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Is an off-task mind a freely-moving mind? Examining the relationship between different dimensions of thought

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ABSTRACT

Mind wandering is frequently defined as task-unrelated or perceptually decoupled thought. However, these definitions may not capture the dynamic features of a wandering mind, such as its tendency to 'move freely'. Here we test the relationship between three theoretically dissociable dimensions of thought: freedom of movement in thought, task-relatedness, and perceptual decoupling (i.e., lack of awareness of surroundings). Using everyday life experience sampling, thought probes were randomly delivered to participants' phones for ten days. Results revealed weak intra-individual correlations between freedom of movement in thought and task-unrelatedness, as well as perceptual decoupling. Within our dataset, over 40% of thoughts would have been misclassified under the assumption that off-task thought is inherently freely moving. Overall, freedom of movement appears to be an independent dimension of thought that is not captured by the two most common measures of mind wandering. Future work focusing on the dynamics of thought may be crucial for improving our understanding of the wandering mind.

1. Introduction

The last decade has seen an explosion of scientific research on mind wandering, leading some researchers to dub the 21st century 'the era of the wandering mind' (Callard, Smallwood, Golchert, & Margulies, 2013). The number of scientific publications with the term 'mind wandering' in the title has increased from only one in 2006 to over 50 in 2016, making mind wandering a prominent topic in cognitive (Andrews-Hanna et al., 2013; Schooler et al., 2011) and clinical psychology (Fox, Kang, Lifshitz, & Christoff, 2016; Marchetti, Koster, Klinger, & Alloy, 2016; Murphy, Macpherson, Jeyabalasingham, Manly, & Dunn, 2013; Stan & Christoff, in press-a), as well as education (Mills, D'Mello, & Kopp, 2015; Schooler, Reichle, & Halpern, 2004; Wammes, Boucher, Seli, Cheyne, & Smilek, 2016) and neuroscience (Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016; Esterman, Noonan, Rosenberg, & DeGutis, 2012).

This burgeoning of scientific publications, however, has occurred in the midst of uncertainty about what it means for a mind to wander. Most research to date has used the term 'mind wandering' to loosely refer to either one of two dimensions of thought: (1) task unrelated thought (i.e., off-task; Smallwood & Schooler, 2015) or (2) stimulus independent thought, which is "perceptually decoupled" from one's surroundings (Schooler et al., 2011). For example, we examined the 55 peer-reviewed articles with 'mind wandering' in the title published in 2016 and listed on PsychInfo or Google Scholar. We found that 52 of these articles (94.5%) used the term 'mind wandering' to refer to off-task thought; 30 of the same articles (54.5%) used 'mind wandering' to refer to a state of perceptual decoupling.

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Table 1
Task-relatedness is empirically dissociable from freedom of movement in thought. (A) If off-task thought and freely-moving thought are not empirically separable and off-task thought co-occurs systematically with freely-moving thought, then the following pattern of results should be expected: the vast majority or almost all responses should fall in the *off-task + freely* moving and *on-task + constrained* thought cells (based on previous literature, up to 50% of thoughts should be *off-task* and the remaining should be on-task); at the same time, very few or no responses should fall in the *off-task + constrained* and *on-task + freely-moving* cells. (B) Observed pattern of data in the current study. Each cell represents average proportion of responses in each cell across participants. Individual probe responses were z-score standardized within participant, then split based on each participant's individual median; 1.2% of data fell on the median and was not included. Less than 60% of the data fell into cells that account for *off-task + freely-moving* thoughts and *on-task + constrained* thoughts. More than 40% of the data fell into cells describing *off-task + constrained* and *on-task + freely-moving* thoughts – two categories of thought that should occur rarely or not at all, if being off-task was not empirically dissociable from having a wandering mind.

(A) Hypothesized pattern if dimensions are not independent			(B) Observed results		
	Freely-moving	Constrained		Freely-moving	Constrained
Off-task	~50%	~0%	Off-task	28.9%	20.2%
On-task	~0%	~50%	On-task	21.8%	27.9%

A recent theoretical account (Christoff et al., 2016) highlights a different view of mind wandering, which emphasizes its dynamics, or how mental states arise and unfold over time. In this view, a wandering mind tends to move relatively freely across multiple possible mental states. Thoughts move in an unconstrained manner from one to the next: the last time you spoke to your best friend, a memory with your friend years ago, plans with a different friend for dinner, to your favorite dishes at a restaurant. The content of thoughts may end up being thematically or episodically linked to some extent over time (Mills, Herrera-Bennett, Faber, & Christoff, in press), but a key feature is that they arise relatively freely with little deliberate (e.g., goal-oriented) or automatic (e.g., habitual, affective cues) constraints.

Although Christoff et al. (2016) highlight the theoretical importance of freedom of movement in thought, the dominant dimensions in the literature (i.e. off-task and stimulus independent thought) do not explicitly capture constraints on thought as part of their definitive qualities. This may not be an issue if off-task thought is inherently freely moving, but currently we do not know the extent to which they are related. If being off-task is synonymous with having a freely-moving mind, task-unrelated thought should have a freely-moving quality to it (Table 1A). Our thoughts would then be expected to fall predominantly within two categories: they should be either *off-task and freely-moving* or *on-task and constrained* (Table 1A). Thoughts that fall within the other two categories (either *off-task and constrained* or *on-task and freely-moving*) should occur rarely or not at all. In this case, the correlation between being off-task and having a freely moving mind should be strong, and the characterization of off-task thought could simply be elaborated to include the tendency for the mind to be freely moving.

In principle, however, task-relatedness and free movement of thought are two conceptually dissociable dimensions. Off-task thoughts may not be inherently freely-moving: off-task thoughts might become constrained and focused, such as when one is worrying about an upcoming presentation or a prior mistake. If this is true, the four categories of thought depicted in Table 1 may occur with similar frequency in everyday life, demonstrating that task-relatedness and freedom of movement in thought are empirically dissociable. This latter possibility would be inconsistent with a theoretical view that equates being off-task with having unconstrained, freely moving thoughts. Thus, in the current work we focused on evaluating whether freely-moving thought can be distinguished from off-task thought, the predominant definition of mind wandering. This approach adds to a growing body of work that has refined our understanding of mind wandering by seeking to identify its key, distinguishable dimensions (Seli, Risko, & Smilek, 2016; Seli, Risko, Smilek, & Schacter, 2016).

We tested whether the free movement of thought is empirically dissociable from task-relatedness by using experience sampling of participants' thoughts in everyday life. Experience sampling during daily life is a commonly used method to assess task-unrelated thought (Kane et al., 2007; Killingsworth & Gilbert, 2010; Song & Wang, 2012). We also tested whether free movement of thought is empirically dissociable from perceptual decoupling – the second most frequently assumed feature of a wandering mind. Each thought probe was delivered on participants' mobile phones, and asked participants to report on the extent to which their thoughts (i) were moving about freely, (ii) were about something other than what they were currently doing, and (iii) contained awareness of their surroundings. By measuring variations in these three dimensions of thought concurrently, we aimed to provide empirical evidence for a novel dimension of thought: one that is not based on the content of the thought, but how freely the mind is moving.

2. Methods

A total of 228 participants enrolled at a large public Canadian university took part for class credit. A sample size of about 200 (at least 194) was needed based on a power analysis in which we estimated a correlation of 0.2 ($\alpha = 0.05$, and $\beta = 0.2$) was estimated for inter-individual correlations.

After signing up, participants came to the lab for a thirty-minute training session in order learn about the study. Upon arrival, they were asked to complete an informed consent. Participants were then given a brief (~20 min) training session. The session included detailed verbal instructions given via video recorded power-point. The video detailed definitions and examples of each dimension, and the video was paused periodically for participants to engage in discussions about each dimension, including being asked to give novel examples and the opportunity to answer any clarification questions to the experimenter. Portions of the exact script used in the video are included in Appendix A. Participants were asked to respond to as many of the probes as possible by keeping their phone near them when it was feasible.