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How pervasive is mind wandering, really?

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Abstract

Recent claims that people spend 40-50% of their waking lives mind wandering (MW) (Killingsworth & Gilbert, 2010; Kane et al. 2007) have become widely accepted and frequently cited. While acknowledging attention to be inconstant and wavering, and MW to be ubiquitous, we argue and present evidence that such simple quantitative estimates are misleading and potentially meaningless without serious qualification. MW estimates requiring dichotomous judgments of inner experience rely on questionable assumptions about how such judgments are made and the resulting data do not permit straightforward interpretations. We present evidence that estimates of daily-life MW vary dramatically depending on response options provided. Offering participants a range of options in estimating task engagement yielded variable MW estimates, from approximately 60% to 10%, depending on assumptions made about how observers make introspective judgments about their MW experiences and how they understand what it means to be on- or off-task.

Keywords: Mind wandering; Task-Unrelated Thought; Frequency; Rate; Daily life

Mind wandering (MW) is ubiquitous and consequential in human functioning and so understanding its prevalence in everyday life is a worthwhile endeavour. Estimates of prevalence have often been obtained via samples of dichotomous “thought probes” asking participants to report whether they are focused on an ongoing task (“on-task”) or MW (Killingsworth & Gilbert, 2010; Kane et al. 2007). Based on these studies, repeated claims have been made (by researchers and the media alike) that people spend almost *half their waking hours* MW (e.g., Bennike et al., 2017; Ergas, 2018; Killingsworth & Gilbert, 2010). Use of such dichotomous self-report measures assumes that people can and do report binary states (on-task and MW) at an instant in time. Although people might be able to attend to only one stream of thought at each instant, this does not mean that self-reports can reflect this so precisely as researchers have assumed. Perhaps the best people can do is make introspective judgments from memory of their recent mental states (James, 1890/1950) over self-selected and possibly variable time intervals to estimate whether they have recently been more or less off-task, and then convert this into a dichotomous report.

The foregoing considerations raise the following question: When people endorse MW roughly 50% of the time in response to dichotomous probes, does this mean they were (a) completely absorbed in MW 50% of the time, (b) completely on-task 50% of the time, or (c) forcing judgments of degree into a dichotomous decision?

Method

We assessed peoples’ responses to a dichotomous (on-task vs. MW) probe, and their responses to a multi-level probe that allowed them to report various combinations of being both on-task and MW. To enable comparison with prior studies conducted in real-world settings, we followed closely the methods of the earlier studies (Kane et al., 2007; Killingsworth and Gilbert,

2010). We probed people (via their smartphones) while they engaged in their everyday activities. In accordance with the recommendations of Simmons, Nelson, and Simonsohn (2012), we report how we determined our sample size, all data exclusions, and all measures in our study.

Participants. Undergraduate students ($n = 239$) were randomly assigned to either the dichotomous ($n = 122$) or multi-level ($n = 117$) probe condition. We determined, in advance, that we could collect as much data as possible before the end of the academic term, with a minimum requirement of 100 participants per condition (which seemed reasonable for our research question). In the dichotomous-probe condition, 14 participants did not respond to at least seven of the 70 probes; in the multi-level-probe condition, 10 participants did not respond to at least 7 of the probes. As with previous research (Cotter & Silvia, 2017; Kane et al., 2017), we excluded these participants' data from all analyses (final $ns = 108$ and 107 , for the dichotomous and multi-level probe conditions, respectively).

Experience sampling. To assess rates of MW, we presented participants with thought probes via MetricWire, which is a smartphone application for daily-life experience-sampling data collection. The survey system probed participants 10 times per day, for seven days, between 8am and midnight (with at least 50 minutes between probes; Cotter & Silvia, 2017). Participants were encouraged to respond to as many probes as possible, but not in dangerous or inappropriate contexts (e.g., while driving). Prior to completing the experiment, an experimenter explained the survey system and completed a practice survey with participants in the laboratory. In the dichotomous-probe condition, the probes read, "At the time of the beep, my mind had wandered to something other than what I was doing," and participants could respond by selecting "no" or "yes" (e.g., Kane et al., 2007, 2017; Killingsworth & Gilbert, 2010). In the multi-level-probe condition, the probe read, "At the time of the beep, my mind was..." and was accompanied by

the following response options: ‘(1) Completely focused on what I was doing’; ‘(2) Mostly focused on what I was doing’; ‘(3) Both focused on what I was doing and something other than what I was doing’; ‘(4) Mostly focused on something other than what I was doing’; or ‘(5) Completely focused on something other than what I was doing’ (Mrazek et al., 2012). Previous research has provided evidence that people are able to make such distinctions in levels of MW and that these distinctions are reliably associated in conceptually meaningful ways with performance on attention-demanding tasks (e.g., Seli, Carriere, et al., 2014). Both probe conditions included three subsequent survey questions that are not considered in the present report (see supplemental materials for full details).

Rates of mind wandering. In the dichotomous probe condition, rates of MW were calculated as the proportion of thought probes to which participants indicated that they were MW (i.e., the proportion of probes to which participants responded “yes”). In the multi-level probe condition, we calculated rates of MW in four different ways. In particular, we calculated rates of MW in terms of the proportion of thought probes to which participants reported (a) any response greater than ‘(1) Completely focused on what I was doing’, (b) any response greater than ‘(2) Mostly focused on what I was doing’, (c) any response greater than ‘(3) Both focused on what I was doing and something other than what I was doing’, and finally, (d) any response greater than ‘(4) Mostly focused on something other than what I was doing’.

Results

In Figure 1, we present rates of MW, yielded by our thought-probes, for both the dichotomous-probe condition (white bars) and the multi-level probe condition (gray bar). As can be seen in Figure 1, when calculating rates of MW in the dichotomous-probe condition, we find that participants reported that they were engaged in MW 40% of the time, which is consistent with other work examining MW in daily life (e.g., Killingsworth & Gilbert, 2010; Kane et al., 2007). In the multi-level probe condition, however, when classifying any responses greater than ‘(1) Completely focused on what I was doing’ as MW, we found that participants engaged in MW 60% of the time, or conversely, that they were completely focused on their ongoing activities a mere 40% of the time. That said, when classifying any responses greater than ‘(2) Mostly focused on what I was doing’ as MW, we find that rates of MW drop to 37%. Continuing with this pattern, we find that, when classifying any responses greater than ‘(3) Both focused on what I was doing and something other than what I was doing’ as MW, rates of MW again drop, this time to 21%. Finally, when classifying any responses greater than ‘(4) Mostly focused on something other than what I was doing’ as MW, we find that participants mind-wandered only 12% of the time. Put differently, participants reported at least some degree of on-task focus 88% of the time.

FREQUENCY OF MIND WANDERING

Figure 1. In the left-hand panel (white bars) are data from the multi-level-probe condition, showing the proportions of mind-wandering reports passing different thresholds: “>1” = The proportion of probe reports that were greater than 1 on the 1-5 mind-wandering scale; “> 2” = The proportion of probe reports that were greater than 2 on the 1-5 mind-wandering scale; and so forth. In the right-hand panel (gray bar) is the proportion of mind wandering based on data from the dichotomous-probe condition. Bars are 95% between-subjects confidence intervals.

FREQUENCY OF MIND WANDERING

Next, we examined the mean proportions of times each of the 5 response options was endorsed across participants (Figure 2). The shape of the distribution is informative in that it provides a *profile* of attentional engagement during a task. In Figure 2, the values decline linearly over the first four levels and either stabilize or perhaps recover at the highest levels of MW. Thus, participants rather freely admit to frequent mildly off-task mentation. They are, however, notably less likely to report serious distraction from their everyday activities, which will almost certainly vary in their importance and attention-demanding character. In Figure 2, we fitted a 2nd order quadratic function to the data for illustrative purposes. The linear and quadratic components jointly yield an $R = .97$, suggesting a rather systematic decline over levels of task engagement. We do not suggest that such a profile will be obtained under all contexts and conditions, but note that participants do appear to be using the scale in a systematic fashion at the group level.

Figure 2. The proportion of probe reports (1-5) from the multi-level-probe condition, fitted to a second order polynomial. Error bars are 95% within-subjects confidence intervals.

Discussion

The MW rates yielded by our dichotomous probe were comparable to those from previous studies (40%), yet our interpretation of this result is qualified by the multi-level probe results revealing that participants were clearly not completely disengaged from their everyday tasks 40% of the time. Indeed, rates of complete disengagement were far less frequent (occurring only 12% of the time). On the other hand, the dichotomous-probe results cannot be taken to mean that people were completely on-task roughly 60% of the time since the multi-level-probe data revealed that participants were completely on-task only 40% of the time. Thus, the critical point that emerges is that the rates of MW yielded by dichotomous probes are difficult to interpret in the absence of the multi-level probe.

The present results raise broader questions about what people mean when they retrospectively judge that they have been completely or incompletely off-task. One possibility is that such judgments are based on the recent memory of the changing contents of awareness, and hence, indirectly, recent memory of the frequency of channel switching between task focus and non-task thoughts. On this view, apparently ubiquitous MW merely reveals that we are rarely and briefly committed fully to any one processing channel (Schad, Nuthmann, & Engbert, 2012). Given frequent and rapid changes of the contents of consciousness, deciding on a single value of how much someone is MW becomes highly arbitrary and the attempt to discover a single specific value misleading. Perhaps, when responding to the dichotomous probe, people are coping by making a breaking point in reporting their responses as off-task when, for example, they feel they are devoting insufficient attentional resources to a focal task. The present results seem consistent with this hypothesis. The midpoint of the five-point scale might reasonably be interpreted as representing something close to participants' impressions that their attention was

approximately equally divided between some ongoing focal task and MW. That the proportion of reports of '3' or greater (Figure 1) is very close to the dichotomous MW value suggests that the people respond to the dichotomous question as if asked if they were MW as much or more than they were attending to the task. It does not mean that they are reporting being completely off-task 40% of the time. Indeed, according to the present results, people are completely off-task only 12% of the time.

An alternative, but compatible, interpretation of the present results is that there are really three types of decisions that one can make reliably about task engagement: essentially on-task (level 1), somewhat equivocal (levels 2-3), or off-task (4-5) in approximate ratios of 2:2:1 (See Figure 2). On this interpretation, participants were mostly, if not completely, off-task about 20% of the time. In any case, the present results suggest that seeking a single value for MW is not very psychologically informative. For practical purposes, one might set some cost-benefit criterion in specific contexts for when MW is problematic, but that would address an economic, not psychological, problem.

Authors' contributions

P. Seli and R. Beaty developed the study concept. All authors contributed to the study design. Testing and data collection were performed by R. Beaty, and P. Seli and J. A. Cheyne performed the data analysis. P. Seli drafted the manuscript, and all authors provided critical revisions. All authors approved the final version of the manuscript for submission.

Open Practices

All data and task materials have been made publicly available via Open Science Framework and can be accessed at <https://osf.io/z7qpg/>

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