Kaplan and Kaplan (1989) held that landscape quality, specifically "restorativeness," could lead cognition inwards towards introspection. It raises the question of which landscapes might inspire thoughts to turn inwards, and then, which landscapes might inspire the flickering of attention between soft-fascination and mind wandering as described by Williams et al. (2019). Kaplan and Kaplan (1989) propose that "extended periods in relatively high-quality environments" lead to deepening interior thought. Such restoration comes when an environment provides a sense of extent, soft-fascination, being away, and compatibility (Kaplan & Kaplan, 1989).

Williams et al. (2019) holds soft fascination as central to their concept of how outdoor spaces encourage creativity through mind wandering. Soft fascination involves the promise of "following the thread of something of interest in order gradually to acquire a bigger picture" in a landscape (Kaplan and Kaplan 1989, p. 185). Such stimuli are present in extensive, wild environments as well as in nearby outdoor environments, from "the play of light on foliage" and "the patterns created by long shadows" (p. 193). This soft sensation of natural stimuli can "demand attention involuntarily but only of modest strength (Kaplan and Kaplan 1989, p.192). Softly fascinating stimuli attract attention but leave room in the mind for other concerns

Soft fascination is closely identified with restoration in other studies and has been used to gauge restoration in urban environments (Lindal & Hartig, 2015; Macaulay, 2024; Nordh et al., 2009). Nordh and colleagues (2009) measured urban green spaces for restoration likelihood and for which landscape elements related to

fascination. In general, restorative potential was predicted by percentage of grass cover, amount of visible trees and bushes, and apparent park size. Fascination was specifically influenced by water and the size of an environment. Of importance were the presence of enough intentionally-designed landscape components relative to the size of the park.

Cervinka et al. (2020) found that outdoor spaces with high restorativeness ratings were also rated highly introspective and mind wandering potential.

Williams et al. (2018) predicted that restoration would happen in landscapes that were non-threatening, coherent, softly-fascinating, and afforded a distance from routine demands and mental contents. They predicted that mind wandering would occur during low-demand tasks, such as simple wayfinding and familiarity in an environment. They predicted that homogenous environments would likely trigger more sustained periods of mind wandering, while more complex and varied environments would trigger the gentle flickering between exogenous attention and mind wandering.

Research into the environmental and cognitive influences of mind wandering also prove helpful for landscape considerations and can contribute to these predictions. It has been shown that the mind wanders differently depending on cognitive load, attentional load, environmental stimuli, level of stimulation, salience of stimuli, meaningfulness of stimuli, and even sensorimotor conditions. Mind wanders less during periods of concentration, focused attention, or perceptual load (Song & Wang, 2012; Vannucci et al., 2017). In terms of attention and interest, heightened interest in stimuli has led to decreases in MW, while less interest in stimuli led to more mind wandering (Smallwood, Nind, and O'Connor, 2009). Event boundaries, such as in a narrative film, decreased MW, while less event change increased MW (Faber, Radvansky and D'Mello, 2018). Extra stimuli in general, such as task-irrelevant verbal cues (Vannucci et al., 2017), and verbal cues based on personal concerns (McVay and Kane, 2013), triggered more MW. And patterns have emerged in which certain external cues related to certain types of internal thoughts. Evidence has been found in which past-focused mental content is associated with negative triggers (Plimpton et al., 2015), negative mood (Song and Wang, 2012), cues that are of interest to the participant (Smallwood, Nind and O'Connor, 2009), the sensation of moving backwards (Miles et al. 2010) and cues projected in the left side of the visual field (Vannucci et al., 2018). Odor, much moreso than visual or verbal cues, was shown to cue memories from the distant past, specifically the first ten years of one's life (Miles and Bernsten, 2011). Future-based MW, on the other hand, has been associated with internal cues triggered by introspective thoughts (Faber and D'Mello, 2018), stimuli that were less interesting (Smallwood, Nind and O'Connor, 2009), the perception of moving forwards (Miles et al., 2010), and cues presented in the right side of the visual field (Vannucci et al., 2019).

Plimpton et al. (2015) proposed that "when people are in an environment that is devoid of meaningful cues they are more likely to think about the future but when they are in stimulus rich environment (like in the present study) they are more likely to think about their past than future" (p.272).

1.1.6. The question of emotion

There remain interesting theoretical questions about the connections between emotion, mind wandering, and nature contact.

While the mind wandering theory proposed by Williams et al. (2018) is attention-based, the emerging evidence of mind wandering in outdoor spaces indicate distinctly emotional associations. Macaulay et al. (2022b, 2024) performed two experiments in near-nature environments that found deliberate mind wandering led to lower measures of negative affect (Interestingly, the MW groups reported lower negative affect than a mindfulness group).

Schertz et al.'s (2022) work, while it did not explicitly examine "mind wandering", showed clear emotional connections between thought content and natural stimuli. Internal thought content during a walk in a natural area was toned more positive and coincided with higher feelings of positive affect than thought content in a shopping mall environment (2021).

And while mind wandering is also distinct from rumination, Bratman et al.'s (2015a,b, 2021) studies on rumination also suggest that time spent outdoors might influence quality of internal thought in ways that reduce negative affect.

Williams et al. (2018) notes that there is likely a complex emotional dynamic involved in the cognitive pathways of Mind Wandering and ART. They note that Attention Restoration Theory does propose that softly-fascinating natural stimuli can influence emotion by way of aesthetic perception, but Kaplan and Kaplan's (1989, 1995) framework is less clear about the pathways by which the aesthetics of nature contact benefit emotion.

One framework from the neuropsychological investigation of mind wandering does present a possible picture of how the relationship between environmental stimuli, internal thought content, and emotion might function. The Dynamic Framework of Spontaneous Thought sheds light on this relationship by centralizing episodic memory processes. The framework highlights the spontaneous, automatic reactivation of memory traces, often a hallmark of the mind wandering experience (Christoff et al., 2016). The authors theorize that bottom-up perception of salient cues from the environment can automatically and unconsciously trigger a variety of old, new, or re-combined hippocampal-neocortical ensembles. These are faint reactivations of the mental content that were active during the past memory formation. The memory traces may or may not reach consciousness, and memory content only becomes constrained and reflected upon when they are processed by higher-level mechanisms.

This framework does not so much deal with the way that specific memory recall influences momentary affective state, though the evidence for that is robust (Murray et al., 2013). Instead, the Dynamic Framework focuses on movement of thought: how these ensembles of memory traces contribute to spontaneity and variability of thought. It theorizes that the instantaneous triggering of multiple hippocampal-neocortical ensembles at once is what gives mind wandering such variability of thought quality. It explains how one can see a stalk of wheat and suddenly think about a friend working at a bakery thousands of miles away. The Dynamic Framework does address rumination, which has explicit emotional implications. Rumination and other depressive symptomology is marked by excessive invariability of thoughts (thoughts that get stuck). It involves the fixation of thoughts on often-negative content. The framework presents routes by which thoughts can become diversified beyond rumination: for instance, through meta-awareness, one can become aware of rumination and actively direct attention away from negative cycles of thought. Alternately, diversification of thought (through mind wandering's heightened variability potential) might facilitate a more spontaneous disengagement from negative thoughts and a transition to other non-ruminative mental states (Christoff et al., 2016).

This framework seems to align with the flickering proposed by Williams et al. (2018), but it is more expansive and can accommodate other cognitive states, such as rumination. It also accounts for environmental effects on mind wandering by way of bottom-up capture of attention by salient stimuli. And it can factor in individual differences (whether trait-level or state-level). The framework also proposes mechanisms by which thought can shift, for instance, from spontaneous mind wandering toward deliberate introspective reflection.

How might this framework fit with Bratman et al.'s (2015) finding that natural stimuli reduced rumination more so than urban environments, or Macaulay et al.'s (2022b, 2024) findings that mind wandering in nature corresponded to a reduction in negative mood? One possible mechanism proposed by Bratman et al., (2021) links attention, rumination, and emotion, and is very much in line with the Dynamic Framework (DF). In this explanation, a state of negative mood coincides with a narrower span of attention, focused more on the self, pain, or negative stimuli. But natural stimuli, in line with ART, can help broaden attention, providing "'greater access to more semantic information' which can shift thought patterns away from the self" (Grol et al., 2015 in Bratman et al., 2021, p. 5). This increased access to more semantic information is in line with the DF's focus on variability of thought. A diversity of multisensory environmental stimuli triggers a high variety of possible thought variations, enabling transitions in thought content away from negative thoughts. Increased variability in stimuli could lead to increased variability in thought. In the case of movement through a landscape, the variability of stimuli is further increased by movement. If people have had positive experiences with

similar natural stimuli, these experiences might trigger low-level memory ensembles based on those stimuli. It is worthwhile to note that these thoughts sometimes do not reach conscious awareness, so this pathway could be important for revealing automatic conscious effects of outdoor environments.

In addition, this framework can help differentiate between certain types of mind wandering that might occur as a result of the landscape: namely, stimulus-dependent thought and stimulus-independent thought (Christoff et al., 2016). Both have been identified as types of mind wandering but both have also unique properties (Seli et al., 2016).

1.2. Introduction to the study

Mind wandering has been shown to occupy between 30% and 50% of our waking thoughts (Killingsworth & Gilbert, 2010). Its occurrence and content have been associated with emotional well-being, creativity, future planning, executive control errors, and development of self-identity (Song & Wang, 2012). The potential benefits to studying this nearly ubiquitous phenomenon in outdoor spaces are many. To this end, environmental psychologists have theorized that mind wandering interacts with attention restoration dynamics to benefit creative thought during nature contact (Williams et al., 2018). And, after recent experimentation in outdoor settings, mind wandering was shown to reduce negative affect (Macaulay et al., 2022b).

Yet the basic contours of how mind wandering occurs in outdoor contexts remains understudied (Williams et al., 2018; Macaulay, 2024). In addition, researchers from the neuropsychological fields of mind wandering research have stressed that the state of the art is still very much in a descriptive phase (Kugel and Smallwood, 2021), before which broad conclusions about mind wandering's costs or benefits can't be formed. Calls have been made from the latter camp to understand the "process of ignition" that triggers mind wandering, as well as how the external environment relates to such a process (Smallwood & Schooler, 2015).

The aim of the study was to address these gaps by developing an ecologically valid methodology that could examine the unfolding of mind wandering in outdoor contexts. The study then aimed to use this new methodology exploratively to describe how mind wandering occurred in one urban blue-green space for 13 participants.

Research questions of this explorative portion included examining where and when the mind wandered within the blue-green space, as well as descriptions of the content of the mind wandering that occurred there, such as emotional valence of mind wandering and temporal orientation of mind wandering episodes. Next, also with an explorative lens, the research examined how certain external conditions related to mind wandering and its contents. This included questions of how time in

nature related to increased frequency of mind wandering, as well as how environmental characteristics of the space related to emotional content of mind wandering that occurred there. Finally, the research zeroed in on data from one participant's walk, to examine how mind wandering unfolded across a single nature experience, examining the diversification of thoughts as the subject moved through the physical space, in line with Christoff et al.'s (2016) Dynamic Framework of spontaneous thought.

Methodological development was informed by pilot study data, empirical results from the explorative study, as well as data from participant interviews (Figure 1). Possible further use of this methodology is proposed, including the investigation of mind wandering's role in creative cognition during nature contact. Eventually, research into MW and creative cognition might guide development of nature engagement to advance creative cognition, especially in urban areas, as well as suggestions for landscape designers and planners. Mind wandering research incorporating similar methodology might also be used to investigate pathways by which natural stimuli influence cognition and emotion.

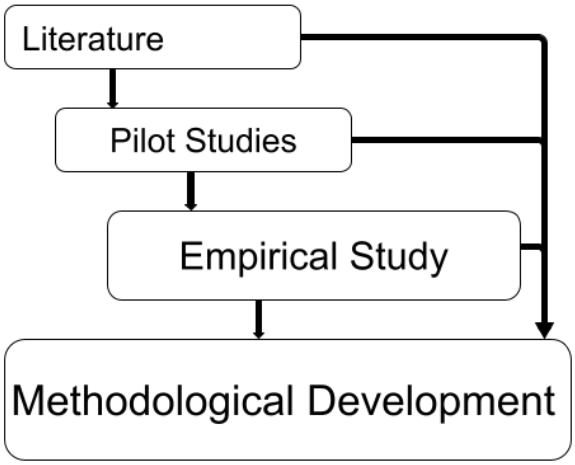


Figure 1. Scheme of the current study as illustrated by the researcher.

1.3. Aim and research questions

The aim of the study was to develop an ecologically valid methodology that could examine the unfolding of mind wandering in outdoor contexts. The study then aimed to use this new methodology exploratively to describe how mind wandering occurred in one urban blue-green space for 13 participants.

The research was organized by the following research questions:

1. Can a video-based experience sampling method assess mind wandering retrospectively while preserving the ecological validity of free-flowing conscious thoughts during a walk?

2. How does mind wandering occur in an urban blue-green space temporally, spatially, and in terms of thought content?
3. How do characteristics of an urban blue-green space relate to the internal contents of mind wandering that occurs there?
4. How did mind wandering unfold during one individual's walk through an urban blue-green space?

2. Methodology

Described in this chapter is the methodology developed to measure mind wandering naturalistically in an urban blue-green space. It details the formation of a novel video-based retrospective experience sampling method, its sampling questions and procedure, ethical considerations, as well as the trial of this methodology during two pilot studies. Inclusion of qualitative methodology (semi-structured interviews and open-ended sampling responses) in a convergent parallel design is discussed. Choice of study location of a blue-green space is elaborated upon, particularly within the urban context. Finally, the analyses employed to process various data and the rationale behind these choices is explained.

2.1. Mixed methods

The research objectives of the empirical study were primarily descriptive in that the study aimed to identify and characterize how the phenomenon of mind wandering occurred outdoors. The objectives were also exploratory in that it aimed to use abductive analyses of a broad array of data to identify patterns regarding the phenomenon. During analysis, the abductive approach moved back and forth between empirical data and theory to characterize the phenomenon as it occurred in the study (Onwuegbuzie & Leech, 2015).

The primary rationale for mixing qualitative and quantitative methods was instrument fidelity and significance enhancement. For instrument fidelity, the purpose was to "identify the adequacy of measures used" and "assist with conceptual and instrument development" since the data collection method was novel (Collins et al., 2006, p. 78). Towards this end, during interviews, participants were asked to what extent the experience sampling procedure accurately represented their actual individual mental scape during the walk.

Another reason for incorporating qualitative responses was to maximize interpretations of the data through triangulation with quantitative data (Collins et al., 2006). This included inclusion of spatial data, video footage of how participants moved through the landscape, where gaze was focused, and interview responses that elaborated on mind wandering experiences. All of these allowed for expanded interpretation of and comparison with the quantitative results. The interviews also

afforded the vivid and meaningful illustration of theories referenced and quantitative results of mind wandering, which is a phenomenon that has high variability and at times high intensity. In all, the qualitative analysis accessed the depth of people's internal experiences. For instance, primary data collection during experience sampling might have revealed that a participant had a "slightly positive" MW experience of intensity level 5 on a bridge. This was labeled "reflecting on life" triggered by "the spot on the bridge where I stood three years ago." But interview data revealed complexity of that experience: it included difficult feelings of relationships, time passing, and having moved from a faraway place, but being in the physical place and standing there reflecting allowed some degree of personal clarity. This triangulation and illustration of the data was central to the final research question: a thematic analysis of one participant's experience as it unfolded on the walk.

A perspective of critical reflexivity was important for the development of the study, analysis of data, and interpretation of results. The study of mind wandering is a study of internal consciousness. The researcher, regardless of the methodology, will always be external to that perspective. The approach is therefore careful to respect the perspectives that are carried in the data, understanding that the field of mind wandering is quite new (even if it has mushroomed), and current state of the art will not encompass individual consciousness. The goal of the study was not to arrive at a broad conclusion that could explain all mind wandering in all outdoor spaces. Rather, the research sought to describe the conscious experiences as they happened in the place, as they were situated within the experience of the individuals who participated (Alvesson and Sköldberg, 2009).

Quantitative data was collected concurrently, on the same day, as qualitative data. Quantitative data and qualitative data were analyzed separately. Finally, merging of the results occurred after analysis in the discussion, which included comparison of the qualitative and quantitative results.

Data was integrated for interpretation and reporting using the contiguous approach, in which quantitative results were reported first, followed by qualitative results.

2.2. Methodological development

The development of methodology used a mixed-methods, abductive approach incorporating both theory and empirical practice. This approach involves movement between theory, data, and back and forth, in order to find appropriate results. Thus, the study developed, tested, refined, re-tested, and further refined methodology in this back-and-forth manner. Literature first was used to develop initial methodology, followed by a pilot study testing the method. Then, after refining the methodology, the study was carried out, yielding quantitative results,

methodological reflections from the researcher, and methodology interviews with participants. The study concludes with further proposed alterations to the methodology.

The initial development of methodology based on literature is presented in this section.

Mind wandering is fleeting and covert. One of its features is that it occurs without awareness. This poses a challenge to studying the phenomenon, inside or outside the lab (Smallwood & Schooler, 2015). A second challenge for this study was to measure the phenomenon outdoors in a naturalistic setting. The study strove towards a valid understanding how individuals interacted with an environment ecologically, as they would on their own terms, so that a faithful representation of the mind's wanderings outdoors could be examined. To do so, the study combined retrospective experience sampling from the field of mind wandering research with a recently developed video-based method from the field of environmental psychology.

Although methodology is being developed to measure mind wandering purely with physiological measures (such as eye tracking or fMRI technology) (Barz and Sonntag, 2021), as it stands now, measurement of mind wandering requires participants to report the occurrence of MW (Smallwood & Schooler, 2015). Probe-caught design is the most common experience sampling method. In it, experimenters interrupt a participant during a task to ask about current mental state. However, this method and others risk validity, as it might heighten introspection and interrupt the normal flow of thought (Schooler, 2002a), and potentially alter the individual's experience within the place. Experience sampling after a task (retrospective experience sampling) using self-caught methods allows for a more natural course of thought to play out, especially regarding the temporal dynamics of mind wandering; however, the reliance on memory for such a covert mental process that might or might not reach meta-awareness is a drawback (Smallwood & Schooler, 2015).

A newly developed video-based landscape analysis method posed a solution to the memory issue and the risk of experimental interference. It also presented a tool that could uniquely assess knowledge gaps about mind wandering's momentary throughout a physical environment. In this tool, a participant visits an environment on their own terms while a small camera records video from their own visual perspective (G. Cerwén, personal communication, December 2023). After the recorded visit/walk, the participant then reviews the footage to assess or react to the landscape as they had experienced it. This potentially avoids the interruption of normal thought flow or priming of introspection. This methodology was shown to help participants remember mental contents that had previously been forgotten in outdoor conditions (G. Cerwén, personal communication, December 2023). The video footage also provides valuable landscape data. This footage can help

triangulate mind wandering contents with the exact environment in which they occur. The use of video also provides data points for time, location, and ecological conditions of the mind wandering experience.

Combining these, methodology was developed and tested with two pilot studies and experimenter self-study. Participants first took a walk alone in an urban blue-green space while wearing a camera that discretely recorded the entirety of their walk. Aims of the study were withheld until after the walk. Immediately after the walk, the participant viewed footage from their own walk to recall where and when their minds wandered. Video was watched and paused when mind wandering was recalled. During the pause, experience sample data was collected about each MW experience via survey. After the footage/experience sampling, semi-structured interviews were conducted that gathered further detail about mind wandering experiences as well as reflections about the methodology.

Data collected included: landscape video footage, timestamps of MW report, locations of MW reports, environmental triggers of MW report, brief written description of MW episode, brief participant interviews, as well as various quantitative dimensions of thought content (emotional valence; intensity; orientation of MW towards past, present, or future; sociocultural makeup of MW content; and verbal and imagery-based form of MW content). These variables for content and form of MW were chosen to gain a broad descriptive understanding of the phenomenological character of MW quantitatively. This follows the work of Gorgolewski et al. (2014), Andrews-Hanna et al. (2013), and other MW researchers who have used these categories to connect the structure of thought to functional outcomes of MW and other research questions. Results from the current outdoor study can then be situated and evaluated within the field.

A copy of the experience sampling survey questions, including elaboration of its data categories, is available in Appendix 1.

2.3. Ethical considerations

The ethical procedure was developed in careful consideration of participants as well as park visitors. Ethical deliberations were carried out with supervisors and a third departmental advisor. Primary considerations included informed consent by participants, privacy precautions for park visitors, ethics of recording in the public sphere, and secure data handling.

Participants signed a document of informed consent, assuring participant anonymity and allowing participants to revoke their participation at any point in the study process. They were assured that data would be protected on a secure server and would not be shared before being anonymized for the published study report.

Recording in the public sphere was done in accordance with guidelines of the Swedish Ethical Review Authority, Swedish Law, and APA (Görman, 2023;

Riksdag, 2018; APA, 2017). Participants were not initially told that mind wandering contents were the subject of the study; however, they were debriefed about the true aim of the research as soon as the 20-minute walk was completed. During debrief participants were reminded that participation was voluntary and of their right to withhold personal information.

Even though this study is within the legal and ethical limits of recording public space, it does not do so lightly, since it does involve recording other park visitors unbeknownst to them and without their explicit consent. If a member of the public sees someone else recording, they can freely decide to remove themselves from the footage. However, with the research's decision to use camera glasses, it removes transparency and the agency of others in the public domain. The reason that this methodology has been chosen despite the privacy implications of the technology is that the researcher and advisors have weighed the ethical considerations against the requirements of the research. The technology has been chosen because: the conditions of everyday, ecological conditions were of high priority for this study. The goal was to gather data about participants' thoughts, undisturbed by experimental conditions. To examine fleeting psychological processes as well as the fleeing conditions of the landscape, it was important that the camera be discrete, both from the public and for the participants. This became especially evident after the participant from Pilot study 2 expressed distraction and distress as a result of the more-visible GoPro Camera. She also reported the perceived alteration of other peoples' behaviors in response to the camera. In effect, the visible camera served to disturb the validity of her thoughts during a nature experience, and it also altered the validity of the experimental scene. Instead, the technology of the camera glasses allowed individuals to walk with less distraction, closer to an everyday non-experimental walk, and several reported this to be the case during their interviews. Another reason this technology was deemed ethical was that the footage was used within this experiment and not after. All data was kept on secure servers (personal external hard drive only), and all data after analysis was deleted. Another reason is that members of the public themselves are not the subject of the study. They are instead part of the ecology of the place. If members of the subject were unwittingly being examined as subjects, the ethical equation would be different. Images of park visitors that appeared in any published research materials were obscured and anonymized.

2.4. Participants

Participants for the main study and pilot study 2 were selected from a convenience sample within Malmö, a city of 350,000 people in southern Sweden. The participant for pilot study 1 (n=1) was a female, 35 years of age and an acquaintance of the experimenter. The participant for pilot study 2 (n=1) was a 29 year old female, who

was recruited via snowball sampling and was unknown to the researcher prior to the study.

For the full study (n=13), participants were recruited via social media & snowball sampling. They volunteered after the experimenter advertised the study online in the following locations: on two Facebook groups for area residents who speak English, an online women's network, and an online queer network. Others were recruited via snowball sampling; however, only participants who were not previously known to the experimenter were eligible for the study. Ages ranged from 26 to 69 and the median age was 34 (see Table 1). Care was taken during recruitment to keep participants unaware of the study's aims, such that the study was advertised as exploring "user experiences in urban green spaces," so that mind wandering was not impacted by introspection regarding the process. All participants had some familiarity with the place. However, familiarity varied between very much (one participant's workplace was adjacent to the park), and little (had been once or twice).

Participants were randomly divided into groups: group 1 or 2. Group 1 walked a loop counter-clockwise through the park. Group 2 walked a clockwise loop.

Table 1. Participant demographic statistics. Group 1 walked a loop counter-clockwise through the park. Group 2 walked a clockwise loop.

Participant Number	Group	Age	Gender Identity	Recruited Via
1	1	26	genderqueer	snowball
2	1	32	female	snowball
3	1	64	male	social media
4	1	37	nonbinary	snowball
5	1	31	male	social media
6	1	34	female	social media
7	2	34	female	social media
8	2	29	male	social media
9	2	43	female	social media
10	2	36	male	snowball
11	2	69	female	social media
12	2	38	male	social media
13	2	33	male	snowball
n	13			
Mean		38.92		
Median		34		
SD		12.47		

2.5. Pilot studies

Two pilot studies were carried out for methodological development. The participant for pilot study 1 (n=1) was a female, 35 years of age and an acquaintance of the experimenter. A GoPro Black7 camera was fitted to the participant's head using an elastic strap. Video for the entirety of each participants walk was recorded using 2.7k resolution at 16:9 frames per second. The camera also recorded sound. The participant was not informed of the purpose of the walk. An approximately 25-minute walk through an urban blue-green space known as Slottsparken (Malmö, Sweden) was shown to the participant on a printed map. To avoid mental clutter, the participant was told to follow the loop through the park without focusing on "correct" directions or worrying about exactly where and when to walk. After the walk, the participant and researcher entered a public library, and the participant was given instructions for the video playback and survey. The participant watched the entirety of the video. They were told to press pause each time they remember their mind wandering. For each pause, data points were recorded via survey. These data points included a timestamp, location of mind wandering episode, brief description of mind wandering episode, intensity of mind wandering, temporal orientation of mind wandering (past, present, or future), and environmental measures of perceived restorativeness. Following the video-survey, the participant was interviewed to gather qualitative data on certain intense mind wandering experiences. And finally, the participant was asked to provide reflections about the methodology.

Results of the pilot study were mapped, visualizing landscape trigger data and temporal data, alongside MW content and intensity (viewable in Appendix 2, Figure A). Results indicated that mind-wandering could be shown to occur in outdoor spaces using video-based retrospective experience sampling. Certain environmental triggers were reported to cue mind wandering. Content and dimensions of mind wandering were recalled and reported clearly. The participant reported that video footage was essential for assisting memory recall of thoughts; however, presence of the camera led to mental interference. Both survey and interview proved important for fuller interpretation of the experience. Evaluation of pilot results led to key methodological changes including the shortening of the walk, shortening of the reviewed footage to a smaller segment of the walk, removal of selected variables from survey, and clarification of instructions regarding what constitutes mind wandering.

With procedural changes made, the study intended to move forward to full implementation. A new participant was recruited via snowball sampling and completed the study. However, both quantitative results and interview results indicated that interference about the experiment and the presence of the GoPro camera severely altered the participant's conscious experience. The participant reported 18 MW experiences, but 14 of them regarded thoughts about the experiment or the camera. Interview data indicated distress caused by the camera.

These results were not factored into the full study, and this participant instead became pilot participant 2. This led to changes in experimental design. Importantly, the GoPro camera was replaced with camera glasses that discretely record video and audio footage (see "Materials," section 2.7).

2.6. Location

An urban blue-green space setting was chosen because of the original goal of understanding how creative thought might benefit from nature contact. As it likely was for artist David Wojnarowicz, nature contact provides both restoration from urban stress and mental fatigue. This likely coincides with cognitive creative benefits, and researchers believe mind wandering could be central to this. Little is known about how mind wandering occurs in urban green or blue spaces (Williams et al., 2018), whether it occurs only during longer experiences in environments of certain higher qualities.

In the urban context, blue and green spaces can provide benefits to large numbers of people who rely on creative thought for their work or spirit. Nature-based strategies present solutions for problem solving, brainstorm ideas, fighting writer's block, dreaming (Singer and Barrios, 2009; Higgins and Wattchow, 2012; Plambech and von den Bosch, 2015). Nature contact ranging from potted plants to deep wilderness has been shown to benefit various measures of creative thought (Shibata & Suzuki, 2004; Atchley et al., 2012), and mind wandering might contribute to that (Williams et al., 2018). But cities in their own right contribute to creative ideation as well. Diverse populations of people flock to cities for the opportunities they present, which facilitates mixing of ideas. Alternately, people flock to specific urban centers to be exposed to new ideas and become inspired by them (Lehrer, 2012). Urban systems research has shown that bigger cities generate more innovation, and rates of patents for new ideas rise in a superlinear way as the populations of cities grow (Bettencourt et al., 2007).

Yet, such growth and densification in the urban environment comes at a cost for individual health and, notably, psychological health (Bakolis et al., 2018). In addition, urban economic, spatial, or social challenges might exacerbate the challenging mental and emotional difficulties of making art (Nettle, 2006). Spatial and environmental constraints of urban life have been associated with health effects. Urban environments show higher rates of mental illness including mood and anxiety disorders (Peen et al., 2010). It has been shown repeatedly, however, that within cities, those with greater access to green and blue spaces fare better psychologically. This either coincides with or is exacerbated by reductions in greenspace, especially for those in the densest and most impoverished situations (Mitchell and Popham, 2008). People living nearer to greenspace, irrespective of

social or economic class, have been shown to have better mental health measures. Kaplan (1995) discusses how cognitive depletion, fatigue of attention, and high task demand of averse stimuli are often found in urban daily life, and proposes that natural stimuli can help restore those cognitive capacities. Urban green spaces have been shown to improve working memory (Berman et al., 2008). If cities are by nature creative places but are also problematic for mental health, then greenspaces could pose one important setting affording both mental health benefits and creativity benefit.

The study took place in an urban blue-green space located within the city center, less than 800 meters from the central train station. The study space officially consists of two adjoining parks – Kungsparken and Slottsparken (henceforth referred to as Slottsparken) – measuring a total of 29.4 hectares incorporating walking paths along ponds, canals, footbridges, open grass fields, birch forest, ornamental tree stands, community gardening plots, public art installations, cafés, and various historically significant buildings, including a 16th century castle and 19th century windmill (Malmö Stad, 2023a,b). Immediately surrounding the park are roads with up to four lanes of car traffic, cycling paths, housing units of medium and high density, as well as offices, commercial locations, and light industry.

The parks are among the oldest public blue-green spaces in Malmö, designed and built in the late 19th century in spaces freed by the demolition of the old city's fortifications (Bucht, 1997). They followed the era's trends of promenade parks in Europe, England, and the US, in which ideas of naturalness were influenced by popularized transcendentalism, thus the design of forest parks and landscape gardens that prioritized nature-based growth over architectural-based constructions. The large landscape parks were built in part to provide workers and their families in increasingly densifying industrial cities contact with nature. In the densest smoke-filled cities, these parks became known as the "lungs of the city" (Bucht, 1997). The perspective marked an early view of health-promoting outdoor landscapes (Connell, 2005). However, much has been written since about the moralistic goals that motivated this landscape philosophy – these public spaces were often advocated and designed by social reformers to pull worker behavior towards nobler pursuits than alcohol consumption. This "rational recreation" movement advocated for the creation and use of parks in order to "re-create" the mind, and evidence has been found for such a philosophy in Sweden at the time as well (Bucht, 1997).

For this study, Slottsparken's design (which still maintains its configurations from the 1870 plans) offered a degree of variability between homogeneity and heterogeneity that could provide some basis for landscape analysis. Certain distinct

zones offered qualities that have been identified to hold attention in a soft way and which might encourage mind wandering.

The exact path of the walk was chosen based on site characteristics, time requirements, ease of navigation, pilot studies, likelihood of mind wandering based on previous research and site visits. Site characteristics prioritized included variation between homogeneity and heterogeneity, coherence, softly-fascinating elements, and simple wayfinding (Williams et al., 2018).

After the two pilot studies, a looped path of approximately 1.6 km that could be completed in roughly 20 minutes was chosen. Then, for analysis, the park was divided into four zones (see Figure 2), which aimed to create a demarcation of landscape variation for analysis. These zones were drawn after the experience sampling was carried out. Factors motivating the zone boundaries were: observations of spatial characteristics from site visits, clusters of MW reports

Figure 2. The four zones of the urban blue-green space. Photographs by the researcher.

mapped onto the space; and consultation of a previous landscape analysis that measured restorative elements of Slottsparken (Johansson & Jakobsson, 2023).

Hypothesis after the site visits and examination of literature was that mind wandering would occur most in Zones 1 and 4. Both are gravel paths entirely lined by water. Zone 1 is a straight path that follows the castle moat waterway. The sight line is dominated by a large grass-covered rampart, which is a noticeable topographical shift in the context of the primarily flat park. Beyond that is the red brick wall of a large museum. The path slopes down into the moat through grass and aquatic reeds that grow at the water's edge. Reeds line the other side of the moat as well. In addition, Zone 1's straight path is screened along one entire side with a tall hedge, which heightens the characteristic of being away. Walking along such a linear, screened path, accompanied by the softly fascinating elements, could potentially engage some exogenous attention while still leaving room for other thoughts.

Zone 4, which follows a path along a large pond, has similarities to Zone 1. Its path is more meandering and interspersed with some larger trees or small stands of them, creating a bit more mystery, but perspective is vast as it looks out onto a large lake with a fountain, ducks, and geese. It is more open than Zone 1 in many parts, surrounded on both sides by expanses of water and grass field. This gently meandering path with moving water, bird life, and a long vista could engage a bit more exogenous attention but still leave room for other thoughts.

Zones 2 and 3 were hypothesized to result in less mind wandering, since they incorporated more complexity and more elements that might command more exogenous attention. Zone 2 sits at the edge of a large community garden with vegetable plots, seasonal flower plots, other small gardens, a popular café and an insect hotel. On the other side of the path in Zone 2 is a large open grass field, in front of which a historical windmill from the mid 1800's stands prominently. Then, there is the miller's cottage, and cottage garden with ornamental fencing. Zone 2 was hypothesized to command the most exogenous attention and therefore leave less room for the mind to wander.

Across a footbridge and over a canal is Zone 3. It is the area most interspersed with trees, punctuated by small groves of conifers that create a distinct sense of space while still allowing a feeling of openness. These trees open up to the water of the large pond beyond, creating a sense of prospect and refuge through the trees. Through this zone, four separate paths converge. At the center of this zone is a bronze sculpture of a boy standing with three geese, one of whom looks threatening. Zone 3, with both complexity and softly fascinating elements, was hypothesized to command more exogenous attention than Zones 1 and 4, but leave more room than Zone 2 for thoughts to wander.

2.7. Materials

During their walks, participants wore camera glasses that recorded video and sound from the entirety of the walk. The SpyglassPro camera glasses, product number ps2-g3000-dvr, produced by the company Prylstaden, have the appearance of average, black-rimmed prescription lenses, but with a five megapixel video camera built into the nose bridge of the frame. The glasses record with a resolution of 1920x1080, a frame rate of 30 frames per second, and a viewing angle of 92 degrees. The camera glasses also captured audio using a single audio channel with bit rate of 512 kbit/s and sampling rate of 32kHz. Upon returning from the walk, recording was stopped and the experiment moved indoors to a PC computer within Malmö City Library. The glasses were connected to the computer using USB cable, and footage was viewed on Windows Media Player with over the ear head-phones. The video was screened on one-half of the 53 cm monitor, while the other half of the screen was taken up by the survey, which was hosted by the online survey provider, Netigate Feedback.

Before the walk, participants were shown and given a full-page color map printed on A4 paper. The map highlighted the suggested walking route overlayed onto a satellite-image downloaded from Google Earth.

2.8. Procedure

Each participant arrived at a pre-scheduled time slot between 9 in the morning and 4 in the afternoon and signed a document of informed consent. Each was told that the goal of the study was to examine “user experiences in urban green spaces”. Each was told that they would take an approximately 20-minute walk through the park while wearing camera glasses, followed by a survey based on their footage, interview, and debrief. A 20-minute walk was chosen in following Macaulay et al. 2022. Each was introduced to the camera glasses, told that footage was recorded to an internal storage card and not viewed live by external parties, asked about comfort wearing them and recording the environment. Each was shown a map of the park with the suggested route highlighted. It was made clear that the route was suggested, and deviations from the route were acceptable. (So that wayfinding did not occupy directed attention). Directions were to “walk through the park as you would if you were walking on your own.” The only explicit request was to not look at mobile phones if at all possible. Group 1 walked counter-clockwise, and group 2 walked clockwise.

Upon completion of the walk, recording was stopped, and the procedure continued indoors in the Malmö City Library. Participants sat at a PC, camera glasses were connected via USB cable to the computer, and footage of the walk was played on the left half of the screen on Windows Media Player. On the right half of the screen was a window with the experience sampling survey. The survey introduced participants to the aims of the study: measuring the times when thoughts drifted away from the environment and inwards, towards your own thoughts, the times that the mind wandered. The survey stated that video footage was to help remember where the mind was during the walk. Participants were instructed to pause the video when they remembered mind wandering. Each time video was paused, participants took a survey which recorded: video timestamp of MW report, very brief description of MW content, the cue (if there was a cue in the environment that triggered mind wandering), intensity of MW experience (Likert 1-7), emotional valence of MW experience (Likert 1-7), whether the thought concerned the past, present, future or a combination (select all that applied), whether the thought concerned the self, others, both or none, whether the thought took the form of internal chatter (Likert 1-3), whether the thought took the form of mental imagery (Likert 1-3). Opportunity to ask the researcher questions at any point was provided.

After completion of experience sampling for the 8-minute video segment, a semi-structured interview was conducted with the participant, asking participants to choose two mind wandering experiences and describe the progression of each in greater detail, from start to finish. The interview also asked if participants' conscious experience varied beyond attention towards the environment and mind wandering. Finally, the interviews gauged faithfulness of the method, whether memory was perceived as accurate, whether video helped trigger memory, and to what extent the experiment altered the experience of a walk in the park. The final part of the interview regarded methodology evaluation to assess whether participants thought that the study accurately captured the conscious experience that occurred on their walk, whether they could remember mind wandering accurately, and whether the contents of their thoughts during the study would accurately represent the content of their thoughts on a normal walk.

Only eight minutes of each participant's walk was played back for experience sampling. This allowed for an initial buffer period that would not track thought content as participants settled into the beginning of the walk. Eight minutes allowed for a clear data window but also reduced the entire procedure time to one that was practical and accessible for participants. Beginning and ending points for the 8-minute segment was determined by finding footage location of one landmark in the park and assessing how far the person had travelled from that place 8 minutes. A judgement for where to place the 8-minute window was made based on the greatest possible overlap with the 4 landscape zones. Because of this and because participants were given freedom of movement, the path of the 8-minute window

does not overlap evenly for all 13 participants. The total distance of the 8-minute study window measured 678 meters, from the first-reported MW to the last; however, participants covered a variation of distances during that time.

The experience sampling survey was based in the following research. Faber and D'Mello (2018) gave instruction for collecting MW trigger data by incorporating phrasing that assured participants it could be left blank if no triggers were associated with the MW. Questions about the content and form of MW thoughts were adapted from Gorgolewski et al.'s (2014) research, which identified distinct dimensions around which MW episodes clustered. They categorized MW thought content into: social cognition (thoughts about self, others, or both), temporality (past, present, or future episodes), emotional valence, intensity, and form (imagery vs. verbal thought). These categories are often then further analyzed to assess covariation or the functional outcomes of mind wandering (Smallwood & Schooler, 2015).

Figure 3. Map of study site, with suggested route outlined in pink. Annotated by the researcher, adapted from Google Earth. Map data Copyright 2023 by Google. Reprinted with permission.

2.9. Data Process

After each experimental session, video data was stored on an external hard drive. Experience sampling data was held online by Netigate and then moved to external hard drive.

After each participant's visit, familiarization with data began. Survey and video data were assessed side-by-side, along with a Google Earth map of the park. Each mind wandering report was entered into the map in the following way: first, the location of the mind wandering was found by connecting the survey-based timestamp of MW report with the timestamp on the video. The exact location was triangulated using the survey-based entry for MW trigger. (Ex: if MW was triggered by reddish twigs at 11:48, they were searched for in the footage around 11:48. The person's location in the landscape could be determined based on the trigger and surrounding areas.). When the exact location could be determined, the person's location in that moment was marked with a placemark on the map. Attached to each placemark was a window describing that MW report, including all survey data for that MW response, as well as a screengrab of the participant's perspective of that moment. Finally, in that window, notes were added regarding landscape characteristics, ecological conditions, and relevant behavioral observations from video footage. Survey data was also imported into an Excel spreadsheet for further familiarization and basic processing.

Triggers were categorized according to the primary subject of the trigger scene identified in ES, thus "the guy taking a picture of the sculpture" is placed into category "triggered by other person or people."

Interviews were transcribed and notes were taken alongside the transcription regarding potential initial thematic coding. Relevant details from interview reports of MW episodes were also added to the placemark on the map file for reference.

Experience sampling reports that did not fit within this study's defined criteria for mind wandering were removed. These 12 MW reports included interfering thoughts about the experiment as well as external distractions. Experimental interference was removed when the thought content concerned the experiment and did not carry into other concerns. These can be categorized as "task-related interference" and are similarly removed in other experience sampling designs (Pelagatti et al., 2020; Maillet et al., 2017). External distractions were distinguished from MW episodes, following Pelagatti et al. (2020): "The MW episodes triggered by external stimuli could be distinguished from external distractions, as participants were not focusing their attention on the external stimuli, but they were thinking about private thoughts and feelings, including autobiographical memories/future plans and simulations, that were prompted by an external stimulus" (p.11). In some cases, this was obvious, such as the concurrent reports, "I like dogs…this is a little one though," followed seconds later by "this is a big dog…too big." In other cases, what seemed like environmental distraction in the survey results was later revealed

to have entered more complex depths during interview results. For this reason, only the most obvious cases were removed for being "environmental distractions."

2.10. Analyses

Quantitative data was analyzed using SPSS version 29.0 for both descriptive and inferential processes, including with a Spearman's Rank Correlation and Univariate ANOVA analyses. Qualitative interview data was analysed thematically, with a deductive semantic approach. Spatial data was assessed using video-stills, cartographic analysis, and site visits.

2.10.1. Methodological Development

The development of methodology used a qualitative, abductive approach incorporating both theory and empirical practice to develop, test, refine, re-test, and further refine methodology. The analysis of data informing this process was reflexive in its interpretation of the data, since the data involved quite individual perspectives and since the employment of the methodology (its setting, time constraints, etc), required a flexible approach (Alvesson & Sköldberg, 2009).

The data analyzed included: literature, pilot studies, the empirical study, and participant interview questions that were geared specifically towards methodological development. While the literature, pilot, and empirical studies formed the development of the method, the participant interviews provided important data about instrument fidelity. Analysis of interview data took a thematic approach to categorize responses into themes.

A perspective of critical reflexivity was important for the entirety of the methodological development, for emphasizing ecological validity, and notably for interview approach and interview analysis. For approaching the interviews, the researcher maintained careful awareness that consciousness is fleeting, ephemeral, subject to influence, and individual (Alvesson & Sköldberg, 2009; Byrne, 2022).

2.10.2. Descriptives

The research first descriptively assessed how mind wandering occurred in the landscape. This included questions of where and when MW occurred within the blue-greenspace, as well as the content of the mind wandering that occurred there.

- Quantity of MW reports: MW survey data was analyzed using SPSS to calculate frequencies of MW reports per participant, including mean, median, and standard of deviation.

- Content and form of thought: MW survey data was analyzed using SPSS to calculate frequencies and percentages for temporality of thought content (whether the MW episode concerned the past, present, future); social cognition (whether the MW episode concerned the self, others, or both); and form of thought (image-based/verbally-based). Then, MW survey data was analyzed using SPSS to calculate frequencies, mean, median, and *SD* of valence and intensity of MW episodes.
- Descriptive visualization of spatial data, using Google Earth to plot each MW episode alongside descriptions of those episodes and image-based screenshots of landscape trigger scenes. Each mind wandering report was plotted onto Google Earth as a unique pin. Location for each pin was determined by matching the time-stamp as provided in the survey with the scene displayed during that time stamp in the video footage (see sec. 2.8: data processing), and, if necessary, triangulating it with ES trigger information. Linear distance of zones was measured using Google Earth's "measure distance and area" tool. With the camera at a height of 450-500 meters, the distance of each zone was measured from beginning to end. Two decimals were recorded for this "Zone distance" measurement.

2.10.3. Explorative inferential statistics

Next, with an explorative lens, the research examined how certain environmental conditions related to mind wandering and its contents. These more complex analyses were chosen as much for the purposes of methodological development as they were for empirical exploration. The analyses served to test efficacy of the newly-developed method and to inform the development of the methodology in the future. The analyses were chosen in order to demonstrate specifically whether the new methodology could collect data that could be used in more complex analyses incorporating more participants and data points in the future. This included questions of how time in nature related to increased frequency of mind wandering, as well as how environmental characteristics related to emotional valence of mind wandering.

- Using SPSS, Spearman's Rank Correlations were calculated for each participant to assess relationship between time and quantity of MW reports. To assess the relationship between time spent in the UBGS and occurrence of MW, a Spearman's rank correlation was analyzed for each participant. The two variables analyzed for each participant were each second of the 8 minute timeline (n=481 seconds) and quantity of MW reported along that timeline (yes/no categorical variable). In addition, Spearman's rank correlations were performed to assess the relationship between all 59 mind wandering reports together across a single 8-minute timeline, as well as those

of group 1's walk and group 2's walk; acknowledging importantly that internal validity could be biased by a within-participant effects.

- To calculate frequency of mind wandering reports per zone, the following analysis was used. The frequency accounted for the fact that certain zones had fewer participants, since route was suggested and not the same for each participant.

$$MWfrequency = \{[(nMWreports \ / \ nParticipants) \ / \ distancemeters] * 1000meters \}$$

First, linear distance of zones (*Zonedistance)* was measured using Google Earth's "measure distance and area" tool. With the camera at a height of 450-500 meters, the distance of each zone was measured from beginning to end. Two decimals were recorded. Then total MW reports within that zone (*nMWreports)* were summed by consulting place markers on the map. Total number of participants who walked in each zone (*nParticipants)* was summed by consulting video of each participant's walk video. If number of participants varied within a zone, separate *MWfrequency* equations were calculated within each zone, and final *MWfrequency* for the zone was mean value of all *MWfrequency* values in that zone.

- Environmental trigger data were the cues in the external environment that ignited mind wandering. Thematic analysis was used to categorize this data. Trigger data had been entered by participants as qualitative data in a blank text box that asked whether there was something in the environment that triggered MW. This data was then analyzed thematically by the researcher into the following categories based on primary reported environmental triggers.
- Then MW survey data was analyzed using SPSS to calculate mean, median, and *SD* values of MW valence for each trigger category. Finally, a block design one-way ANOVA in SPSS was run to assess whether valence values differed significantly depending on landscape triggers. The analysis blocked the effect of individual participant trends on valence.
- Using SPSS, a general linear model with interaction was created to compare the effect of landscape triggers on emotional valence of MW, with a block on the individual effects of participants on valence.
- Then MW survey data was analyzed using SPSS to calculate mean, median, and *SD* values of MW valence for each landscape zone. Finally, a block design one-way ANOVA in SPSS was run to assess whether valence values differed significantly depending on which landscape zone MW occurred in. The analysis blocked the effect of individual participant trends on valence.

2.10.4. Qualitative analysis

Finally, the research zeroed in on one participant's walk, to examine how mind wandering unfolded across a single nature experience for one individual. This analysis took a reflexive qualitative approach in consideration of mixed data that included interview data, experience sampling reports, and video footage. With an experiential orientation, the analysis to illustrate how mind wandering was experienced by the participant. Its goal was to illustrate physical and mental wanderings, to provide depth of context to the empirical results, and to elaborate upon the transitions between mental states during movement through the blue-green space. The view towards transitions was informed by Christoff et al.'s (2016) framework for spontaneous thought. The section also addressed some aspects of the adequacy of the novel video-based experience sampling method. The critical reflexive approach provided a degree of contrast to the quantitative analyses in its deeper description of one individual's experience (Alvesson and Sköldberg, 2009).

Analyzed were interview data, survey data, written response data, and video data. The analysis took an abductive approach in analyzing patterns from across all data sources, starting with familiarization of the quantitative and video data as it was entered into the site map along with the other participants. Then this participant's interview was transcribed and considered alongside quantitative data. Process was taken from thematic analysis. Codes were generated identified first for the participant's thought content. Then, codes were generated for thought movement. After initial codes were formed, themes were developed and reviewed again next to the raw data. Finally, themes were finalized (Byrne, 2022). In order to clearly illustrate the phenomenon as it was experienced by the individual, the reporting of the results took a narrative approach.

The participant was chosen for thematic analysis because of richness of data and ability to communicate succinctly about internal conscious states and the external environment. They were not chosen as a way to illustrate mind wandering as it occurred across the entire study, but instead as a way to illustrate the potentiality of mind wandering within one experience.

3. Results

The methodology allowed data from 59 mind wandering experiences to be systematically collected and assessed. It revealed that the mind wandered readily for most subjects (*min* = 1 MW report, *max* = 8 MW report), spread across most of the study area. Participants reported that the largest percentage of thought content related to the present, followed by the past then the future. Emotional valence of MW content was slightly positive, averaging 4.65 (*SD* = 1.45) out of 7. Intensity of MW content was generally rated neutral, averaging 3.93 (*SD* = 1.42) out of 7. Participants reported both word-based and imagery-based episodes of MW, which concerned both the self and others.

Possible relationships between the nature experience and mind wandering were analyzed exploratively. Correlation analysis between time and frequency of MW showed a significant positive correlation for only one participant. For landscape zones, more complex zones enclosed with a variety of different landscape components seemed to coincide with more mind wandering reports than zones that were open and more uniform. Next, environmental triggers of MW were categorized and analyzed. Other human park visitors triggered the most MW episodes, followed by buildings, vegetation, birds, then park hardscape. Concluding the quantitative empirical study, two ANOVAs with a block design were run to assess relationships between landscape categories and valence of MW. One of these analyses dealt with the relationship between landscape trigger categories and MW valence, blocking for effects of participants. The second of these analyses dealt with the relationship between landscape zones and MW valence, blocking for effects of participants. The analyses found no significant associations. The trigger category corresponding with the highest mean MW valence scores was vegetation, while the category corresponding with the lowest mean MW valence scores was other humans. The landscape zone corresponding with the highest mean MW valence scores was zone 1, which was a more open and uniform zone along the water and had lower frequency of MW. The landscape zone corresponding with the lowest mean MW valence scores was zone 3, which featured a high degree of legibility and complexity.

In-depth qualitative analysis of one participant's experience illustrated the diversification of thoughts during the short span of the study period, especially via spontaneous memories.

Thematic analysis of responses to participant interviews was performed to assess ecological validity of the novel methodology. Results showed that the video-based methodology gave participants access to mind wandering experience that they had previously forgotten, indicating that the methodology successfully allowed the train of thought to come and go naturalistically before being recalled during experience sampling. Interviews revealed some interference in the form of disturbance from the glasses or the act of experimental recording. Some participants reported being more observant during the walk than they otherwise would have, indicating another degree of experimental interference. Finally, the interviews often discussed an "in-betweenness" or blurriness of thought that was difficult to categorize during which the mind was neither focused externally on the environment nor fully wandering.

3.1. Explorative empirical study

3.1.1. How did MW occur in the blue-green space

Every participant reported mind wandering during 8-minute test period of the urban blue-green space walk. In total, all 13 participants reported a combined 59 valid mind wandering experiences. This results in a median of 4 mind wandering experiences per participant (Table 2). One participant reported as few as 1 valid MW report, while another had as many as 8 MW reports. (*SD* = 2.17).

Table 2. Mind Wandering reports per participant

	Participant number	Group	Quantity of MW reports	Valid Percent of MW reports
	1	1	3	5,1
	2	1	4	6,8
	3	1	7	11,9
	4	1	7	11,9
	5	1	5	8,5
	6	1	7	11,9
	7	2	2	3,4
	8	2	8	13,6
	9	2	3	5,1
	10	2	3	5,1
	11	2	3	5,1
	12	2	6	10,2
	13	2	1	1,7
n	13		59	
M			4.54	
Mdn			4	
SD			2.17	

Spatially, mind wandering occurred across much of the study area, with some locations experiencing higher frequencies than others and some small gaps in which no mind wandering was reported (Figure 4). The total distance of the 8-minute study window measured 678 meters, from the first-reported MW to the last; however, distance varied for each participant.

Figure 4. All 59 mind wandering reports plotted across annotated map of study site. Each pin represents one mind wandering report. Colors correspond to participants. Text corresponds to participant number and number of MW report (Map Data: Google, Copyright 2024). Reprinted with permission.

3.1.2. Descriptive analysis of content of mind wandering

Mental time travel

Did participants experience "mental time travel" qualities of mind wandering, that is, did their thoughts stray away from the present and into the future or past? If so, where did it go? The greatest proportion of thoughts were based in the present: 30.2% (n = 13) of mind wandering episode reports were thoughts based in the present. 18.6% (n = 8) of reports were thoughts based in the past. 11.6% (n = 5) of reports concerned future based thoughts. The remaining reports concerned a mix of

time periods, or participants could not say. 11.6% (n = 5) of reports concerned the past, present, and future. 9.3% (n = 4) of reports concerned the future and present. 9.3% (n = 4) of reports concerned the past and present. 4.7% (n = 2) of reports concerned the future and past. And participants were unsure in 4.7% (n = 2) of the cases. Total reports (n = 43). Data visualization shown in Appendix 2, Figure B.

Emotional valence and Intensity of MW content

Participants were asked to report emotional valence of MW on a 1-7 Likert scale (1 being the most negative and 7 being the most positive) and intensity of MW episode on a 1-7 Likert scale (1 being the least intense and 7 being the most intense). Average valence of MW was 4.65 (SD = 1.45). Average intensity of MW was 3.93 (SD = 1.42). Total reports (n = 43). Data visualization shown in Appendix 2, Figure C.

Social cognition

The survey asked participants whether the mind wandering episode concerned the self, others, both, or was unclear. In the greatest proportion of responses, thoughts involved both the self and others. 59.5% (n = 25) of MW reports involved thought content about the self and others. 16.7% (n = 7) of MW reports involved thoughts about others only. 14.3% (n = 6) of MW reports involved thoughts about the self only. In 9.5% (n = 4) of reports, participants were unsure. Total reports (n = 42). Data visualization shown in Appendix 2, Figure D.

Image-based thought content

The survey asked participants to what extent MW took the form of mental imagery. In 33.3% (n =14) of reports, MW took the form of mental imagery. 14.3% (n =6) were not imagery. 45.2% (n =19) were reported to be a mix. 7.1% (n =3) of reports could not be determined. Total reports (n = 42). Data visualization shown in Appendix 2. Data visualization shown in Appendix 2, Figure E.

Verbal thought content

And finally, in contrast to image-based thought, the survey asked participants whether mind wandering took the form of verbal chatter, such as internal speech. In 23.3% (n =10) of reports, MW took the form of verbal chatter. 20.9% (n =9) were not verbal chatter. 51.2% (n =22) were reported to be a mix. 4.7% (n =2) of reports could not be determined. Total reports (n = 43). Data visualization shown in Appendix 2, Figure E.

3.1.3. Correlation analysis between MW reports and time spent in the urban blue-green space

The study then evaluated what effect time spent in the greenspace might have played on frequency of mind wandering. On the whole, there was no statistically significant relationship between time spent in the urban blue-green space and MW reports; however, the analysis indicated some weak trends. After Spearman's rank correlations were run for each participant, there was a positive correlation between time and MW for 9 of 13 participants; however, only one participant's positive correlation reached statistical significance, while none of the negative correlations reached statistical significance (Table 3).

Table 3. Spearman's correlation between time spent in the park and MW reports

	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	Participant 6		Group 1	
r	0.01	0.03	0.05	0.08	0.06	-0.02		0.09	
Sig.	0.397	0.252	0.127	0.039	0.080	0.304		0.024	
df	479	479	479	479	479	479		479	
	Participant 7	Participant 8	Participant 9	Participant 10	Participant 11	Participant 12	Participant 13	Group 2	All participants
r	-0.03	0.01	0.00	-0.04	0.04	0.01	0.02	0.01	0.07
Sig.	0.230	0.416	0.465	0.210	0.194	0.394	0.300	0.446	0.063
df	479	479	479	479	479	479	479	479	479

When examining all participants together, the positive correlation reached r(479) = 0.07, with a significance of $p = 0.063$ (acknowledging validity might be affected by within-participant effects). When examining Group 1 together, the positive correlation reached r(479) = 0.09, with significance of $p = 0.024$ (acknowledging validity might be affected by within-participant effects). When examining Group 2 together, the positive correlation reached r(479) = 0.01, with a p-value of 0.446 (acknowledging validity might be affected by within-participant effects). This indicates some level of positive correlation between time spent in the UBGS and occurrence of MW, though the analysis did not reach statistical significance.

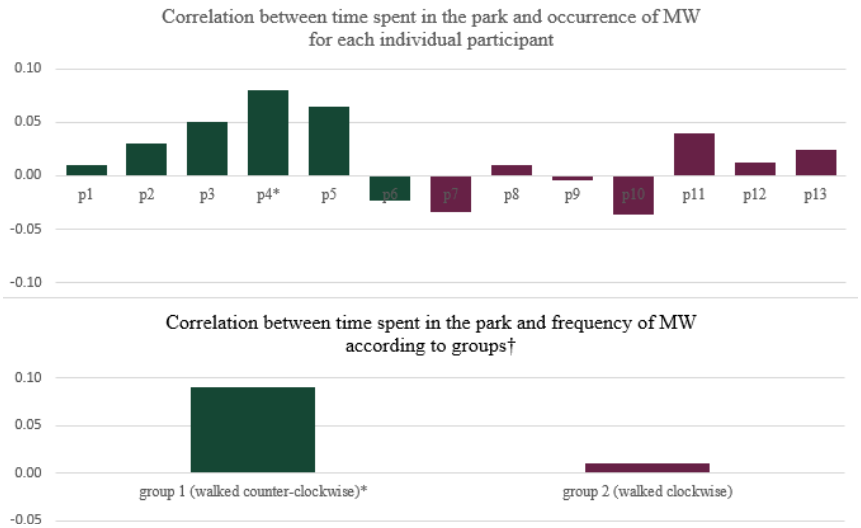
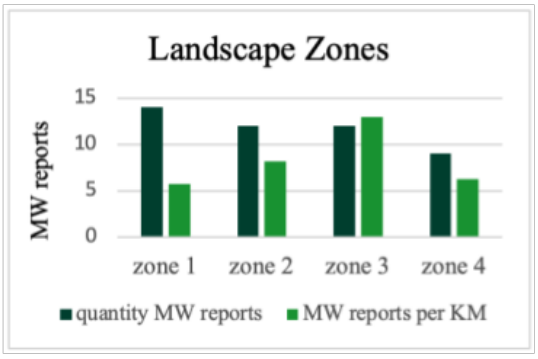


Figure 5. Data visualization of Spearman's correlations for each participant, as well as combined correlations for Group 1 and Group 2

3.1.4. Frequency within landscape zones

Acknowledging that analysis of time data revealed no significant correlation between time and mind wandering reports, the analysis turned to the spatial influences of mind wandering. In which zones of the space did MW most frequently occur? The analysis revealed that Zone 3 contained the most mind wandering, followed by Zone 2, when factoring the number of mind wandering reports with the length of the zone in meters and the amount of people who walked there.



	Quantity MW reports	MW reports per km
Zone 1	14	5.73
Zone 2	12	8.34
Zone 3	12	13.09
Zone 4	9	6.28

Figure 6. Demarcated zones of the blue-green space with mind wandering reports shown in each zone, accompanied by data visualization of MW frequency within each zone. (Map Data: Google, Copyright 2024). Reprinted with permission. Data visualizations show measurements for quantity of mind wandering reports for each zone, as well as frequency calculations that account for variation in participant numbers.

Zone 3 was the area with the most overhead tree-cover. It was a small area surrounded on two sides by water: a canal on one side and a pond on the other. At its center is a bronze sculpture of a child with geese. Zone 2 contained higher

quantities of cultural elements, such as a windmill, a miller's cottage, ornamental fencing, and gardening plots. Zones 1 and 4, which had lower frequencies of MW, were more open, uniform, and natural than Zones 2 and 3 (Figure 7).

Figure 7: Images of each landscape zone. Photographs by the researcher, 2024.

3.1.5. Environmental and emotional valence of MW content

The study then explored the relationship between physical aspects of the blue-green space and the valence of MW content that occurred there. Data analyzed were environmental triggers (categorical variable) and valence of MW (from experience sampling survey) using an ANOVA with blocking analysis. The block accounted for differences within participants.

Environmental triggers of MW were first categorized according to the primary trigger reported in ES data. Trigger descriptions had been entered as qualitative data by participants in a blank text box. This data was then analyzed thematically by the researcher into the following categories based on primary reported environmental triggers (Table 4, Figure 8).

Table 4. Descriptive statistics for frequencies of Primary MW triggers

Trigger category	MW reports	Percent	Valid Percent
Building Structure	12	20,3	20,3
Park Hardscape	6	10,2	10,2
Another Human	15	25,4	25,4
Sculpture	2	3,4	3,4
Dogs	3	5,1	5,1
Water	4	6,8	6,8
Birds	8	13,6	13,6
Green vegetation	9	15,3	15,3
Total	59	100,0	100,0

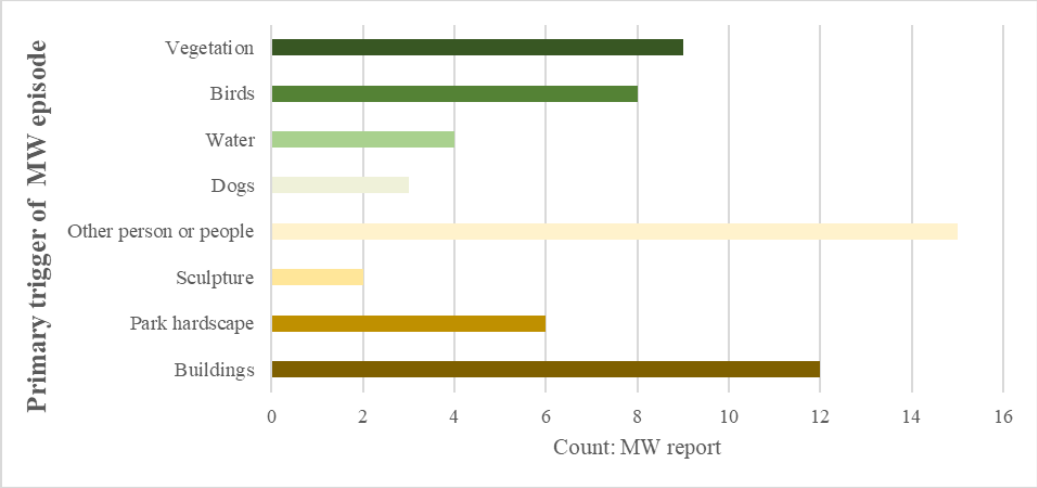


Figure 8: Data visualization of primary triggers of MW episodes. MW "triggers" are the cues in the environment that led the mind to wander.

The study then explored whether emotional valence of MW differed significantly depending on the categories of environmental triggers that cued the MW episode. An ANOVA with a block design was run, which blocked the effect of participants. (F= 1.84 with 6 and 25 degrees of freedom. p = 0.35).

Since $p = 0.35 \geq 0.05 = \alpha$, the null hypothesis is not rejected. There is not enough evidence to conclude that the mean valence of MW content differs among the different landscape triggers of MW (Figure 9).

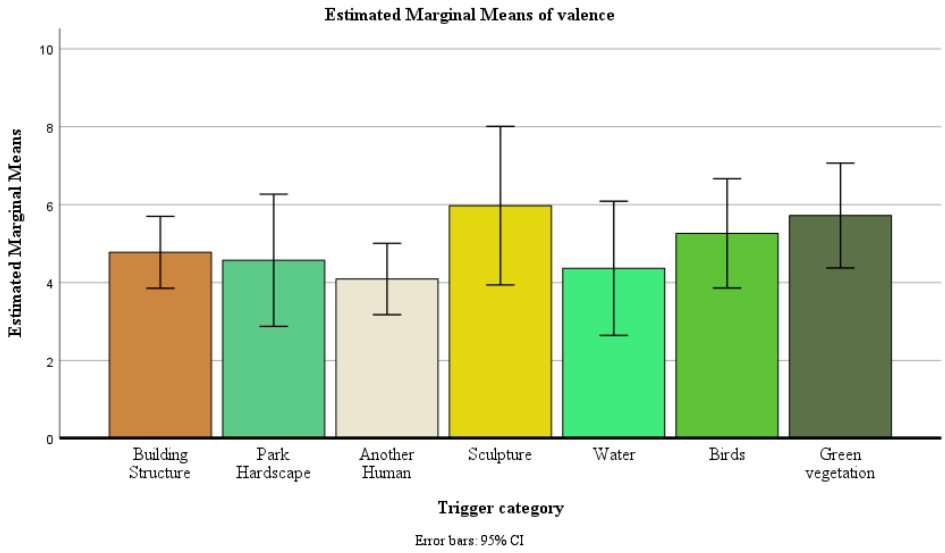


Figure 9. Results of ANOVA with a block design, showing weighted mean values of the valence of mind wandering content for each trigger category.

3.1.6. Landscape zones and emotional valence of the MW content

The study then explored the relationship between the zones of the blue-green space and the valence of MW content that occurred there. Data analyzed were: landscape zones (categorical variable) and valence of MW (from experience sampling survey) using an ANOVA with blocking analysis. The block accounted for differences within participants.

The study used an ANOVA with a block design to calculate whether mean emotional valence of MW differed significantly according to the landscape zones in which they occurred. (F= 0.629 with 3 and 23 degrees of freedom. p = 0.60).

Since $p = 0.60 \geq 0.05 = \alpha$, null hypothesis is not rejected. There is not enough evidence to conclude that the mean valence of MW content differs significantly across the different landscape zones.

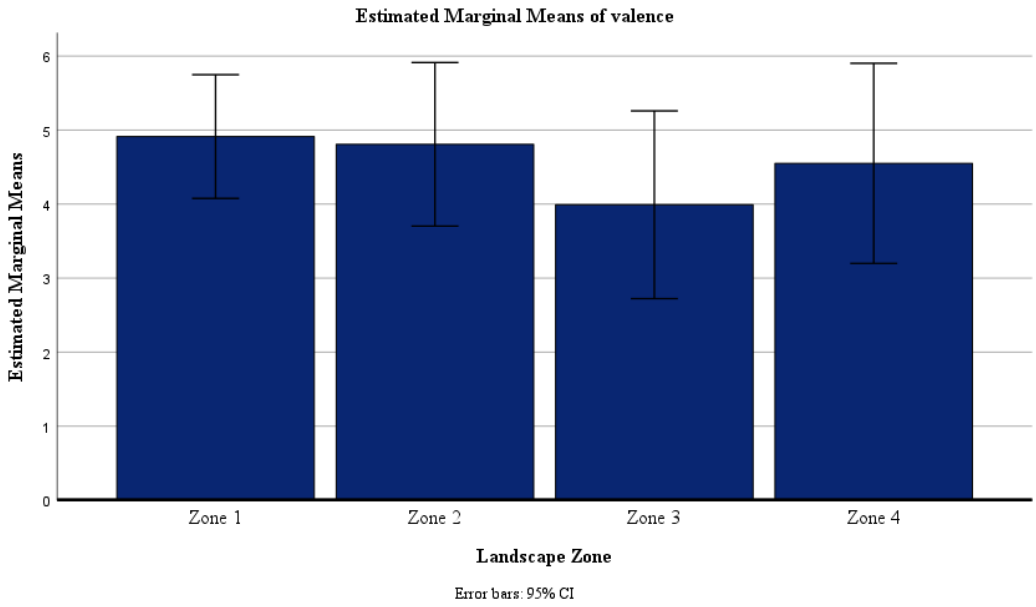


Figure 10. Results of ANOVA with a block design, showing weighted mean values of the valence of mind wandering content for each landscape zone.

3.2. Reflexive qualitative analysis

How did mind wandering unfold across an entire walk? How did the contents of mind wandering shift and change as it occurred through the landscape? To answer these questions, one participant's walk was thematically analyzed, first in terms of its MW content; then in terms of the movement between inward thoughts as they physically moved through the landscape. All data pertaining to the participant was used in the analysis (interview, experience sampling survey, and video landscape data). Identifying details of the participant have been anonymized and "they/them" pronouns have been used in these results.

The participant joined the study on a sunny day in mid-April. The temperature was 8 degrees, and the walk occurred at midday on a Wednesday. Before starting the walk, the participant reported that they had not spent time in the park.

In terms of thought content, the study found primary themes of memory, personal relationships, and adjustment to life in a faraway place. Then, after analysis of movement, the study found themes of progressive diversification of thought accompanied by exposure to salient environmental stimuli. This diversification included diversification of thought content, diversification of emotional valence, diversification of temporal-orientation of thought, and diversification of thought type (from memory to introspection to future planning).

It was notable to see how thoughts moved both within themes and towards different themes throughout the walk. This shifting of thoughts can be highlighted in one fleeting moment in the middle of the walk, after the participant had had three

MW episodes about dating, family relationships, and friendship, which were mostly memory-based and tinged with thoughts about adjusting to living in a place far from their original home. Those reports had been rated slightly negative, slightly positive, neutral, and negative respectively. In the focal point that follows, thoughts shift towards introspection, positive affect, and future-based thought. It occurs near the fifth minute of the test period, as the participant stands on a bridge spanning a canal and two separate landscape zones. The person had just experienced, 50 seconds earlier, their most intense and negative MW episode of the whole walk: a jolting memory of being on a date in that same location years earlier (Before taking the walk, the participant had not realized that the study location was the same location as this date several years before). Now, standing on the footbridge over the water, the thoughts shift again to the past, remembering being on that date and standing in that same place years earlier, right after moving to this new city. This made them think, "Well my dating life has been kind of shit."

However, something occurs that shifts the form and content of the thought, despite it being about the same difficult memory. "I just continued to reflect," they said. "I've been here for three years, how has my life changed." There is a shift to reflection and a reconsideration of the memory, an awareness of the time that has passed, and the contents of the thought begin to broaden.

It is in this very fleeting but introspective moment, intensity decreased from a 6 to a 5. Emotional valence went from negative to slightly positive. Thoughts went from imagery to verbal form. Thoughts shifted to the future for the first time in their walk. From that point onwards, MW was future-based in three out of four occasions until the end of the test period.

Again, regarding this MW episode, it is notable that the subject had such different emotional reactions to the same memory. In a span of only 50 seconds, emotional valence went from a two to a five when rating MW episodes incorporating the same memory. It was also notable considering that that they began the walk with thoughts of dating and singleness, triggered by seeing a swan swimming by itself.

Other parts of the data might indicate how and why they experienced this variation of thought towards the same memory. Earlier in the walk, after the first "slightly negative" thought triggered by the swan, they experienced two mind wandering episodes which showed a broad diversification of thought content. The first was an involuntary memory about walking with a friend, a "slightly positive" memory. The second was another spontaneous memory about their mother and gardening. More complex, it incorporated coping with long distance away from family, as well as thoughts of beauty and gardening associated with her. Triggered by small white yarrow flowers growing low along the water, they said, "That made me think of my mom because she loves flowers and I thought she would appreciate it, being in this beautiful space so much." Thus, it is possible that the diversification

of thought that preceded the bridge reflection played some role in the content that occurred when confronted with this difficult memory.

The analysis shows physical movement through an urban blue-green environment and corresponding movement in spontaneous thoughts. Thought movement is marked by variability and diversity of thought, bound together by a diversity of environmental triggers and movement among them.

Figure 11. Still shots from footage recorded during the walk by the participant while wearing camera glasses. Images depict the participant's gaze corresponding to the moment that mind wandering was reported, for the first five mind wandering reports of the subject's walk. Border colors correspond to emotional valence of MW reports.

A majority of MW reports happened in the more complex and stimulus-rich zones two and three, accompanied by diversification of stimuli. MW was quicker

and more successive in zones 2 and 3, but it was also less intense and emotionally valent. Mind wandering was more spread out in the more-open zone 4.

This analysis covered data regarding 8 minutes of the participant's walk. In some ways, the data shows a dramatic arc and richness of content, especially for such a short amount of time. The 8-minutes accounted for an array of psychological information from a relatively small amount of material. For eight minutes, the subject walked, the subject observed, and the subject thought, and it generated this narrative. Indeed, diversification of thought was identified as a central aspect of the narrative.

3.3. Methodological interviews

Thematic analysis of interviews from both the pilot phase and main study revealed important results about whether the retrospective experience sampling method succeed in measuring a naturalistic outdoor experience for participants, whether the method allowed participants' thoughts to move in an ecologically valid way as they walked, and whether it accurately measured mind wandering experiences.

Data was mixed regarding camera disturbance, with some participants reporting feeling mentally independent from the experiment with zero camera disturbance, while others reported some level of distraction from the camera glasses. The majority remarked that they remembered the glasses in some moments but were able to forget them for most of the walk. The participant with the highest level of disturbance reported being "really aware that everything was being recorded." Others recalled awareness of the glasses in smaller moments, such as when they consulted the map or adjusted their hair from the lens. For other participants, the feeling of being on a "normal walk" was not affected by the glasses, but the walk was made less normal for them because use of other technology was discouraged, such as headphones, smartphones, or stopping to take photographs, and these would be common parts of nature contact for some of the participants.

Five participants said the walk felt different because they were more observant towards the environment. Knowing that a survey would follow the walk, (even if the exact nature of the survey was unclear), they noticed more about their surroundings, including birds. The result of this noticing for some participants was that they spent less time in their heads. "Actually I thought less other thoughts this time, and that might have been because I knew that I was going to fill out the survey afterwards. 'Cause I can make myself really really go into memories," said one participant. Another said "I was constantly trying to pull myself back into the lived experience because I had to remember what I was experiencing," and reported spending less time on internal thoughts as a result. One participant, however, reported that the experiment gave the opportunity to pay less attention to the environment and engage in more fluid thinking."

One unexpected result from the methodology interviews was a common theme of interest and enjoyment from the experiment protocol, especially from the ability to observe one's own thoughts in retrospect. "It was very eye-opening to see my own thoughts from the outside," reported one participant. Another said, "I needed this walk, I'm going to relax. I didn't think that I will *think*. And now when I watched, I see what I was thinking. It was like, all the time, all the moments. So, it's interesting. The brain is working all the time and we don't think about that." Finally another participant was just grateful for a reason to take a walk in the sunny weather.

This aspect of retrospective awareness also applies to the ability of the method to jog memories of mind wandering that had been forgotten by participants. All but one participant (n = 12), as well as one pilot participant, reported that the video playback allowed them to remember previously forgotten internal thoughts. Of the video playback phase, one participant said, "I went into it thinking that I had no moments when my mind wandered. But I found three within the videos, and it helped to jog a couple more." Another participant said, "One thing that was interesting was that I could remember my train of thought in a way. Like I could remember that in *this* thought of the route I was thinking about something like *this.* I could like track it, in a way, in my memory. That was very interesting." The ability of the video to jog memory is informative for the methodology, but it is also revealing for the nature of these thoughts in the first place: mind wandering is a mental experience that is forgotten quickly or escapes our conscious awareness in the first place, even when they are intense or emotionally charged.

But the video also provided a sense of clarity that revealed an in-betweenness of thought that was not easily categorized as *either* mind wandering *or* not mind wandering. The model proposed by Williams et al. (2018) proposes that attention shifts between environmentally-captured attention and mind wandering. They note that theories of Attention Restoration Theory do not fully describe the degree of internal versus external orientation of attentional focus. The results of this study do show that attention moved back and forth between the environment and internal thoughts; however, participants noted a lot of in between, including internal consideration of the environment that did not qualify as mind wandering, such as, "Like, I don't know, when I look at a tree and briefly reflect on how nice it looks or whatever. Like, things like that wouldn't really qualify. I'm still spending time in my head, I'm not necessarily in the environment. But I'm not so far removed from it that I would've put it in the survey." Another participant described having a lot of "silly little thoughts" that wouldn't be considered. Another said, "I think I have like a constant, like my mind is like, 'blalalalalalala,' a lot of images and a lot of— when I walk here, it's hard to sort of pick out a single one that is specific to the time."

One participant described the mental perspective as a resonance between his thoughts and external world. “That’s what’s amazing about being outside like this. The internal, the external, gets [joined (he brings the fingers of both his hands together, intertwined)]. It’s hard to differentiate them. And that’s, I guess, what’s so wonderful about them. So that’s why it’s hard for me to talk about when my mind wandered because it is parallel to the actual wandering of my feet.”

4. Discussion

This section begins by discussing the empirical results from the explorative field study. Next, it covers methodological implications and limitations from those empirical findings. The discussion then moves to suggestions for refining methodology. Finally, suggestions for future research and practical implications are discussed.

4.1. Empirical findings

To describe the phenomenon of mind wandering as it occurred in one urban blue-green space, the study collected a broad array of data and analyzed it abductively, in concert with theory, to identify possible patterns. These themes include the environment's role in diversification of thought contents, including the temporal orientation of mind wandering, and especially memory. Connections between emotional valence, natural environment, and mind wandering are also discussed.

To begin, the novel methodology successfully collected and layered spatial and mind wandering data. These formed the picture of one physical landscape interspersed with many traces of individuals' internal worlds. Mind wandering occurred throughout most of the study duration and across the study area, reflecting past findings of how common this phenomenon is within the conscious experience (Killingsworth & Gilbert, 2010). This both supports and adds complexity to the theorizing of Williams et al. (2018), who proposed a flickering back and forth between exogenous attention towards the physical environment and inward state of mind wandering. It seems that this flickering likely occurs, perhaps with more abundance of inward thought than was conceived by Atchley et al. (2012). Related to attention dynamics, the explorative study showed some evidence for higher MW rates in the more stimulating Zones 2 and 3, despite the hypothesis that the more uniform and softly-fascinating Zones 1 and 4 would see more mind wandering. This does seem to conform with evidence that higher degrees of stimulation lead to more mind wandering (Vannucci et al., 2017; McVay and Kane, 2013). Limitations of these findings in relation to methodology are discussed in the next section.

In a similar vein, the degree to which landscape might have affected the internal content of mind wandering is discussed. Since the temporal orientation of MW

episodes has been a major focus of MW research and connects to themes of mood and memory, those results will first be discussed. The greatest proportion of MW episodes in this study, 30.2% (n = 13), concerned the present. Then, 18.6% (n = 8) of MW episodes were about the past, and 11.6% (n = 5) of reports concerned future-based thoughts. Full temporal results can be viewed in Appendix 2. The results of this study differ from the dominant finding in others, which have regularly documented that mind wandering is biased towards future thought (Smallwood & Schooler, 2015). This leaves the possibility that outdoor spaces might encourage different content of thought than other settings, as was the case in a study by Schertz et al. (2022), in which a natural environment correlated with more past-based thoughts while a commercial environment correlated with more future-based thoughts. Methodological considerations for this question are discussed in the next section.

Temporal orientation of MW content is often studied because of its associations with identity, future planning, and mood, as well its occurrence in various environmental contexts (Smallwood and Schooler, 2015). This suggests it a good candidate variable for understanding how mind wandering might interact with landscape experience. In terms of mood, past-based MW has been shown to correspond with lower mood, and future-based MW with higher mood (Ruby et al., 2013). However, cognitive load has also been shown to affect temporality of MW content: less attentional demand likely corresponds to future-based MW (with the assumption that future-based thought involves more cognitive effort than does past-based thought) (Smallwood et al., 2009). Similarly, it was also shown that environmental triggers can affect temporality of MW. If participants have personal experience with a setting, they are more likely to think about the past than the future (Smallwood et al., 2009). Stimulus-richness has also been associated with past-based mind wandering (Plimpton et al., 2015). Schertz et al. (2022) found that a nature-based setting, with higher frequencies of past-based thought, corresponded to higher thought valence and positive affect.

Regardless of valence, participants in this study did engage in thought that conceptualized future scenarios, memories, and the present moment. This connects mind wandering with Kaplan's early theorizing about the role of introspection in restorative environments and visa versa (1983). He proposed human environment compatibility was heightened when the space allowed for the integration of one's past and future through reflection. Results here indicate that subjects did conceptualize their pasts, presents, and futures, even during very fleeting moments of MW, regardless of whether MW reached introspective reflection.

This was highlighted in the qualitative analysis of one individual's walk, which showed how mind wandering episodes moved back and forth between past, present, and future thought. Qualitative data showed the possibility that mind wandering progressed towards active, future-based introspection as the participant stood on

the footbridge, perhaps ushered in by the diversification of thought earlier in the walk. As thoughts diversified across memories and incorporated non-present others, emotional valence shifted. The spontaneous diversification of thought occurred during movement towards and perception of environmental stimuli: the swan, the lake, a bunch of small flowers, the bridge, the water, a sign, dog poo, and a windmill.

For that participant, the environmental stimuli cued mind wandering with disparate ratings of emotional valence. It couldn't be concluded from the qualitative analysis, nor from the two explorative ANOVA's, whether certain environmental triggers or zones corresponded to higher or lower emotional valence scores, unlike Schertz et al.'s (2022) study. However, MW content triggered by sculptures and vegetation had the highest mean valence scores, while MW triggered by other people contained the lowest mean valence scores. That difference may reflect chance, but the question would benefit from further study with a larger population size, especially since environmental cues have been shown to affect thought content of mind wandering (Plimpton et al., 2015).

Finally, regarding the qualitative inquiry, one can see how thoughts were diversified away from the self and towards a variety of others, all as they walked along. In effect, they walked alone but also accompanied by others, despite distance and time. It is possible that this provided some sort of broadening of perspectival scope, affect, or thought content that allowed such a different reaction on the footbridge to the difficult thoughts about dating.

Also revealing about the variation of thought content, it is worth noting that these were indeed very brief and largely spontaneous associations. The participant stated that, because of the experiment, they spent more time noticing and observing things in the landscape and less time in their head during the walk. This indicates a high degree of voluntary, directed attention towards the landscape. Indeed, upon analysis of video footage, their gaze was constantly scanning the landscape. They reported that upon noticing the mind wandering, they said, "I was constantly trying to pull myself back into the lived experience." Despite such directed attention, mind wandering persisted. This reinforces the spontaneity and automatic nature of these thoughts: the mind wandered far and wide even when attention was focused on the environment. Considering theory and past evidence, especially Christoff et al.'s (2016) dynamic framework of spontaneous thought and Bratman et al.'s (2021) work on rumination, it is plausible that wider environmental aesthetics as well as particularly salient environmental stimuli might have encouraged the diversification of thought content and diversification of emotional valence.

4.2. Methodology in the context of empirical findings and limitations

Here the successes and limitations of methodology will be discussed in relation to the empirical research questions.

This methodology has shown that participants can specify and report the temporal orientation of MW content during nature contact; however, analysis was limited. With a larger population size, current methodology could better assess the question with small changes. The prevalence of "present"-based responses could be made more valid if the questionnaire specified that "present" referred to the exact present, along with 5 minutes before and after the current moment. This approach was used by Schertz et al. (2022), who found higher correlations between natural environments and past-based mind wandering. Taking an analysis from the same study, categorical time data could be modeled as a logistic regression, showing probabilities of those types of thoughts in certain locations.

Further understanding of the relationship between landscape and mind wandering can be achieved with other methodological alterations. For one, the ANOVA with blocking designs could be repeated with larger sample sizes. These could also more systematically vary the environmental variables, for instance, measuring urban vs. green environments (Bratman et al., 2015), or only characteristics along one model of landscape theory, such Kaplan and Kaplan's (1983) landscape preference matrix. Such analysis would require higher sample sizes.

The prediction of Williams et al. (2018) that homogenous environments would likely trigger more sustained periods of internally-oriented thought, while more complex and diverse environments would trigger the gentle flickering between exogenous attention and mind wandering, could not be adequately assessed by methodology. The methodology did not assess duration of mind wandering; so conclusions about "how much" the mind wandered in a place can't be assessed from current results. For instance, data in Zone 4 showed fewer MW reports, which could indicate fewer episodes of mind wandering and more external attention. On the other hand, the same data could indicate that fewer mind wandering reports meant internal thought persisted for longer durations. To solve this, duration of mind wandering could be questioned in the survey.

Again, related to spatial analysis, the method allowed for highly precise spatial data. There were indications that mind wandering occurred more frequently in the more complex and variated areas of the park (Zones 2 and 3) rather than the more uniform areas (Zones 1 and 4). But answering questions about the relationship between space and mind wandering could be better served by more systematic variation of landscape, more data, and by more rigorous spatial analysis techniques, such as hot spots or clustering. Advanced mapping techniques could also help

visualize mind wandering as it occurs in spaces (See maps in Appendix 2, Figures F & G).

Even though memory was successfully aided by the video-based methodology, outstanding questions remain about whether certain mind wandering experiences were more likely to be remembered while others forgotten. Though audio was included, no sonically-triggered mind wandering events were reported. And no thoughts were reported that arose from any of the other sensory systems. If mind wandering is indeed triggered by environmental stimuli, all of the senses would likely cue these episodes. Certain combinations of sensations might trigger specific MW experiences. There is robust evidence that the olfactory system triggers involuntary memories, for example (Chu and Downes, 2002). It is therefore likely that this methodology prioritized visually-triggered mind wandering as opposed to (or at the expense of) MW triggered by other senses. The same is likely true regarding mind wandering trigged by internal thought. Research has shown that one in three mind wandering reports tend to be triggered by one's own internal cogitations (Faber and D'Mello, 2018), but in the current study, only two MW reports were identified as not arising from the environmental cues. Finally, regarding visuality, this method might prioritize MW reports triggered by brighter, louder, more obvious, and more memorable visual stimuli, while less-apparent triggers of mind wandering might not stimulate the same memory response retrospectively.

Because of memory dynamics, this research might also capture more positive MW experience than is externally valid. Memory recall has been shown to improve when subjects are in positive moods, since pleasantness is mentally activating, which enhances recall (Bradley et al., 1992). Thus, natural settings which are known to increase positive emotions, might result in more recall on a retrospective experience sampling survey.

One methodological consideration that must be mentioned is the centrality of movement to this research. Results showed that minds wandered as participants moved by walking through an environment. Diversification of mental contents occurred as participants moved and were exposed to a diversity of environmental stimuli. A walking design was chosen following Williams et al.'s (2018) conceptualization of how mind wandering might occur during nature contact, as well as how it could be studied. A walk was also chosen, in contrast to stationary observation, because the methodology sought to prioritize ecological validity of how participants might encounter natural stimuli on an everyday basis. But results would likely change with less physical movement. It is left to be explored how the mind would wander during stationary observation of outdoor nature, such as if participants sat on a park bench. More basically, it is also left to be explored how the mind would wander during walking versus rest, without environment as a variable. Similar questions could be asked about viewing natural stimuli on a video

or other media. Physical activity has consistently been shown to improve cognitive performance (Bailey & Kang, 2022). Among other pathways that explain these improvements is the increase of blood flow to the brain (Tsubaki et al., 2018). Walking also exposes an individual to more environmental stimuli than would sitting or remaining stationary. Thus, in the current methodological design, it might be assumed that the physicality of participants' movements, as well as the exposure to a variety of stimuli likely affected frequency of mind wandering and quality of thoughts. Some evidence has shown that walking in nature corresponded with greater improvements for creative cognition than did sitting in nature or walking or sitting indoors (Oppezzo & Schwartz, 2014). However, an investigation of mind wandering during walking versus rest (indoors, on a treadmill) showed no significant differences in frequency of MW or in creativity scores (Opdal, 2015). Quality of thoughts might change according to the environment and according to an individual's current goals or experience with that environment. Attention towards environment might change depending on stimulation. Multiple participants in the current study linked walking to diversification of thoughts and free-flowing thoughts. One said that walking allowed for "more things to look at," but he contrasted the MW of walking with other types of MW, such as when sitting on an airplane, during which thoughts might linger longer on one subject. This matches others who said that attention towards environmental stimuli actually reduced the depth of internal thought. This matches other evidence that the mind wanders less as participants engage in physical activity (Deng et al., 2022). Other participants reported that the action of walking triggered mind wandering about walking in the past or future. "I could see myself going on other walks or hiking and just being in this peaceful state of mind," said one participant. And it is likely that combinations of sensations activate memories that are specific to an individual's history within a place or activity.

The complexities of walking bring up interesting research possibilities that have both practical implications and theoretical implications for how activity and environment affect cognition. How would the mind wander during exposure to a relatively stable array of natural stimuli as opposed to a progression of natural stimuli? How would the mind wander during rest as opposed to during walking? How would the mind wander while walking in an urban environment rather than sitting in an urban environment? And how might emotion or creativity measures be affected by these variables? Focusing on specific questions and isolating variables would provide interesting answers to questions about how the mind wanders in more specific settings. On the other hand, such specificity might reduce ecological validity of how thoughts function while on an everyday walk.

4.3. Methodological reflections

Mind wandering does occur outdoors, can be tracked and measured outdoors using this methodology to heighten ecological validity of undisturbed thoughts. One of the clearest methodological findings demonstrated how the video playback cued mind wandering experiences that had either been forgotten or not reached meta-awareness. The developed methodology is flexible and could be tailored to answer specific questions, some of which have been identified in the previous sections, regarding aspects of mind wandering and thought dynamics related to people-environment interactions. Those might involve smaller sample sizes for deeper qualitative analysis or larger sample sizes for broader quantitative questions. Following the qualitative analysis performed in this study, the methodology might be well-suited for small-*n* designs that prioritize analyses using a critically reflexive approach on fewer participants. These could elaborate on the highly individual phenomenological qualities of mind wandering and what they can reveal about the interplay between external landscape and internal thoughts. The developed methodology could also be altered and repeated for questions requiring larger sample sizes, especially ones requiring quantitative data. For instance, with a larger sample size, more systematic variation of landscape, and slight alterations of survey questions, the methodology could revisit the ANOVA results in the present study and make clearer connections between environmental triggers and thought content.

Future methodological development using probe-based experience sampling is suggested in order to validate and triangulate results. Use of other methods could help resolve validity questions about the video-based method's reliance on memory. In probe-based methodology, experience samples are taken via app or similar technology downloaded to participants' phones. During a task (or a walk), notifications are sent throughout the course of an experimental period (hour, days, weeks, or more), probing for brief experience sample surveys (Andrews, 2024; MacKerron and Mourato, 2013). Or, for more experimental control and less potential interference from participants' mobile devices, periodic experience sampling probes can be done using devices that are the property of the researcher, such as smartphones or smart watches (Schertz et al., 2022).

Use of probe-based experience sampling methodology could help validate the video-based methodology. Probe-based methodology could also be used to more effectively answer certain research questions, such as those requiring larger sample sizes. This is because smart phone apps can be employed easily across larger populations to still conduct naturalistic testing. This could help assess the relationship between characteristics of physical environments and components of thought content. It could also assess spatial frequency within a landscape in ways that situate data more closely with other research (Killingsworth & Gilbert, 2010).

Beyond mind wandering, the methodology could also provide high levels of detail and ecological validity in other investigations within environmental

psychology. One ideal topic is attention and attention restoration theory within outdoor spaces, an area with important outstanding questions (Joye and Dewitte, 2018). The video-based methodology could incorporate a small-*n* design or a larger participant pool to examine where attention is focused during nature contact.

4.3.1. Individual aspects

This analysis has attempted to resist the over-generalization of results. There is an urge to understand how nature affect us, our thoughts, our emotions; however, theorists have cautioned that nature will not confer uniform benefits across human populations. The transactional approach is one that presses this point. "The transactional perspective suggests that people's responses to their environment are more complex than traditional theories have assumed. How people respond to their environment depends not only on characteristics of the environment, but also on characteristics of the individual person," (Mozer and Uzzell, 2003, in Meuwese, 2022, p. 40). Likewise, within this study population, mind wandering frequency and content varied between people and varied within one individual's walk. Thought content and thought patterns were shown to be highly individual and depend on individual attention spans, emotional dimensions, stress level, experience in nature, hunger, caffeination, daily circumstances.

Even neuroscientists have urged that individual differences be prioritized in understanding the complex nature of inward thought, urging the study of phenomena within single individuals rather than across populations. Kucyi et al. (2024) pointed to mounting evidence from fMRI studies showing that the brain areas primarily responsible for mind wandering (the Default Mode Network) shows precise and individual-level functioning. They report that brain mechanisms giving rise to mind wandering not only vary depending on individuals, but also within individuals, depending on the context.

The study has attempted to explore without generalizing. The analysis provides important lessons, but with the caveat that this phenomenon should be explored across varying populations as well as in individuals. For instance, this study highlighted the link between memory, mind wandering and urban blue-green environments. Thus, a positive experience in a place might depend on having had positive memories there in the first place.

4.4. Future research and practical implications

This research began with the aim of understanding how nature contact might benefit creativity. How would a future study look that more specifically advanced that aim? Research indicates that the study of mind wandering outdoors is still in the nascent stages, before which it might be difficult to draw conclusions about the creativity

benefits of mind wandering outdoors. One intriguing area of research, though, could be an in-depth qualitative analysis using the video-based methodology with a much smaller population of artists, writers, academics, or other creatives. The study could elaborate in greater detail about how people use specific outdoor spaces to benefit their creative process, and whether mind wandering occurs in those spaces. "Creativity in the individual is heightened when thoughts move freely or occur spontaneously," write de Rooij et al. (2024), who investigated dynamics of mind wandering and creativity. Several analyses from the current study have indicated that such freely flowing thoughts occurred in the urban blue-green space. It could be fruitful to investigate the movement of thoughts as it occurs outdoors for people engaged in creative pursuits.

This study diverged from creativity, though, and it landed in a place that examined more fundamental aspects of conscious thought as it occurs in natural spaces. The results, especially in light of broader neuropsychological research on mind wandering (Christoff et al., 2016), point to a fruitful territory of examining how outdoor spaces affect the workings of conscious thought processes, and perhaps how outdoor spaces affect the workings of thought processes that do not reach conscious meta-awareness. The novel methodology helped capture the automatic and spontaneous nature of mind wandering; it helped show that natural stimuli can rapidly prompt far-off, emotionally laden thoughts. And the methodology helped quantify these thoughts, allowing for a possible window into how specific characteristics of an outdoor environment can affect the quality of one's thoughts. This broad analysis has traced connections between environment, memory, spontaneous thought content, and emotion that deserve further inquiry, and it has developed a methodology that could be deployed to understand those connections further.

5. Conclusion

This project began with the question of how outdoor spaces influence creativity. Is there scientific basis for the idea of nature as a muse? Are there specific findings that could help shape a writing retreat, or give landscape advice to a city that wants to foster innovation?

This study aimed to contribute to those very large questions by answering a question that is related. Advances in neuropsychological research have pointed to a specific kind of internal thought, loosely coined mind wandering, that likely contributes to creative thought (Christoff et al., 2016). Environmental psychologists have proposed that outdoor environments are ideal for encouraging mind wandering, as well as providing a host of other cognitive and emotional benefits that could encourage creative capacity (Williams et al., 2018). Yet little is known about how exactly mind wandering occurs in nature contexts, and the dynamics between physical environments and internal thought remain understudied.

In order to assess mind wandering naturalistically in an urban blue-green space, the current project combined interviews, experience sampling, and a novel video-based landscape analysis method to understand how external environments related to internal thought. The study assessed how mind wandering occurred spatially, temporally, and phenomenologically. It aimed to assess whether mind wandering occurred according to the patterns that were proposed to encourage creativity, and it aimed to connect specific landscape characteristics to frequency and dimensions of mind wandering.

For the majority of participants during this 20-minute walk, thoughts readily drifted inwards, and patterns of those thoughts as they related to the physical environment were discussed. Locations of mind wandering did seem to cluster in particular areas: one space representing a higher degree of complexity, tree canopy, and fascinating elements. Another cluster of mind wandering reports corresponded with social, built, and historical stimuli, though those results were explorative and methods for future research have been proposed. The specific environmental triggers of mind wandering were also recorded and analysed. Other humans in the park triggered the most mind wandering reports, followed by buildings, then green/vegetative stimuli. However, the mind wandering triggered by other humans seemed to be of lower emotional valence than mind wandering triggered by green/vegetative stimuli, though this finding did not reach statistical significance.

This study took a broad approach to understanding a large phenomenon, allowing patterns to emerge abductively from results. In a similar way, the method was developed abductively, incorporating knowledge from environmental psychology, mind wandering research, pilot studies. This methodology was built to assess mind wandering broadly, across many variables and data types. With the understanding gained from testing this methodology in a broad range of research questions, the methodology can be altered and tailored to a specified study design for a specific area of interest in this field. This study has identified various candidates for those investigations, including regarding creativity, mood, attention, and temporal orientation of thought content.

Experience sampling using this novel video-based method proved worthwhile for studying immediate effects of environment on cognition and emotion in a naturalistic research setting. Because of the way it reveals automatic associations between stimuli and mind wandering, as measured by various methods of experience sampling, could be a tool for studying not only creativity but more fundamental components of cognition in outdoor spaces.

Mind wandering could be tracked using this video-based method of retroactive experience sampling. This is corroborated by participants' reports that the video allowed them to remember mind wandering that they either forgot or had not realized occurred in the first place. Experience sampling and mind wandering theory can be fruitful territory for understanding how external stimuli trigger cognitive reactions.

Mind wandering did occur during a 20-minute walk in outdoor spaces. Although more research is needed to connect creativity, mind wandering, and nature, it seems evident that this urban blue-green space readily coincided with spontaneous thought.

As participants moved through the urban-blue green space, their thoughts moved as well. There were difficult thoughts and happy thoughts next to each other. At times the thoughts were quite intense. And thoughts were consequently forgotten. This study helped identify, measure, and analyze those quiet, fleeting, and powerful thoughts as they took flight during the walk but before they were completely forgotten by the participants.

References

Agnoli, S., Vanucci, M., Pelagatti, C., & Corazza, G. E. (2018). Exploring the Link Between Mind Wandering, Mindfulness, and Creativity: A Multidimensional Approach. *Creativity Research Journal*. https://www.tandfonline.com/doi/abs/10.1080/10400419.2018.1411423

Atchley, R. A., Strayer, D. L., & Atchley, P. (2012). Creativity in the Wild: Improving Creative Reasoning through Immersion in Natural Settings. *PLoS ONE*, *7*(12), e51474. https://doi.org/10.1371/journal.pone.0051474

Alvesson, M., & Skoldberg, K. (2009). *Reflexive Methodology: New Vistas for Qualitative Research*. SAGE Publications.

APA, American Psychological Association. (2017). *Ethical principles of psychologists and code of conduct*. Https://Www.Apa.Org. Retrieved September 19, 2024, from https://www.apa.org/ethics/code

Anderson, F. (2019). *Cruising the dead river: David Wojnarowicz and New York's ruined waterfront*. The University of Chicago Press. https://doi.org/10.7208/9780226603896

Andrews, E. (2024). *Characterizing The Relationship Between Aspects of Psychological Well-Being and Longitudinal Measurements of Thought Characteristics Taken within Everyday Life*. https://repository.arizona.edu/handle/10150/674418

Andrews-Hanna, J. R., Kaiser, R. H., Turner, A. E. J., Reineberg, A. E., Godinez, D., Dimidjian, S., & Banich, M. T. (2013). A penny for your thoughts: Dimensions of self-generated thought content and relationships with individual differences in emotional wellbeing. *Frontiers in Psychology*, *4*. https://doi.org/10.3389/fpsyg.2013.00900

Bailey, A. W., & Kang, H.-K. (2022). Walking and Sitting Outdoors: Which Is Better for Cognitive Performance and Mental States? *International Journal of Environmental Research and Public Health*, *19*(24), 16638. https://doi.org/10.3390/ijerph192416638

Baird, B., Smallwood, J., & Schooler, J. W. (2011). Back to the future: Autobiographical planning and the functionality of mind-wandering. *Consciousness and Cognition*, *20*(4), 1604–1611. https://doi.org/10.1016/j.concog.2011.08.007

Baird, B., Smallwood, J., Mrazek, M. D., Kam, J. W. Y., Franklin, M. S., & Schooler, J. W. (2012). Inspired by Distraction: Mind Wandering Facilitates Creative Incubation. *Psychological Science*, *23*(10), 1117–1122. https://doi.org/10.1177/0956797612446024

Bakolis, I., Hammoud, R., Smythe, M., Gibbons, J., Davidson, N., Tognin, S., & Mechelli, A. (2018). Urban Mind: Using Smartphone Technologies to Investigate the Impact of Nature on Mental Well-Being in Real Time. *BioScience*, *68*(2), 134–145. https://doi.org/10.1093/biosci/bix149

Barz, M., & Sonntag, D. (2021). Automatic Visual Attention Detection for Mobile Eye Tracking Using Pre-Trained Computer Vision Models and Human Gaze. *Sensors*, *21*(12), 4143. https://doi.org/10.3390/s21124143

Basu, A., Duvall, J., & Kaplan, R. (2019). Attention Restoration Theory: Exploring the Role of Soft Fascination and Mental Bandwidth. *Environment and Behavior*, *51*(9–10), 1055–1081. https://doi.org/10.1177/0013916518774400

Berman, M. G., Jonides, J., & Kaplan, S. (2008). The Cognitive Benefits of Interacting With Nature. *Psychological Science*, *19*(12), 1207–1212. https://doi.org/10.1111/j.1467-9280.2008.02225.x

Berman, M. G., Peltier, S., Nee, D. E., Kross, E., Deldin, P. J., & Jonides, J. (2010). Depression, rumination and the default network. *Social Cognitive and Affective Neuroscience*, *6*(5), 548. https://doi.org/10.1093/scan/nsq080

Bettencourt, L. M. A., Lobo, J., & Strumsky, D. (2007). Invention in the city: Increasing returns to patenting as a scaling function of metropolitan size. *Research Policy*, *36*(1), 107–120. https://doi.org/10.1016/j.respol.2006.09.026

Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering pictures: Pleasure and arousal in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *18*(2), 379–390. https://doi.org/10.1037/0278-7393.18.2.379

Bratman, G. N., Anderson, C. B., Berman, M. G., Cochran, B., De Vries, S., Flanders, J., Folke, C., Frumkin, H., Gross, J. J., Hartig, T., Kahn, P. H., Kuo, M., Lawler, J. J., Levin, P. S., Lindahl, T., Meyer-Lindenberg, A., Mitchell, R., Ouyang, Z., Roe, J., … Daily, G. C. (2019). Nature and mental health: An ecosystem service perspective. *Science Advances*, *5*(7), eaax0903. https://doi.org/10.1126/sciadv.aax0903

Bratman, G. N., Daily, G. C., Levy, B. J., & Gross, J. J. (2015). The benefits of nature experience: Improved affect and cognition. *Landscape and Urban Planning*, *138*, 41–50. https://doi.org/10.1016/j.landurbplan.2015.02.005

Bratman, G. N., Hamilton, J. P., Hahn, K. S., Daily, G. C., & Gross, J. J. (2015). Nature experience reduces rumination and subgenual prefrontal cortex activation. *Proceedings of the National Academy of Sciences*, *112*(28), 8567–8572. https://doi.org/10.1073/pnas.1510459112

Bratman, G. N., Young, G., Mehta, A., Lee Babineaux, I., Daily, G. C., & Gross, J. J. (2021). Affective Benefits of Nature Contact: The Role of Rumination. *Frontiers in Psychology*, *12*. https://doi.org/10.3389/fpsyg.2021.643866

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Bucht, E. (1997). *Public Parks in Sweden 1860-1960: The Planning and Design Discourse*. Swedish University of Agricultural Sciences.

Byrne, D. (2022). A worked example of Braun and Clarke's approach to reflexive thematic analysis. *Quality & Quantity*, *56*(3), 1391–1412. https://doi.org/10.1007/s11135-021-01182-y

Canin, L. H. (1991). *Psychological restoration among AIDS caregivers: Maintaining self-care.* [Thesis] University of Michigan. http://deepblue.lib.umich.edu/handle/2027.42/128799

Carr, C. (2013). *Fire in the Belly: The Life and Times of David Wojnarowicz*. Bloomsbury Publishing USA.

Callard, F., Smallwood, J., Golchert, J., & Margulies, D. S. (n.d.). The era of the wandering mind? Twenty-first century research on self-generated mental activity. *Frontiers in Psychology*.

Casner, S. M., & Schooler, J. W. (2014). Thoughts in Flight: Automation Use and Pilots' Task-Related and Task-Unrelated Thought. *Human Factors*, *56*(3), 433–442. https://doi.org/10.1177/0018720813501550

Cervinka, R., Schwab, M., & Haluza, D. (2020). Investigating the Qualities of a Recreational Forest: Findings from the Cross-Sectional Hallerwald Case Study. *International Journal of Environmental Research and Public Health*, *17*(5), Article 5. https://doi.org/10.3390/ijerph17051676

Cerwén, G. & Hägerhäll, C. (Submitted). SLU Multisensory Outdoor Laboratory: Conducting Psychophysiological Experiments in the Field. Frontiers in Psychology.

Christoff, K., Irving, Z. C., Fox, K. C. R., Spreng, R. N., & Andrews-Hanna, J. R. (2016). Mind-wandering as spontaneous thought: A dynamic framework. *Nature Reviews Neuroscience*, *17*(11), 718–731. https://doi.org/10.1038/nrn.2016.113

Chu, S., & Downes, J. J. (2002). Proust nose best: Odors are better cues of autobiographical memory. *Memory & Cognition*, *30*(4), 511–518. https://doi.org/10.3758/BF03194952

Collins, K. M. T., Onwuegbuzie, A. J., & Sutton, I. L. (2006). A Model Incorporating the Rationale and Purpose for Conducting Mixed-Methods Research in Special Education and Beyond. *Learning Disabilities*.

Connell, J. (2005). Managing gardens for visitors in Great Britain: A story of continuity and change. *Tourism Management*, *26*(2), 185–201. https://doi.org/10.1016/j.tourman.2003.10.002

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and Conducting Mixed Methods Research*. SAGE.

Deng, Y.-Q., Zhang, B., Zheng, X., Liu, Y., Wang, X., & Zhou, C. (2022). The impacts of mind-wandering on flow: Examining the critical role of

physical activity and mindfulness. *Frontiers in Psychology*, *13*, 674501. https://doi.org/10.3389/fpsyg.2022.674501

De Rooij, A., Atef, A., & Faber, M. (2024). A Wandering Mind is Not Always a Creative Mind: How Thought Dynamics Explain the Relationship between Mind Wandering and Creativity. *The Journal of Creative Behavior*, *58*(1), 151–170. https://doi.org/10.1002/jocb.640

Ehlers, A., Hackmann, A., & Michael, T. (2004). Intrusive re-experiencing in post-traumatic stress disorder: Phenomenology, theory, and therapy. *Memory*, *12*(4), 403–415. https://doi.org/10.1080/09658210444000025

Faber, M., & D'Mello, S. K. (2018). How the stimulus influences mind wandering in semantically rich task contexts. *Cognitive Research: Principles and Implications*, *3*(1), 35. https://doi.org/10.1186/s41235-018-0129-0

Faber, M., Radvansky, G. A., & D'Mello, S. K. (2018). Driven to distraction: A lack of change gives rise to mind wandering. *Cognition*, *173*, 133–137. https://doi.org/10.1016/j.cognition.2018.01.007

Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving Integration in Mixed Methods Designs—Principles and Practices. *Health Services Research*, *48*(6pt2), 2134–2156. https://doi.org/10.1111/1475-6773.12117

Fox, K. C., & Beaty, R. E. (2019). Mind-wandering as creative thinking: Neural, psychological, and theoretical considerations. *Current Opinion in Behavioral Sciences*, *27*, 123–130. https://doi.org/10.1016/j.cobeha.2018.10.009

Galera, C., Orriols, L., M'Bailara, K., Laborey, M., Contrand, B., Ribereau-Gayon, R., Masson, F., Bakiri, S., Gabaude, C., Fort, A., Maury, B., Lemercier, C., Cours, M., Bouvard, M.-P., & Lagarde, E. (2012). Mind wandering and driving: Responsibility case-control study. *BMJ*, *345*(dec13 8), e8105–e8105. https://doi.org/10.1136/bmj.e8105

Google Earth. (2023, May 13) [Map of Kungsparken, Malmö, Sweden] Data attribution: Google. Retrieved September 11, 2024. https://earth.google.com/web/@55.60302842,12.98587728,12.98587728

Gorgolewski, K. J., Lurie, D., Urchs, S., Kipping, J. A., Craddock, R. C., Milham, M. P., Margulies, D. S., & Smallwood, J. (2014). A Correspondence between Individual Differences in the Brain's Intrinsic Functional Architecture and the Content and Form of Self-Generated Thoughts. *PLoS ONE*, *9*(5), e97176. https://doi.org/10.1371/journal.pone.0097176

Grol, M., Hertel, P. T., Koster, E. H. W., & De Raedt, R. (2015). The Effects of Rumination Induction on Attentional Breadth for Self-Related Information. *Clinical Psychological Science*, *3*(4), 607–618. https://doi.org/10.1177/2167702614566814

Guidelines and Examples for Reporting Sample Demographics | SPSP. (n.d.). Retrieved September 12, 2024, from https://spsp.org/professional-development/publishing-resources/resources-for-inclusive-practices/guidelines-and-examples-for-reporting-sample-demographics

Hartig, T. (1993). Nature experience in transactional perspective. *Landscape and Urban Planning*, *25*(1–2), 17–36. https://doi.org/10.1016/0169-2046(93)90120-3

Harvard Catalyst. (n.d.). *Mixed Methods Research*. Community Engagement Program. Retrieved September 18, 2024, from https://catalyst.harvard.edu/community-engagement/mmr/

Herzog, T. R., Black, A. M., Fountaine, K. A., & Knotts, D. J. (1997). REFLECTION AND ATTENTIONAL RECOVERY AS DISTINCTIVE BENEFITS OF RESTORATIVE ENVIRONMENTS. *Journal of Environmental Psychology*, *17*(2), 165–170. https://doi.org/10.1006/jevp.1997.0051

Higgins, P., & Wattchow, B. (2013). The water of life: Creative non-fiction and lived experience on an interdisciplinary canoe journey on Scotland's River Spey. *Journal of Adventure Education and Outdoor Learning*, *13*(1), 18–35. https://doi.org/10.1080/14729679.2012.702526

Johansson, K., & Jakobsson, L. (2023, April 11). *Parkkaraktärer* [First cycle, G2E]. https://stud.epsilon.slu.se/18761/#:~:text=F%C3%B6r%20att%20ta%20reda%20p%C3%A5%20hur%20de%20upplevs%20i%20verkligheten

Joye, Y., & Dewitte, S. (2018). Nature's broken path to restoration. A critical look at Attention Restoration Theory. *Journal of Environmental Psychology*, *59*, 1–8. https://doi.org/10.1016/j.jenvp.2018.08.006

Kaplan, R., & Kaplan, S. (1989). *The Experience of Nature: A Psychological Perspective*. CUP Archive.

Kaplan, S. (1983). A Model of Person-Environment Compatibility. *Environment and Behavior*, *15*(3), 311–332. https://doi.org/10.1177/0013916583153003

Kaplan, S. (1993). The role of natural environment aesthetics in the restorative experience. In *Managing urban and high-use recreation settings*. North Central Forest Experiment Station, Forest Service, U.S. Department of Agriculture.

Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology*, *15*(3), 169–182. https://doi.org/10.1016/0272-4944(95)90001-2

Kaplan, S., Science, P. E. E. and C., & Arbor, A. (1993). *The role of natural environment aesthetics in the restorative experience* [Technical Report]. Forest Service, USDA. http://deepblue.lib.umich.edu/handle/2027.42/150703

Killingsworth, M. A., & Gilbert, D. T. (2010). A Wandering Mind Is an Unhappy Mind. *Science*, *330*(6006), 932–932. https://doi.org/10.1126/science.1192439

Kucyi, A., Kam, J. W. Y., Andrews-Hanna, J. R., Christoff, K., & Whitfield-Gabrieli, S. (2023). Recent advances in the neuroscience of spontaneous

and off-task thought: Implications for mental health. *Nature Mental Health*, *1*(11), 827. https://doi.org/10.1038/s44220-023-00133-w

Kugel, J. (n.d.). *The Mind Stew Podcast* (E19) [Broadcast]. Retrieved May 7, 2024, from https://www.mindstewpodcast.com/e019/

Länsstyrelsen Skåne. (n.d.). *Slottsmöllan i Malmö* [Text]. Retrieved September 19, 2024, from https://www.lansstyrelsen.se/skane/besoksmal/kulturmiljoer/slottsmollan-i-malmo.html

Lehrer, J. (2012). *Imagine: How creativity works*. Canongate.

Leszczynski, M., Chaieb, L., Reber, T. P., Derner, M., Axmacher, N., & Fell, J. (2017). Mind wandering simultaneously prolongs reactions and promotes creative incubation. *Scientific Reports*, *7*(1), 10197. https://doi.org/10.1038/s41598-017-10616-3

Lindal, P. J., & Hartig, T. (2015). Effects of urban street vegetation on judgments of restoration likelihood. *Urban Forestry & Urban Greening*, *14*(2), 200–209. https://doi.org/10.1016/j.ufug.2015.02.001

Macaulay, R., Johnson, K., Lee, K., & Williams, K. (2022). Comparing the effect of mindful and other engagement interventions in nature on attention restoration, nature connection, and mood. *Journal of Environmental Psychology*, *81*, 101813. https://doi.org/10.1016/j.jenvp.2022.101813

Macaulay, R., Johnson, K., Lee, K., & Williams, K. (2024a). *Examining the facets of mindful engagement and mind wandering in nature*. http://hdl.handle.net/11343/340487

Macaulay, R., Johnson, K., Lee, K., & Williams, K. (2024b). Examining the facets of mindful engagement and mind wandering in nature. *Journal of Environmental Psychology*, *94*, 102253. https://doi.org/10.1016/j.jenvp.2024.102253

Macaulay, R., Lee, K., Johnson, K., & Williams, K. (2022). 'Letting my mind run wild': Exploring the role of individual engagement in nature experiences. *Urban Forestry & Urban Greening*, *71*, 127566. https://doi.org/10.1016/j.ufug.2022.127566

MacKerron, G., & Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change*, *23*(5), 992–1000. https://doi.org/10.1016/j.gloenvcha.2013.03.010

Maillet, D., Seli, P., & Schacter, D. L. (2017). Mind-wandering and task stimuli: Stimulus-dependent thoughts influence performance on memory tasks and are more often past- versus future-oriented. *Consciousness and Cognition*, *52*, 55–67. https://doi.org/10.1016/j.concog.2017.04.014

Malmö Stad. (2023a). *Kungsparken* [Text]. Retrieved February 22, 2024, from https://malmo.se/Uppleva-och-gora/Natur-och-parker/Parker-i-Malmo/Kungsparken.html

Malmö Stad. (2023b). *Slottsparken* [Text]. Retrieved February 22, 2024, from https://malmo.se/Uppleva-och-gora/Natur-och-parker/Parker-i-Malmo/Slottsparken.html

Marks, W. D., Yokose, J., Kitamura, T., & Ogawa, S. K. (2022). Neuronal Ensembles Organize Activity to Generate Contextual Memory. *Frontiers in Behavioral Neuroscience*, *16*, 805132. https://doi.org/10.3389/fnbeh.2022.805132

McVay, J. C., & Kane, M. J. (2013). Dispatching the wandering mind? Toward a laboratory method for cuing "spontaneous" off-task thought. *Frontiers in Psychology*, *4*. https://doi.org/10.3389/fpsyg.2013.00570

Meuwese, D. (2022). *When in Need, Nature is There for You: The Restorative Effects of Nature in Supporting the Prevention and Treatment of Mental Health Problems* [PhD-Thesis - Research and graduation internal].

Miles, A. N., & Berntsen, D. (2011). Odour-induced mental time travel into the past and future: Do odour cues retain a unique link to our distant past? *Memory (Hove, England)*, *19*(8), 930–940. https://doi.org/10.1080/09658211.2011.613847

Miles, L. K., Karpinska, K., Lumsden, J., & Macrae, C. N. (2010). The Meandering Mind: Vection and Mental Time Travel. *PLoS ONE*, *5*(5), e10825. https://doi.org/10.1371/journal.pone.0010825

Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. *The Lancet*, *372*(9650), 1655–1660. https://doi.org/10.1016/S0140-6736(08)61689-X

Mooneyham, B. W., & Schooler, J. W. (2013). The costs and benefits of mind-wandering: A review. *Canadian Journal of Experimental Psychology / Revue Canadienne de Psychologie Expérimentale*, *67*(1), 11–18. https://doi.org/10.1037/a0031569

Murray, B. D., Holland, A. C., & Kensinger, E. (2013). Episodic Memory and Emotion. In M. D. Robinson, E. R. Watkins, & E. Harmon-Jones (Eds.), *Handbook of Cognition and Emotion*. Guilford Press.

Nettle, D. (2006). Schizotypy and mental health amongst poets, visual artists, and mathematicians. *Journal of Research in Personality*, *40*(6), 876–890. https://doi.org/10.1016/j.jrp.2005.09.004

Nordh, H., Hartig, T., Hägerhäll, C. M., & Fry, G. (2009). Components of small urban parks that predict the possibility for restoration. *Urban Forestry & Urban Greening*, *8*(4), 225–235. https://doi.org/10.1016/j.ufug.2009.06.003

Nyheter, S. V. T. (2024, June 24). Då kan du bada i Malmö kanal – om visionen slår in. *SVT Nyheter*. https://www.svt.se/nyheter/lokalt/skane/da-kan-du-bada-i-malmo-kanal-om-visionen-slar-in

Onwuegbuzie, A., & Leech, N. (2015). Linking Research Questions to Mixed Methods Data Analysis Procedures 1. *The Qualitative Report*. https://doi.org/10.46743/2160-3715/2006.1663

Opdal, I. M. (2015). Wandering body, wandering mind? The relationship between bodily movement, creativity and mind wandering [Master's Thesis, University of Tromsø]. https://hdl.handle.net/10037/9143

Oppezzo, M., & Schwartz, D. L. (2014). Give your ideas some legs: The positive effect of walking on creative thinking. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *40*(4), 1142–1152. https://doi.org/10.1037/a0036577

Pavlova, M. K. (2024). A dual process model of spontaneous conscious thought. *Consciousness and Cognition*, *118*, 103631. https://doi.org/10.1016/j.concog.2023.103631

Peen, J., Schoevers, R. A., Beekman, A. T., & Dekker, J. (2010). The current status of urban-rural differences in psychiatric disorders. *Acta Psychiatrica Scandinavica*, *121*(2), 84–93. https://doi.org/10.1111/j.1600-0447.2009.01438.x

Pelagatti, C., Binda, P., & Vannucci, M. (2020). A closer look at the timecourse of mind wandering: Pupillary responses and behaviour. *PLOS ONE*, *15*(4), e0226792. https://doi.org/10.1371/journal.pone.0226792

Plambech, T., & Konijnendijk Van Den Bosch, C. C. (2015). The impact of nature on creativity – A study among Danish creative professionals. *Urban Forestry & Urban Greening*, *14*(2), 255–263. https://doi.org/10.1016/j.ufug.2015.02.006

Plimpton, B., Patel, P., & Kvavilashvili, L. (2015). Role of triggers and dysphoria in mind-wandering about past, present and future: A laboratory study. *Consciousness and Cognition*, *33*, 261–276. https://doi.org/10.1016/j.concog.2015.01.014

Rikgsdag *(2018:1200)*. *Kamerabevakningslag (2018:1200)*. Retrieved September 19, 2024, from https://www.riksdagen.se/sv/dokument-och-lagar/dokument/svensk-forfattningssamling/kamerabevakningslag-20181200_sfs-2018-1200/

Ruby, F. J. M., Smallwood, J., Engen, H., & Singer, T. (2013). How Self-Generated Thought Shapes Mood—The Relation between Mind-Wandering and Mood Depends on the Socio-Temporal Content of Thoughts. *PLoS ONE*, *8*(10), e77554. https://doi.org/10.1371/journal.pone.0077554

Schertz, K. E., Bowman, J. E., Kotabe, H. P., Layden, E. A., Zhen, J., Lakhtakia, T., Lyu, M., Paraschos, O. A., Van Hedger, S. C., Rim, N. W., Vohs, K. D., & Berman, M. G. (2022a). Environmental influences on affect and cognition: A study of natural and commercial semi-public spaces. *Journal of Environmental Psychology*, *83*, 101852. https://doi.org/10.1016/j.jenvp.2022.101852

Schertz, K. E., Bowman, J. E., Kotabe, H. P., Layden, E. A., Zhen, J., Lakhtakia, T., Lyu, M., Paraschos, O. A., Van Hedger, S. C., Rim, N. W., Vohs, K. D., & Berman, M. G. (2022b). Environmental influences on affect and cognition: A study of natural and commercial semi-public spaces. *Journal of Environmental Psychology*, *83*, 101852. https://doi.org/10.1016/j.jenvp.2022.101852

Schertz, K. E., Sachdeva, S., Kardan, O., Kotabe, H. P., Wolf, K. L., & Berman, M. G. (2018). A thought in the park: The influence of naturalness and low-level visual features on expressed thoughts. *Cognition*, *174*, 82–93. https://doi.org/10.1016/j.cognition.2018.01.011

Schooler, J. W. (2002). Re-representing consciousness: Dissociations between experience and meta-consciousness. *Trends in Cognitive Sciences*, *6*(8), 339–344. https://doi.org/10.1016/S1364-6613(02)01949-6

Schooler, J. W., Smallwood, J., Christoff, K., Handy, T. C., Reichle, E. D., & Sayette, M. A. (2011). Meta-awareness, perceptual decoupling and the wandering mind. *Trends in Cognitive Sciences*, S1364661311000878. https://doi.org/10.1016/j.tics.2011.05.006

Schwartz, A. J., Dodds, P. S., O'Neil-Dunne, J. P. M., Danforth, C. M., & Ricketts, T. H. (2019). Visitors to urban greenspace have higher sentiment and lower negativity on Twitter. *People and Nature*, *1*(4), 476–485. https://doi.org/10.1002/pan3.10045

Schwarz, K., Fragkias, M., Boone, C. G., Zhou, W., McHale, M., Grove, J. M., O'Neil-Dunne, J., McFadden, J. P., Buckley, G. L., Childers, D., Ogden, L., Pincetl, S., Pataki, D., Whitmer, A., & Cadenasso, M. L. (2015). Trees Grow on Money: Urban Tree Canopy Cover and Environmental Justice. *PLOS ONE*, *10*(4), e0122051. https://doi.org/10.1371/journal.pone.0122051

Seli, P., Risko, E. F., & Smilek, D. (2016). On the Necessity of Distinguishing Between Unintentional and Intentional Mind Wandering. *Psychological Science*, *27*(5), 685–691. https://doi.org/10.1177/0956797616634068

Shibata, S., & Suzuki, N. (2004). Effects of an indoor plant on creative task performance and mood. *Scandinavian Journal of Psychology*, *45*(5), 373–381. https://doi.org/10.1111/j.1467-9450.2004.00419.x

Singer, J. L., & Barrios, M. V. (2009). Writer's Block and Blocked Writers: Using Natural Imagery to Enhance Creativity. In S. B. Kaufman & J. C. Kaufman (Eds.), *The Psychology of Creative Writing* (1st ed., pp. 225–246). Cambridge University Press. https://doi.org/10.1017/CBO9780511627101.016

Sio, U. N., & Ormerod, T. C. (2015). Incubation and cueing effects in problem-solving: Set aside the difficult problems but focus on the easy ones. *Thinking & Reasoning*, *21*(1), 113–129. https://doi.org/10.1080/13546783.2014.886626

Smalley, A. J., White, M. P., Sandiford, R., Desai, N., Watson, C., Smalley, N., Tuppen, J., Sakka, L., & Fleming, L. E. (2023). Soundscapes, music, and memories: Exploring the factors that influence emotional responses to virtual nature content. *Journal of Environmental Psychology*, *89*, 102060. https://doi.org/10.1016/j.jenvp.2023.102060

Smallwood, J., & Andrews-Hanna, J. (2013). Not all minds that wander are lost: The importance of a balanced perspective on the mind-wandering state. *Frontiers in Psychology*, *4*. https://doi.org/10.3389/fpsyg.2013.00441

Smallwood, J., Nind, L., & O'Connor, R. C. (2009). When is your head at? An exploration of the factors associated with the temporal focus of the wandering mind. *Consciousness and Cognition*, *18*(1), 118–125. https://doi.org/10.1016/j.concog.2008.11.004

Smallwood, J., & Schooler, J. W. (2015). The Science of Mind Wandering: Empirically Navigating the Stream of Consciousness. *Annual Review of Psychology*, *66*(1), 487–518. https://doi.org/10.1146/annurev-psych-010814-015331

Song, X., & Wang, X. (2012). Mind Wandering in Chinese Daily Lives – An Experience Sampling Study. *PLOS ONE*, *7*(9), e44423. https://doi.org/10.1371/journal.pone.0044423

Stawarczyk, D., Cassol, H., & D'Argembeau, A. (2013). Phenomenology of future-oriented mind-wandering episodes. *Frontiers in Psychology*, *4*. https://doi.org/10.3389/fpsyg.2013.00425

Steindorf, L., Hammerton, H. A., & Rummel, J. (2021). Mind wandering outside the box—About the role of off-task thoughts and their assessment during creative incubation. *Psychology of Aesthetics, Creativity, and the Arts*, *15*(4), 584–595. https://doi.org/10.1037/aca0000373

Stoltz, J., & Grahn, P. (2021). Perceived sensory dimensions: An evidence-based approach to greenspace aesthetics. *Urban Forestry & Urban Greening*, *59*, 126989. https://doi.org/10.1016/j.ufug.2021.126989

Szpunar, K. K., Khan, N. Y., & Schacter, D. L. (2013). Interpolated memory tests reduce mind wandering and improve learning of online lectures. *Proceedings of the National Academy of Sciences*, *110*(16), 6313–6317. https://doi.org/10.1073/pnas.1221764110

Tan, T., Zou, H., Chen, C., & Luo, J. (2015). Mind Wandering and the Incubation Effect in Insight Problem Solving. *Creativity Research Journal*, *27*(4), 375–382. https://doi.org/10.1080/10400419.2015.1088290

Tsubaki, A., Morishita, S., Tokunaga, Y., Sato, D., Tamaki, H., Yamazaki, Y., Qin, W., & Onishi, H. (2018). Changes in Cerebral Oxyhaemoglobin Levels During and After a Single 20-Minute Bout of Moderate-Intensity Cycling. In O. Thews, J. C. LaManna, & D. K. Harrison (Eds.), *Oxygen Transport to Tissue XL* (Vol. 1072, pp. 127–131). Springer International Publishing. https://doi.org/10.1007/978-3-319-91287-5_20

Van Den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for Nature in Urbanized Societies: Stress, Restoration, and the Pursuit of Sustainability. *Journal of Social Issues*, *63*(1), 79–96. https://doi.org/10.1111/j.1540-4560.2007.00497.x

Van Den Berg, A. E., Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning*, *127*, 173–181. https://doi.org/10.1016/j.landurbplan.2014.04.012

van Rompay, T. J. L., Oran, S., Galetzka, M., & van den Berg, A. E. (2023). Lose yourself: Spacious nature and the connected self. *Journal of*

Environmental Psychology, *91*, 102108. https://doi.org/10.1016/j.jenvp.2023.102108

Vannucci, M., Pelagatti, C., & Marchetti, I. (2017). Manipulating cues in mind wandering: Verbal cues affect the frequency and the temporal focus of mind wandering. *Consciousness and Cognition*, *53*, 61–69. https://doi.org/10.1016/j.concog.2017.06.004

Vannucci, M., Pelagatti, C., Chiorri, C., & Brugger, P. (2019). Space–time interaction: Visuo-spatial processing affects the temporal focus of mind wandering. *Psychological Research*, *83*(4), 698–709. https://doi.org/10.1007/s00426-018-1080-x

Vitale, V., & Bonaiuto, M. (2024). The role of nature in emotion regulation processes: An evidence-based rapid review. *Journal of Environmental Psychology*, *96*, 102325. https://doi.org/10.1016/j.jenvp.2024.102325

Wang, K., Sun, Z., Cai, M., Liu, L., Wu, H., & Peng, Z. (2022). Impacts of Urban Blue-Green Space on Residents' Health: A Bibliometric Review. *International Journal of Environmental Research and Public Health*, *19*(23), 16192. https://doi.org/10.3390/ijerph192316192

Wells, N. M., Rollings, K. A., Ong, A. D., & Reid, M. C. (2019). Nearby Nature Buffers the Pain Catastrophizing–Pain Intensity Relation Among Urban Residents With Chronic Pain. *Frontiers in Built Environment*, *5*. https://doi.org/10.3389/fbuil.2019.00142

Williams, K. J. H., Lee, K. E., Hartig, T., Sargent, L. D., Williams, N. S. G., & Johnson, K. A. (2018). Conceptualising creativity benefits of nature experience: Attention restoration and mind wandering as complementary processes. *Journal of Environmental Psychology*, *59*, 36–45. https://doi.org/10.1016/j.jenvp.2018.08.005

Wojnarowicz Foundation. (2024). *Collections* [Archive]. The David Wojnarowicz Foundation. https://wojfound.org/scholarship/collections/

Zanesco, A. P., Denkova, E., & Jha, A. P. (2024). Mind-wandering increases in frequency over time during task performance: An individual-participant meta-analytic review. *Psychological Bulletin*, No Pagination Specified-No Pagination Specified. https://doi.org/10.1037/bul0000424

Appendix 1: Methodological Materials

	Data type
FIRST SOME DEMOGRAPHIC INFORMATION	
Q1 Age	
	numerical
Q2 Gender	
	open-ended
Q3 First some demographic information	
NOW WE BEGIN. MIND WANDERING EPISODES	
Q1 Timestamp for pause in video	
	Open-ended text box
Q2 Very brief description of mind wandering episode (write as few as 3 words or a sentence)	
	Open-ended text box
Q3 Was there something in the landscape that prompted this thought?	
	Open-ended text box
Q4 How intense was this thought or thoughts?	**Data type**
Choose 1: very negative, negative, slightly negative, neutral, slightly positive, positive, very positive	Likert scale 1-7
Q5 How positive or negative was this thought or thoughts?	
Choose 1: Scale of 1 to 7, with 7 highest intensity	Likert scale 1-7
Q6 Did the thought come in the form of imagery, such as a memory or a daydream?	
Choose 1: definitely imagery, mix of imagery, definitely not imagery, unsure	Categorical
Q7 Did the thought come in the form of words, such as internal chatter?	
Choose 1: definitely words, mix of words, definitely not words, unsure	Categorical
Q8 The thought was about:	
Choose 1: myself only, myself and others, others only, unsure	Categorical
Q9 (choose as many as you want) This thought concerned something:	
Choose multiple: past, present, future, unsure	Categorical

Appendix 2: Data visualizations

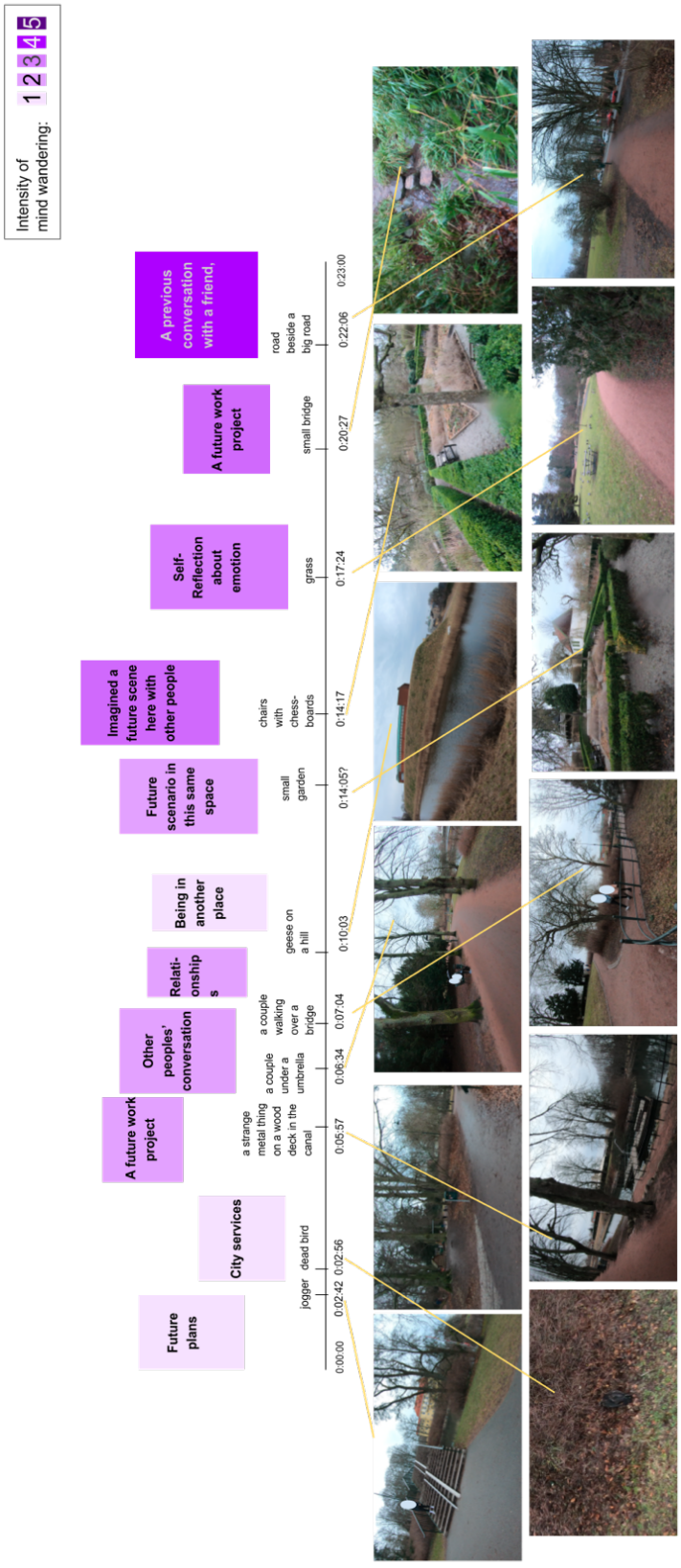
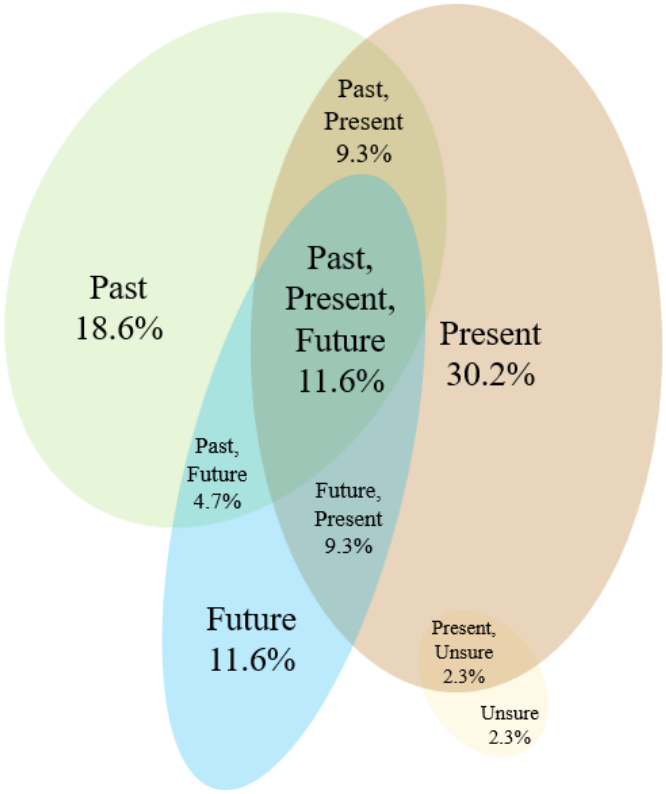


Figure A: Pilot study data visualization, depicting MW content in squares above timeline for the walk. Triggers are labeled and depicted with images. Intensity of MW is visualized using color gradients.



time scale answer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Future	5	8,5	11,6	11,6
	Future Present	4	6,8	9,3	20,9
	Future Past	2	3,4	4,7	25,6
	Future Past Present	5	8,5	11,6	37,2
	Present	13	22,0	30,2	67,4
	Present Past	4	6,8	9,3	76,7
	Past	8	13,6	18,6	95,3
	Present Can't Say	1	1,7	2,3	97,7
	Can't Say	1	1,7	2,3	100,0
	Total	43	72,9	100,0	
Missing	System	16	27,1		
Total		59	100,0		

Figure B: Mental time travel. Did MW content concern the past, present, future, or a combination?

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
intensity	44	1	7	3,93	1,421	,074	,357	-,839	,702
valence	43	2	7	4,65	1,446	,254	,361	-,968	,709
Valid N (listwise)	43								

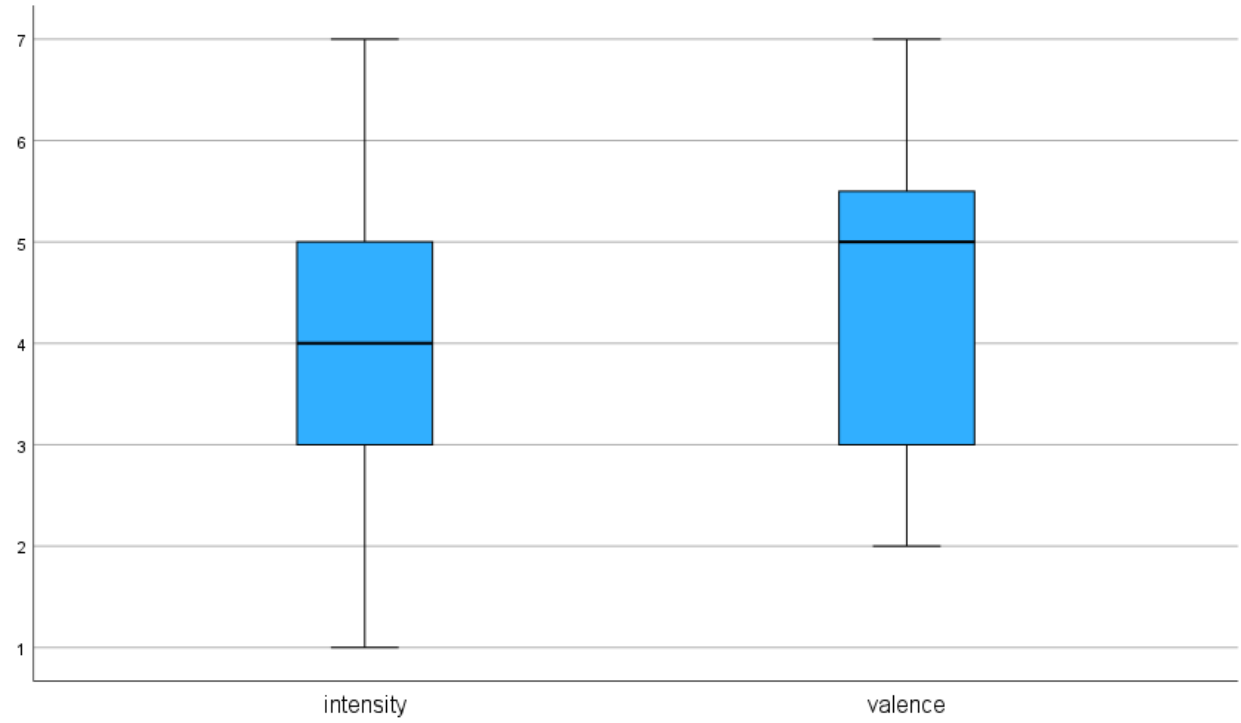
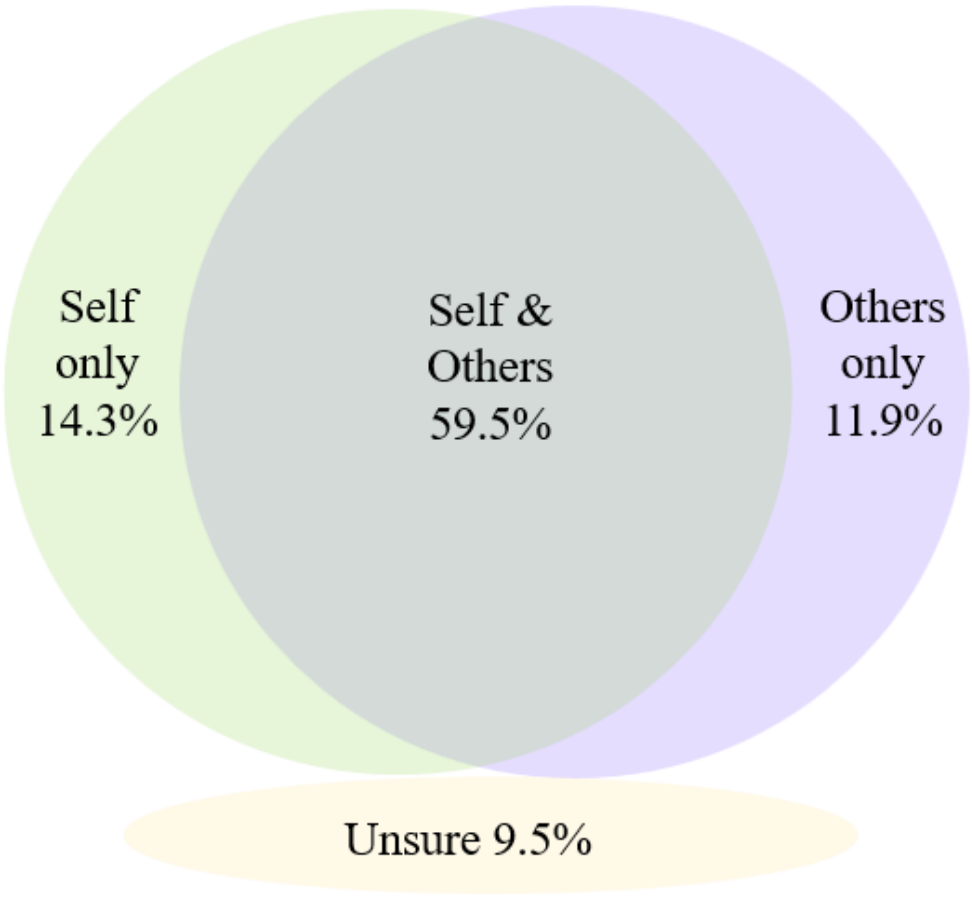


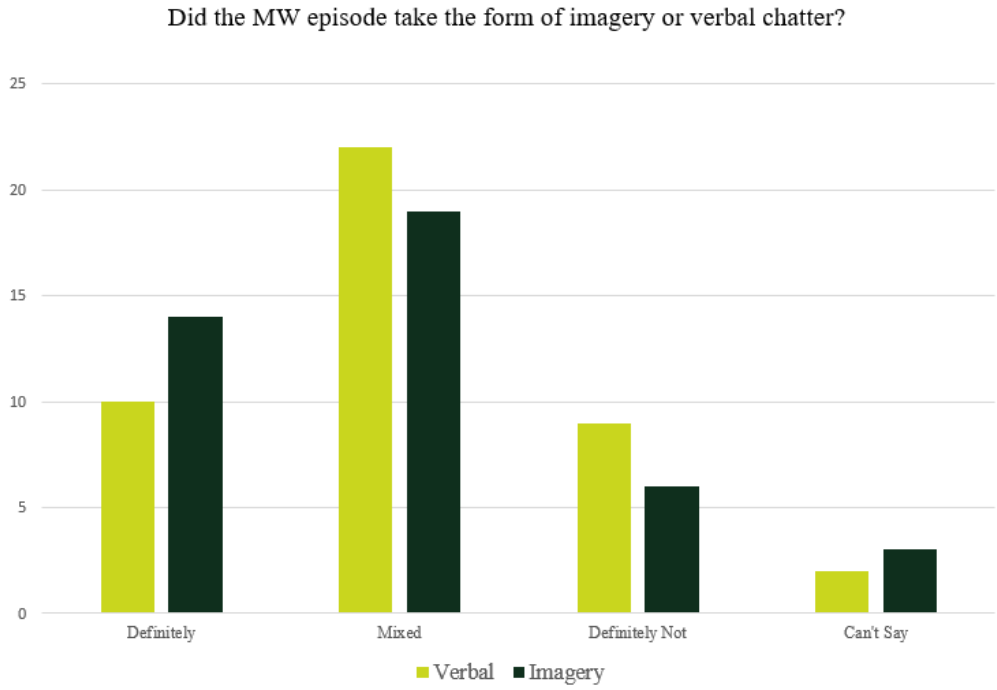
Figure C: Emotional valence and intensity of MW content.



Did MW concern the self, others, a combination, or unsure?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	4	6,8	9,5	9,5
	Others Only	7	11,9	16,7	26,2
	Self and Others	25	42,4	59,5	85,7
	Self Only	6	10,2	14,3	100,0
	Total	42	71,2	100,0	
Missing	System	17	28,8		
Total		59	100,0		

Figure D: Social Cognition During MW. Did MW content concern the self, others or a combination?



Did MW take the form of mental imagery?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	3	5,1	7,1	7,1
	Not Imagery	6	10,2	14,3	21,4
	Mix Imagery	19	32,2	45,2	66,7
	Yes Imagery	14	23,7	33,3	100,0
	Total	42	71,2	100,0	
Missing	System	17	28,8		
Total		59	100,0		

Did MW take the form of verbal chatter?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unsure	2	3,4	4,7	4,7
	Not Verbal	9	15,3	20,9	25,6
	Mix Verbal	22	37,3	51,2	76,7
	Yes Verbal	10	16,9	23,3	100,0
	Total	43	72,9	100,0	
Missing	System	16	27,1		
Total		59	100,0		

Figure E: Imagery or Verbal form of MW. Did MW take the form of imagery? Did it take the form of verbal chatter?

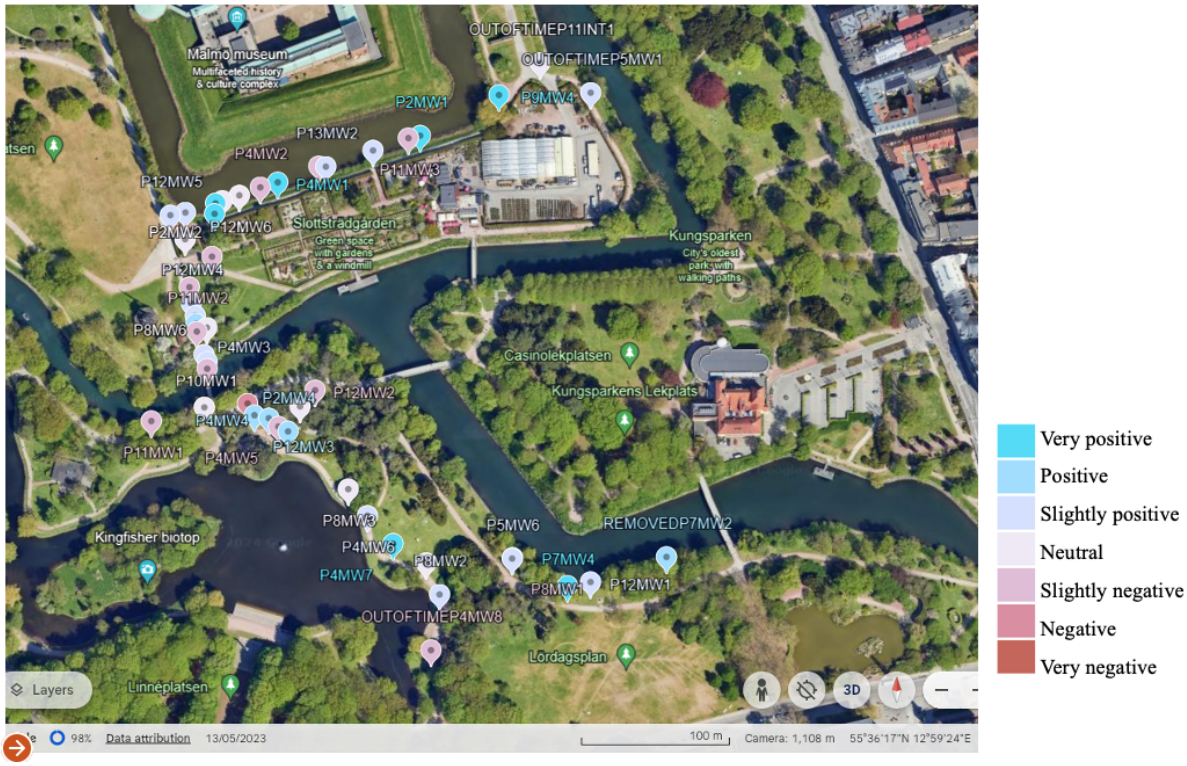


Figure F: Map depicting emotional valence of each mind wandering report and location of its occurrence (Map Data: Google, Copyright 2024). Reprinted with permission.

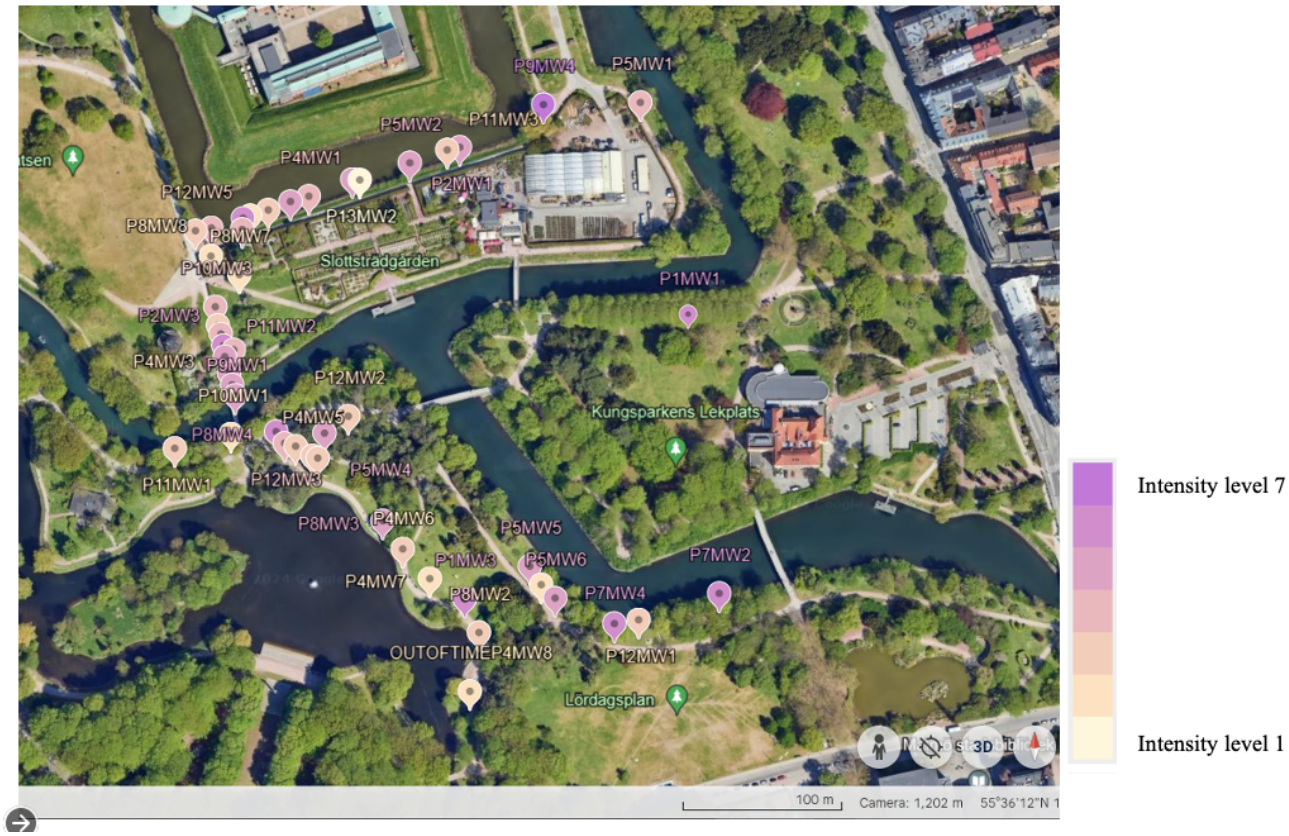


Figure G: Map depicting intensity of each mind wandering report and where it occurred. (Map Data: Google, Copyright 2024). Reprinted with permission.