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What Does "Mind-Wandering" Mean To the Folk? An Empirical Investigation[1]

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Abstract

Although mind-wandering research is rapidly progressing, stark disagreements are emerging about what the term "mind-wandering" means. Four prominent views define mind-wandering as 1) task-unrelated thought, 2) stimulus-independent thought, 3) unintentional thought, or 4) dynamically unguided thought. Although theorists claim to capture the ordinary understanding of mind-wandering, no systematic studies have assessed these claims. Two large factorial studies present participants (*N*=545) with vignettes that describe someone's thoughts and ask whether her mind was wandering, while systematically manipulating features relevant to the four major accounts of mind-wandering. Dynamics explains between four and forty times more variance in participants' mind-wandering judgments than other features. Our third study (*N*=153) tests and supports a unique prediction of the dynamic framework—obsessive rumination contrasts with mind-wandering. Our final study (*N*=277) used vignettes that resemble mind-wandering experiments. Dynamics had significant and large effects, while task-unrelatedness was non-significant. These results strongly suggest that the central feature of mind-wandering is its dynamics.

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Introduction

Mind-wandering science has expanded so rapidly that researchers dubbed this "the era of the wandering mind" (Callard, Smallwood, Golchert, & Margulies, 2013). Yet stark disagreements are emerging within philosophy and cognitive science about what the term "mind-wandering" means. Until recently, leading researchers defined mind-wandering as task-unrelated thought – thought disengaged from one's primary task – and/or stimulus-independent thought – thought decoupled from perception (Smallwood & Schooler, 2006, 2015).

Researchers recently questioned this standard approach because it lumps together disparate phenomena (Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016; Irving, 2016; Irving & Thompson, 2018; Mills, Raffaelli, Irving, Stan, & Christoff, 2017; Seli, Kane, Smallwood, et al., 2018). Consider the diverse experiences a student may have when she disengages from lecture. Her mind might wander from a show she's been watching, to a party next weekend, to a joke she heard yesterday. Or she might reason through a math proof in her head. The standard approach classifies both experiences as mind-wandering, since the student's thoughts are about neither lecture nor perception (and thus are task-unrelated and stimulus-independent). But solving a proof seems antithetical to mind-wandering.

These challenges have generated disagreement about what "mind-wandering" means. Four views loom large. We have seen two, on which mind-wandering is task-unrelated or stimulus-independent thought. The third classifies mind-wandering as unintentional thought: thought that arises independent of conscious intentions (McVay & Kane, 2010; Watzl, 2017).[2] On the fourth, mind-wandering is dynamically unguided thought. On the dynamic view, mind-wandering is not guided to remain in place, so it meanders from topic to topic over time (Christoff et al., 2016; Irving, 2016; Irving & Thompson, 2018; Mills et al., 2017; cf. Sripada, 2016, 2018).

[2] McVay and Kane (2010) and Watzl (2017) argue that mind-wandering is unintentional because it reflects control failure and akrasia, respectively. Contrarily, our Studies 1 and 4 show that the folk accept Seli and colleagues (2016) thesis that mind-wandering can be intentional.

This disagreement is partly empirical: Which theory best explains existing psychological and neuroscientific findings and which will best generate future research? However, "mind-wandering" is also a folk term that researchers introduced to capture a "phenomenon… familiar to the lay person" (Smallwood & Schooler, 2006). This raises a question: What does "mind-wandering" mean to ordinary people? This question hasn't been systematically investigated and is important for two reasons. First, almost all mind-wandering research relies on an introspective method called "thought sampling" (Irving, 2018; Smallwood & Schooler, 2015). If researchers are correct and "mind-wandering" tracks introspective experiences, everyday intuitions may suggest distinctions and generalizations that are scientifically relevant. Second, we can avoid confusions in scientific communication by using terms that track common usage. For example, claims about the prevalence and function of mind-wandering may be misinterpreted if scientific and everyday conceptions of mind-wandering are incongruent.

In two large factorial studies, we present participants (N = 722) with vignettes that describe someone's thoughts and systematically manipulate features relevant to the four major accounts of mind-wandering. We find that dynamic guidance explains between four and forty times more variance in participants' mind-wandering judgments than other features. Our third study (N = 153) uses vignettes to test a unique prediction of the dynamic framework—that obsessive, ruminative, thought contrasts with mind-wandering, even though it is both task and stimulus independent. We find support for this prediction. Our final study (N = 277) used vignettes that resemble the conditions in experimental mind-wandering research. Dynamics had significant and large effects in this study, while task-unrelatedness was not significant. Our results strongly align with the dynamic theory (as well as a particular kind of family resemblance theory, one in which dynamics are the central feature of mind-wandering; see Discussion).

Study 1: Experimental Manipulation of Task-Relatedness, Intentionality, and Dynamic Guidance

Study 1 tested whether folk judgments align with theories of mind-wandering as off-task thought, unintentional thought, or dynamically unguided thought. To do so, we contrasted vignettes that had the same thought contents, but varied with respect to whether they were on-task or off-task, intentional or unintentional, and guided to a single topic or meandering unguided from one topic to another.

Methods

A priori sample-size calculations with the software G*power (Faul, Erdfelder, Lang, & Buchner, 2007) indicated that we required at least 341 participants, given a power of .95 and effect sizes of at least $\eta^2 = .027$ in a pilot study. For an equal number of participants in our 24 groups, we therefore requested 360 participants from Amazon Mechanical Turk (MTurk). 363 participants (Gender: 210 men, 153 women, 1 other; Median age group: 24–35; Median education: some college or bachelors) were eventually recruited because three participants completed the experiment without reporting to MTurk.

In a between-subjects factorial design, each subject read a single vignette in which a character named Susan has three thoughts.[3] Participants were then asked "How much do you agree with the following statement: Susan's mind is wandering" and answered on a seven-point Likert scale (1 = strongly disagree; 7 = strongly agree). Eight participants were excluded from the analysis because they failed one of two attention checks.

Vignettes varied along three dimensions: (1) task-relatedness – off-task vs. no-task; (2) intentionality – unintentional initiation vs. intentional initiation; and (3) dynamic guidance – meandering vs guided. Task-relatedness and intentionality were manipulated by altering how Susan's thoughts are initiated (Table 1).

[3] We used a between-subjects design where each participant rated one vignette to reduce demand characteristics, which is standard practice in vignette-based experiments. If participants had rated more than one vignette, they may have explicitly compared them to guess which one the experimenter considers mind-wandering.

Vignettes also varied with respect to their dynamics (how they unfolded over time) (Table 2 and Figure 1).[4] Specifically, we varied whether Susan guided her thoughts to remain on a single topic or whether her thoughts meandered as she "didn't focus on any topic for long". Guided vignettes contain three sentences, each of which describes a thought about the same topic: grocery shopping, planning a camping trip, or planning a reception for work. Meandering vignettes contain one sentence from each focused vignette, to describe a case where Susan's thoughts meander between three topics (groceries, camping, and a reception). This technique yielded an overall 2x2x2x3 design, where focused and meandering vignettes varied in their dynamics but were matched on the contents of Susan's thoughts. This allowed us to control for the potential effects of content on mind-wandering judgments, while ensuring that our results were generalizable across topics. Instructions for how to create each vignette are included in an online appendix.

[Place Table 1 Around Here]

[Place Figure 1 Around Here]

[Place Table 2 Around Here]

Results

Collapsing across content domains, a three-way ANOVA (task-relatedness X guidance X intention) was conducted to predict mind-wandering ratings. While all three dimensions of thought were significant ($p < .05$) (Figure 2; Table 3), dynamic guidance ($\eta^2 = .15$) explained approximately four times more variance than task-relatedness ($\eta^2 = .04$) and ten times more variance than intentionality ($\eta^2 = .015$) (Table 3; Figure 2).[5]

[4] We call this dimension "dynamic guidance", because it is based on the so-called "dynamic theory" of mind-wandering (Christoff et al., 2016; Irving, 2016).

[5] Our analyses focused on the differences in mind-wandering ratings across conditions, rather than mean mind-wandering ratings. We did so because mean ratings are susceptible to biases such as anchoring effects. Specifically, participants seemed to anchor at the midpoint (rather than the low end) of the scale for cases that are not mind-wandering. For example, we found in study 4 that on-task, intentional, and guided thought was not rated as significantly lower than the midpoint of 4 (mean rating = 3.56, 95% *CI* [2.98, 4.15]).

Visual inspection of Figure 2 suggests a possible three-way interaction in which off task, unintentional thought *specifically* yields high mind wandering ratings even when thought dynamics are guided. However, the three-way interaction did not reach statistical significance (p = 0.314), indicating that the right-most grey bar does not statistically differ when compared to the other three grey bars. The task-relatedness by intentionality interaction was significant (p < 0.033), indicating that being off-task boosted mind wandering ratings slightly more in the unintentional initiation condition (mean task-relatedness effect = 1.11) than the intentional initiation condition (mean task-relatedness effect = 0.27). The task-relatedness by dynamics interaction was also significant (p < 0.004) indicating being off task had a modestly larger effect on mind wandering ratings when thought was guided (mean task-relatedness effect = 1.26) versus unguided (mean task-relatedness effect = 0.25). No other interactions were significant. Descriptive statistics for all studies are available in the online appendix.

[Place Figure 2 Around Here]

[Place Table 3 Around Here]

Study 2: Manipulation of Stimulus-Independence and Dynamic Guidance

Study 2 used the matched vignettes method to test an additional potential dimension of mind-wandering, exploring whether stimulus-independence or dynamic guidance best predicts mind-wandering judgments. To do so, we used new vignettes where Susan could consider the same topic (e.g. packing for a trip) by either thinking about (stimulus-independent) or looking at (stimulus-dependent) objects in her home.[6]

Methods

[6] For two reasons, we used separate vignettes in Studies 1 through 4 instead of constructing one set of vignettes that manipulated all the variables we studied. First, our design would become unwieldy if we manipulated every variable simultaneously (doing so would require 72 conditions). Our vignettes would then likely be too complicated for ordinary people to understand (simplicity is a central virtue in vignette-based research). Second, Studies 2, 3, and 4 each placed specialized demands on our vignettes. Study 2 required that Susan could consider the same things by thinking about or looking at them. Study 3 required that Susan could think about the same topic in a goal-directed or ruminative manner. Study 4 required that Susan think about three different topics, which can fall under the broad umbrella of "her plans for the next few weeks". We doubt that a single set of vignettes could satisfy all three desiderata, while being simple and natural enough to be understood by laypeople.

A new group of 182 participants were recruited through Amazon's MTurk (Gender: 98 men, 82 women, 2 other; Median age group: 24–35; Median education: some college or bachelors). As in Study 1, we requested 15 participants per group. Five participants were excluded from the analysis because they failed one of two attention checks.

Each participant rated a vignette describing Susan's experiences, as in Study 1. Vignettes varied along two dimensions: dynamic guidance and stimulus-dependence. In all vignettes, Susan was performing no task and her mind began to wander unintentionally. Vignettes were about three new topics to ensure that our results generalized across content domains.

Stimulus-dependence was manipulated by varying whether Susan thought about (stimulus-independent) or looked at (stimulus-dependent) objects in her house, as illustrated in Table 4 (left column). During focused vignettes, Susan thought about or looked at things in order to prepare for a task (packing for a trip, cooking dinner, or painting).

[Place Table 4 Around Here]

The procedure from Study 1 was used to manipulate the dynamics of internal and external vignettes, yielding a 2x2x3 design that varied dynamics and stimulus-dependence, but was matched for topics.

Results

Collapsing across content domains, a two-way ANOVA (dynamic guidance X stimulus-dependence) was conducted to predict mind-wandering ratings. As in Study 1, both thought dimensions were significant ($p < .05$), although stimulus independence was only marginally significant (Figure 3; Table 5). However, guidance ($\eta^2 = .47$) explained approximately forty times more variance than stimulus-independence ($\eta^2 = .012$) (Figure 3; Table 5). Interactions were not significant ($p = 0.674$).

[Place Figure 3 Around Here]

[Place Table 5 Around Here]

Study 3: Manipulating Rumination

Folk judgments so far cohere with the dynamic view of mind-wandering. However, we have not assessed a unique prediction of the dynamic view concerning rumination. Rumination is ‘‘a mode of responding to distress… [where] people… remain fixated on the problems and on their feelings about them’’ (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Rumination is often, indeed generally, task and stimulus independent. But the dynamic view implies that mind-wandering, which meanders between topics, contrasts with rumination that is "stuck" on a distressing topic (Christoff et al., 2016; Irving, 2016; Irving & Glasser, 2019). Opponents of the dynamic view object that rumination is a type of mind-wandering (Metzinger, 2018; Seli, Kane, Smallwood, et al., 2018). We therefore tested whether ordinary people classify rumination as mind-wandering.

Methods

A new group of 145 participants were recruited through Amazon's MTurk (Gender: 102 men, 41 women, 2 other; Median age: 29; Median education: some college or bachelors). As in Study 1, we requested 15 participants per group. 46 participants were excluded from the analysis because they failed one of two attention checks.

Similar to Studies 1 and 2, each participant rated a vignette describing Susan's thoughts. As in Study 2, Susan was not performing a task and began thinking unintentionally. Vignettes were in one of three conditions: dynamically unguided (meandering) vs dynamically guided (deliberative thinking) vs ruminative. Ruminative vignettes were focused on the same thoughts as deliberately guided ones but varied with respect to whether Susan found her thoughts elicited distress (nervousness, anxiety, and worry) and obsessive focus (Susan was "fixated" and "drawn back" to a topic during rumination).

The procedure from Study 1 and 2 was used to manipulate dynamic guidance, yielding a 3X3 design on which dynamically guided, dynamically unguided, and ruminative vignettes were matched for topics (Table 6).

[Place Table 6 Around Here]

Results

Two-sample t-tests revealed that mind-wandering judgments were significantly higher for dynamically unguided vignettes than either dynamically guided vignettes $t(63) = 3.64$, $p < 0.001$ or ruminative vignettes ($t(60) = 3.10$, $p = 0.003$). Both effects were large, with a Cohen's d of 0.91 and 0.79, respectively. In contrast, mind-wandering judgments did not differ between dynamically guided vignettes and ruminative vignettes ($p = 0.849$; Figure 4).

[Place Figure 4 Around Here]

Study 4: On-Task Thought

Study 1 manipulated task-relatedness by contrasting cases where Susan was *off-task* and had *no-task*. We used this manipulation because the standard view arguably entails that mind-wandering cannot occur without a task. If mind-wandering is *task-unrelated* thought, the wanderer must have some task to *wander away from* (Irving, 2016; Seli, Kane, Smallwood, et al., 2018). This assumption undergirds influential mind-wandering experiments. For example, Baird and colleagues (2012) infer that mind-wandering aids creativity because easy tasks (which induce task-unrelated thoughts) facilitate creativity more than rest (i.e. no task). Baird's inference is valid only if off-task mind-wandering is distinct from no-task rest. Similarly, studies of everyday mind-wandering ask participants "are you thinking about something *other than what you were doing*" (Killingsworth & Gilbert, 2010) or "my mind had wandered to something *other than what I was doing*" (Kane et al., 2007, emphasis added). These questions assume that mind-wandering occurs only when participants are *doing something* (i.e. performing a task) that their minds wander *away from*.

Laboratory mind-wandering studies, however, typically contrast off-task thought (e.g. Susan's mind wanders from homework) with *on-task* thought (e.g. Susan focuses on homework). Task-relatedness may therefore predict mind-wandering ratings better if we contrast off-task and *on-task* thought. We tested this hypothesis in Study 4.

Methods

A new group of 260 participants were recruited through Amazon's MTurk (Gender: 167 men, 93 women, 0 other; Median age: 36; Median education: Bachelor's degree). As in Study 1, we requested 15 participants per group. We recruited MTurk Masters who had above 90% reputation to ensure data quality (Peer, Vosgerau, & Acquisti, 2014). 17 participants were dropped because they incorrectly answered one of two attention checks.

Similar to Studies 1 through 4, each participant rated a vignette describing Susan's experiences. Vignettes varied along two dimensions (Table 7): dynamic guidance (guided vs unguided) and task-relatedness (off-task vs no-task vs on-task). Task-relatedness was manipulated according to the procedure in Table 7. The procedure from Study 1 was used to manipulate the dynamics of thought, yielding a 3x2 design that varied task-relatedness and dynamics, but was matched for topics.

Our goal was to mirror laboratory conditions where subjects intentionally engage in on-task thought. Subjects engage in on-task thought when they intentionally perform a task such as pressing a button or, in our case, planning a camping trip. Given this, on-task vignettes had to be intentionally initiated. To match vignettes across conditions, all vignettes were therefore intentionally initiated.

[Place Table 7 Around Here]

Our on-task and unguided condition involved *unstructured tasks*. The dynamic view predicts that certain kinds of on-task thought (e.g. brainstorming and creative thinking) are more similar to mind-wandering than others (e.g. planning a trip) (Christoff et al., 2016; Irving, Under

Revisions, 2016; Sripada, 2018). This is because tasks like brainstorming impose little *dynamic structure* on the train of thought: such tasks are so broad that they let one's mind wander to many topics (see Irving, Under Revisions, 2016 for a model of unstrutured tasks). Our on-task and unguided condition therefore has Susan perform an unstructured task—"thinking about her plans for the next few weeks"—that lets her mind freely wander to three different topics. Here is one such vignette, with each topic in a different colour:

- Susan intentionally decides to think about her plans for the next few weeks, when she has the following thoughts. She makes a list of equipment that she needs for her next camping trip – "tent, sleeping bag, pillow..." Then she imagines walking through the grocery store aisles later in the week, considering what she would like to buy. Then she thinks about how to describe her work experience at an upcoming interview. Susan doesn't focus on any of these things for long, and when she switches topics, she simply moves on.

Even though Susan is on-task, the dynamic theory predicts that she should receive higher mind-wandering ratings because her thoughts are dynamically unstructured (i.e. weakly guided).

Results

Collapsing across content domains, a two-way ANOVA (dynamic guidance X task-relatedness) was conducted to predict mind-wandering ratings. As in previous studies, the effect of dynamic guidance on ratings was significant and large ($F(1,255) = 43.68,\ \eta^2 = 0.14,\ p < 0.001$). Task-relatedness did not significantly predict mind-wandering ratings, although there was a trend in that direction ($p = 0.057$). Visual inspection of Figure 5 suggests a possible two-way interaction in which the effect of task-relatedness is significant when thought is guided. However, the interaction between dynamics and task-relatedness was not significant ($p = 0.440$). Our results strongly speak against the hypothesis that task-relatedness is closely linked to mind-wandering in contexts that mirror the experimental distinction between on-task and off-task thought.

[Place Figure 5 Around Here]

Study 5: Linguistic Analysis of Intentionality and Mind-Wandering

Study 1 found that intentionality weakly predicts mind-wandering, whereas many predict a stronger relationship (McVay & Kane, 2010; Watzl, 2017) or even that intentional mind-wandering is *impossible* (Murray & Krasich, forthcoming). Study 5 therefore used linguistic analysis to probe the folk's understanding of intentionality and mind-wandering.

Methods

One way to shed light on a term's meaning is to examine its *collocates*: that is, words that are commonly juxtaposed with that term. We therefore examined collocates for terms that refer to mind-wandering[7] in two English-language corpora: The Corpus of Contemporary American English (Davies, 2008), the largest genre-balanced corpora, and The Intelligent Web Based Corpus (Davies, 2017), the largest online corpus where websites were chosen in a systematic way (to ensure that they were popular amongst users from English-speaking countries, for example).

Results

In both corpora, by far the most common collocate for mind-wandering terms is "let", as in "Susan *let* her mind wander on purpose" (Davies, 2008, 2017; Table 8). These constructions describe cases of *intentional* mind-wandering, where someone consents to their mind's

[7]Across both corpora, speakers use almost exclusively "non-agentive" (Irving, 2016) constructions to refer to mind-wandering. Non-agentive constructions are those where the grammatical subject of the sentence is a person's mind (e.g. "Susan's mind was wandering"), rather than the person herself (e.g. "Susan was mind-wandering"). Although scientists sometimes use agentive constructions to refer to mind-wandering (e.g. "subjects mind-wandered in 50% of trials"), this is a neologism that is almost entirely absent from the English language corpora we reviewed. In the genre-balanced COCA, there were 0 non-agentive constructions describing mind-wandering compared to 249 non-agentive constructions. In the online iWEB, there were 4 non-agentive constructions describing mind-wandering compared to 3443 non-agentive constructions. Furthermore, 3 of the 4 agentive constructions in iWEB were from popular science publications. We therefore restricted our collocates analysis to non-agentive constructions, as doing otherwise would not change our results. According to Irving (2016), non-agentive constructions are philosophically interesting because they suggest that we are *passive recipients* of mind-wandering: our mind is what wanders, not us (Irving, 2016). The present linguistic analysis shows that these interesting constructions are pervasive in ordinary English.

wandering, rather than cases where someone's mind wanders unintentionally. Linguistic data therefore lends additional support to the view, already supported by our experimental evidence, that ordinary people consider intentional mind-wandering to be a typical form of mind-wandering (Seli, Risko, Smilek, & Schacter, 2016). However, our data does not show that the folk believe we can *directly intend* to mind-wander. Letting one's mind wander may involve only *indirect intentional control*: one might intend to perform some intermediate action (e.g. walking) that causes one's mind to wander. We therefore do not resolve the philosophical debate over whether intentions to mind-wander are direct (Irving, Under Revision) or indirect (Murray & Krasich, forthcoming).

[Place Table 8 Around Here]

Discussion

Mind-wandering is standardly defined in two ways: as task-unrelated or stimulus-independent thought (Smallwood & Schooler, 2015). A third research program contrasts unintentional and intentional mind-wandering (Seli, Risko, Smilek, & Schacter, 2016). A fourth approach defines mind-wandering as dynamically unguided thought (Christoff et al., 2016; Irving, 2016; Irving & Thompson, 2018; Mills et al., 2017; Sripada, 2018).

We investigated whether these theories cohere with ordinary people's understanding of mind-wandering. Studies one and two found that the dynamic view explained by far the most variance in folk mind-wandering judgments. Study three found that ordinary people agree with a unique prediction of the dynamic view—obsessive rumination contrasts with mind-wandering. Study four used vignettes designed to mirror experimental mind-wandering research. Here, the effect of dynamics remained significant and large, whereas task-relatedness became non-significant. These studies represent the first empirical investigation into what ordinary people mean by "mind-wandering".

Our results are significant for several reasons. Confusions can arise when scientific terminology diverges from ordinary meaning. Scientists who define "mind-wandering" as task-unrelated, stimulus-independent, or unintentional thought may talk past their lay audiences and colleagues,

who centrally understand mind-wandering in dynamic terms. Such crosstalk may invite audiences to draw unwarranted inferences. Researchers have drawn fascinating conclusions about task-unrelated thought. Because researchers call task-unrelated thought "mind-wandering", however, audiences may inappropriately generalize the conclusions to dynamically unguided thought. Consider the following cases:

- Researchers routinely claim that people spend 30–50% of their waking lives "mind-wandering" because task-unrelated thought is this pervasive (Kane et al., 2007; Killingsworth & Gilbert, 2010; Klinger & and Cox, 1987). Yet many task-unrelated thoughts are likely goal-directed or ruminative, categories that lay people contrast with mind-wandering.

- Researchers hotly debated evidence that "mind-wandering" recruits the executive network (Christoff, Gordon, Smallwood, Smith, & Schooler, 2009; Fox, Spreng, Ellamil, Andrews-Hanna, & Christoff, 2015; McVay & Kane, 2010; Smallwood, 2010; Smallwood & Schooler, 2006). The executive–mind-wandering connection may surprise audiences who endorse the dynamic/folk view, since the executive typically supports focused, goal-directed, thought (Owen, McMillan, Laird, & Bullmore, 2005; Rottschy et al., 2012). One explanation of this connection is that the executive supports *goal-directed* task-unrelated thought, not dynamically unguided thought, which ordinary people associate with mind-wandering.

Our studies suggest that the dynamic theory of mind-wandering has an advantage: It tracks ordinary usage. The dynamic theory also has scientific advantages (Christoff et al., 2016; Irving, 2016; Irving and Glasser, 2019). Recall that standard theories of mind-wandering bundle together disparate phenomena. When someone is "off-task", she may meander between topics, concentrate on a goal, or endlessly ruminate. These experiences have very different phenomenology, costs and benefits, psychological and neural mechanisms, and so on.

In contrast, dynamically unguided thought has relatively cohesive attributes. Unguided thought is linked to specific forms of agency (Irving, 2016) and creativity (Christoff et al., 2016; Sripada,

2018). It is closely associated with the default network. And it is elevated in disorders such as Attention Deficit Disorder (Andrews-Hanna et al., 2018; Christoff et al., 2016). If we understand mind-wandering as dynamically unguided thought, it may prove considerably more unified, philosophically defensible, and empirically tractable.

It may be no coincidence that the commonsense theory of mind-wandering has substantive philosophical and scientific advantages. Philosophers regularly rely on *commonsense intuitions* when we theorize about psychological entities such as perception, attention, memory, imagination, emotion, or mind-wandering. Consider how philosophers appeal to intuitions about what cases do (and don't) fall under psychological categories. Such intuitions are ultimately grounded in one's grasp of folk psychology, albeit filtered through philosophical training. Our vignette-based experiments complement this armchair case method, since experiments give us empirical evidence about the boundaries of folk-psychological concepts. Similarly, our linguistic corpora analysis provides evidence about how the folk speak and is therefore a rigorous alternative to ordinary language philosophy of psychology. Our empirical conceptual analysis is thus an extension of orthodox commonsense methods in the philosophy of psychology. And commonsense aligns most closely with the dynamic theory of mind-wandering.

Finally, our results help to indicate which version of the "family resemblance" theory of mind-wandering is most plausible (Christoff et al., 2018; Irving & Glasser, 2019; Metzinger, 2018; Seli, Kane, Smallwood, et al., 2018). Seli and colleagues (2018) characterize mind-wandering in terms of a cluster of (at least) four features: whether one's thoughts are 1) task-unrelated, 2) stimulus-independent, 3) unintentional, and 4) dynamically unguided. Although prototypical instances of mind-wandering have all these features, they argue that none are necessary.

Our results indicate that certain versions of the family resemblance framework are more promising than others. Rosch and Mervis' (1975) classic model of family resemblance concepts assumes that all features are relevant features are *equally* weighted and prototypicality depends on the *number* of features an instance exhibits. Our data speak against this "equal weighting" model, but are consistent with alternative formalisms of family resemblance concepts that allow for differences in feature salience (e.g. Gati & Tversky, 2004). Specifically, one could hold that

mind-wandering is a family resemblance concept with one central feature—its dynamics—and multiple peripheral features (task-unrelatedness, stimulus-independence, and unintentionality).

However, our results cannot settle the debate over whether mind-wandering is a family resemblance concept (see Christoff et al., 2018; Seli et al., 2018 for a debate). Our study is designed only to examine the *relative contributions* of various features (dynamics, task-unrelatedness, etc.) to judgments about mind-wandering. We find that one feature (dynamics) is central whereas the others are peripheral. But this is consistent with two interpretations of peripheral features. First, peripheral features may be *constitutive* of the concept mind-wandering, as predicted by the family resemblance theory of concepts (Rosch & Mervis, 1975). Second, peripheral features may merely be *diagnostic* of mind-wandering—but not constitutive of the concept itself—as predicted by the binary (Keil & Batterman, 1984) and theoretical (Murphy & Medin, 1985) models of concepts. Further studies are necessary to decide between these interpretations (Hampton, 1995).[8]

Over the past decade, the science of mind-wandering has seen a whirlwind of progress. Yet our studies suggest that the folk concept of mind-wandering has been partly lost in the dust. Our empirical conceptual analysis reveals that laypeople prioritize a feature of mind-wandering that researchers have neglected until recently: its dynamics. This disconnect is troubling. To avoid confusions and effectively communicate with our scientific colleagues and the public, researchers should take the preexisting meaning of "mind-wandering" into account. By respecting the folk concept, we may even learn distinctions that advance the science of mind-wandering.

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[8] Computational linguistic methods can uncover the meaning of the word 'mind-wandering.' One might instead treat the family resemblance theory as a *scientific model* of mind-wandering. Irving and Glasser (2019) explain how to test that model using a modified inference to the best explanation. They also sketch how this study might bear upon that inference.

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Tables

	Off-task	No-task
Unintentional Initiation[9]	Susan is **supposed to be doing her homework** when she *finds herself thinking* about something else…	Susan is **lounging around, not doing anything in particular**, when she *finds herself thinking* about something else…
Intentional Initiation	Susan is **supposed to be doing her homework** when she *intentionally decides to think* about something else…	Susan is **lounging around, not doing anything in particular**, when she *intentionally decides to think* about something else…

Table 1: Manipulating Task-Relatedness (in bold) and Intentionality (in italics). Examples of stimuli from Study 1.

Dynamically Guided	*Dynamically Unguided*
Susan is supposed to be doing her homework when she finds herself thinking about **the groceries she needs this week**. She	Susan is supposed to be doing her homework when she finds herself thinking **about other things**. She remembers some items from her

[9] Rather than call Susan's thoughts "unintentional", we used the everyday locution "Susan *finds herself* thinking about something else." Philosophers widely agree that intentional action requires non-observational self-awareness (Anscombe, 1957; Peacocke, 2007; Proust, 2013). Given this, we assumed that Susan cannot "find herself" intentionally performing an action (since she lacks self-awareness). We test and confirm this assumption in the Online Appendix.

remembers some items from her grocery list – "eggs, bread, milk, apples"… She thinks about what meals she wants to cook this week and what ingredients she will need. Then she imagines walking through the grocery store aisles later today and thinks about what she would like to buy. **Susan is trying to focus on the groceries she needs and if she gets distracted, she makes sure to return to this topic.**	grocery list – "eggs, bread, milk, apples"... Then she thinks about how to decorate a reception hall for her student group. Then she imagines the route she will drive to the campgrounds on her upcoming camping trip. **Susan doesn't focus on any of these thoughts for long, and when she switches topics she simply moves on.**

Table 2: Examples of Guided and Unguided Vignettes from Study 1. Guided vignettes describe three thoughts about the same topic (in green), whereas unguided vignettes describe thoughts about three different topics (in green, blue, and orange). Guided and unguided vignettes also contain different sentences describing the dynamics of thought (in bold).

Dimension	***F***	***p***	$\boldsymbol{\eta^2}$
Dynamic Guidance	$F(1,352)=69.66$	<0.001	0.15
Task-Relatedness	$F(1,352)=19.89$	<0.001	0.04
Intentionality	$F(1,352)=6.94$	0.009	0.02

Table 3: ANOVA to predict mind-wandering ratings using dynamics, task-relatedness, and intentionality (=si)*

	Stimulus-Independent	Stimulus-Dependent
Guided	Susan is lounging around, not doing anything in particular, when she finds herself **thinking about** *what she needs to pack for her upcoming trip to Europe.* She **remembers** her passport, which she needs to pack in her carry-on luggage.	Susan is lounging around, not doing anything in particular, when she finds herself **looking at** what she needs to pack for her upcoming trip to Europe. She **looks at** her passport, which she needs to pack in her carry-on

	Then she **imagines** some clothes that she needs put in her suitcase. Then she **thinks about** the umbrella that she wants to bring in case it rains. *Susan is trying to focus on what she needs to pack and if she gets distracted, she makes sure to return to this topic.*	luggage. Then she **looks at** some clothes that she needs put in her suitcase. Then she **looks at** the umbrella that she wants to bring in case it rains. *Susan is trying to focus on what she needs to pack and if she gets distracted, she makes sure to return to this topic.*
Unguided	Susan is lounging around, not doing anything in particular, when she finds herself **thinking about** various things. She **remembers** her passport, which she needs to pack in her carry-on luggage for her upcoming trip to Europe. Then she **imagines** the tomatoes that she will cut for dinner tonight. Then she **thinks about** the old paint she has to scrape off the walls when she repaints her apartment. *Susan doesn't focus on any of these thoughts for long, and when she switches topics, she simply moves on.*	Susan is lounging around, not doing anything in particular, when she finds herself **looking at** various things. She **looks at** her passport, which she needs to pack in her carry-on luggage for her upcoming trip to Europe. Then she **looks at** the tomatoes that she will cut for dinner tonight. Then she **looks at** the old paint she has to scrape off the walls when she repaints her apartment. *Susan doesn't focus on any of these thoughts for long, and when she switches topics, she simply moves on.*

Table 4: Example of how to manipulate stimulus-dependence (bold) and guidance (italics) in Study 2. Guided vignettes describe three thoughts about the same topic (in green), whereas unguided vignettes describe thoughts about three different topics (in green, blue, and orange).

Dimension	F	p	η^2
Dynamic Guidance	$F(1,173)=157.26$	<0.001	.47
Stimulus-Dependence	$F(1,173)=3.98$	0.048	.01

Table 5: ANOVA to predict mind-wandering ratings using dynamic guidance and stimulus-dependence

Unguided	Guided	Ruminative
Susan is lounging around, not doing anything in particular, **when she finds herself thinking about various things**. She remembers a list of required courses for next year – "Math, Biology, English." Then she imagines the music she will play at a party this weekend. Then she thinks about how to describe her work experience in an upcoming job interview. **Susan doesn't focus on any of these thoughts for long, and when she switches topics she simply moves on.**	Susan is lounging around, not doing anything in particular, when **she finds herself thinking about what classes to take next year**. She remembers a list of her required courses – "Math, Biology, English." Then she imagines how she can fit a biology lab into her schedule. Then she **thinks** about taking advanced physics, and whether she can handle all the equations. **Susan is trying to focus on what classes to take, and if she gets distracted, she makes sure to return to this topic.**	Susan is lounging around, not doing anything in particular, when **her thoughts turn obsessively to what classes to take next year**. She ***nervously*** remembers a list of her required courses – "Math, Biology, English." Then she ***anxiously*** imagines how she can fit a biology lab into her schedule. Then she **worries** about taking advanced physics, and whether she can handle all the equations. **Susan can't help but fixate on what classes to take, and she's drawn back to this topic whenever she tries to think about something else.**

Table 6: Examples of Unguided, Guided, and Ruminative Vignettes. Guided and ruminative vignettes contain thoughts about one topic (in green), whereas dynamic vignettes contain thoughts about three different topics (in green, blue, and orange). Other changes are in bold.

	Off-Task	No-Task	On-Task

Guided	Susan is doing her homework when she intentionally decides to think about her camping trip...	Susan is lounging around, not doing anything in particular, when she intentionally decides to think about her camping trip...	Susan intentionally decides to think about her upcoming camping trip, when she has the following thoughts...
Unguided	Susan is doing her homework when she intentionally decides to think about various things...	Susan is lounging around, not doing anything in particular, when she intentionally decides to think about various things...	Susan intentionally decides to think about her plans for the next few weeks, when she has the following thoughts...

Table 7: Procedure used to manipulate stimulus-dependence and guidance. Each guided vignette is followed by three thoughts about the same topic (in this example, a camping trip). Each unguided vignette is followed by three thoughts about Susan's plans for the next few weeks (her camping trip, job interview, and groceries).

	COCA	iWeb
1	Let (19.0%)	Let (29.4%)
2	Back (9.7%)	Letting (7.4%)
3	Letting (3.5%)	Gently (1.5%)
4	Lets (2.4%)	Distracted (0.4%)
5	Wondered (1.4%)	Refocus (0.2%)

Table 8: The five most common collocates of phrases that describe mind-wandering, excluding pronouns. Results are from The Corpus of Contemporary American English (COCA) and The Intelligent Web Based Corpus (iWeb). The percentage of all phrases that include this collocate is represented in brackets.

Figures and Captions

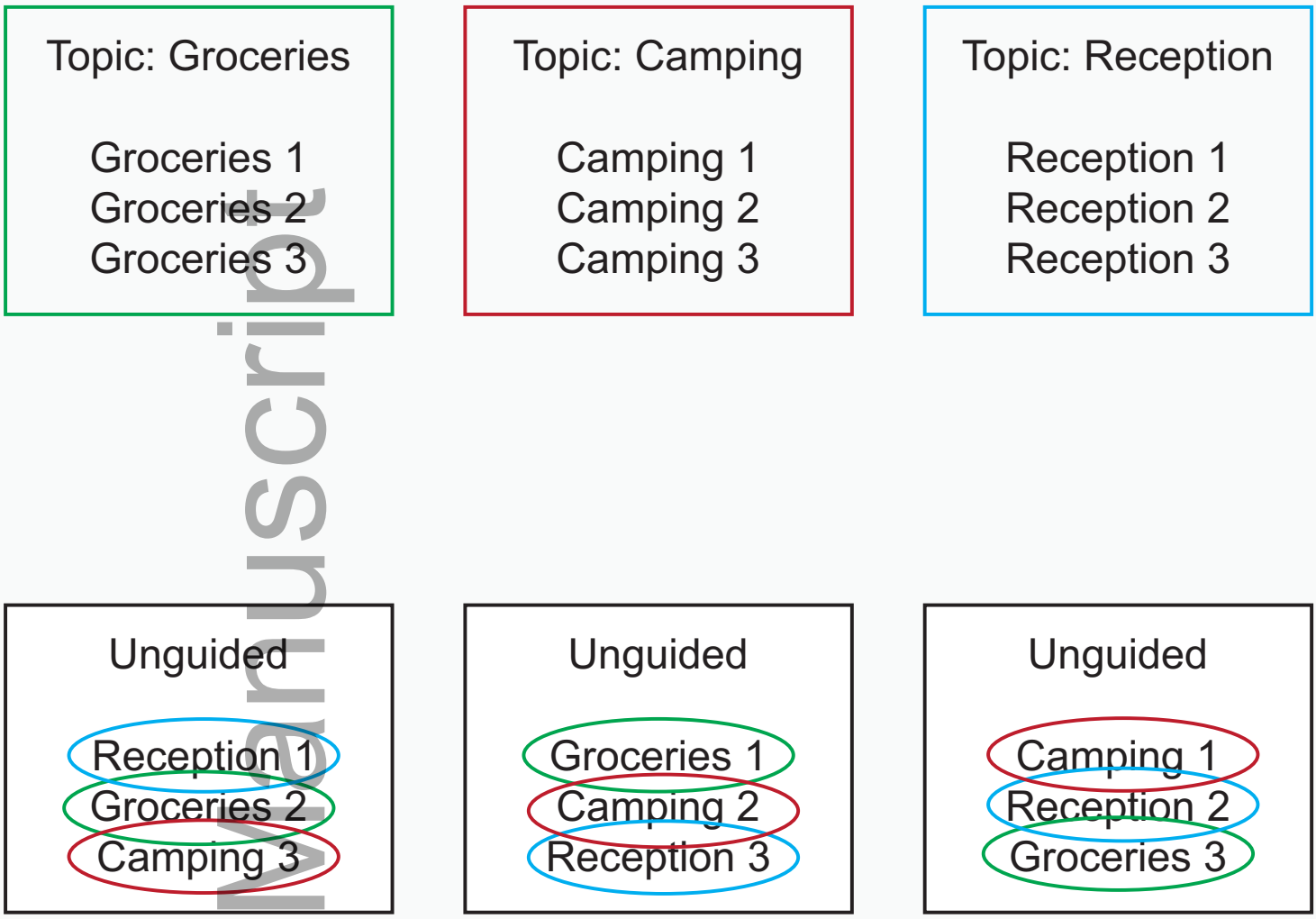
Figure 1: How guided vignettes were recombined to create unguided vignettes. During "guided" vignettes, the character has three thoughts that are focused on a single topic (top row). During unguided thinking, the character has three thoughts that meander between different topics (bottom row). To avoid content effects, the unguided vignettes recombined sentences drawn from the guided vignettes.

Figure 2: Mind-Wandering Ratings by Dynamic Guidance, Task-Relatedness, and Intentionality. Subjects were presented with vignettes that manipulated three factors relevant to three leading theories of mind-wandering. Dynamic guidance was a strong predictor of mind-wandering ratings with unguided thinking (red bar) earning higher mind-wandering ratings than guided thinking across all conditions. Error bars represent standard errors.

Figure 3: Mind-Wandering Ratings by Dynamic Guidance and Perceptual Orientation. Subjects were presented with vignettes that factorially manipulated dynamically guided versus dynamically unguided thinking and external versus internal perceptual orientation. Mind-wandering ratings were substantially higher for unguided thinking (red bar) irrespective of perceptual orientation. Error bars represent standard errors.

Figure 4: Mind-wandering ratings for unguided, deliberately guided, and ruminative thought. Unguided thought (red bar) received significantly higher ratings than either deliberatively guided or ruminative thought, which were not significantly different from each other. Error bars represent standard errors.

Figure 5: Mind-wandering ratings by task-relatedness and dynamics. Subjects were presented with vignettes that factorially manipulated dynamically guidance (guided vs unguided) and task-relatedness (on-task vs off-task vs no-task). Mind-wandering ratings were significantly higher for unguided (red bars) versus guided (grey bars) thought. Task-relatedness had no significant effect on ratings. Error bars represent standard errors.



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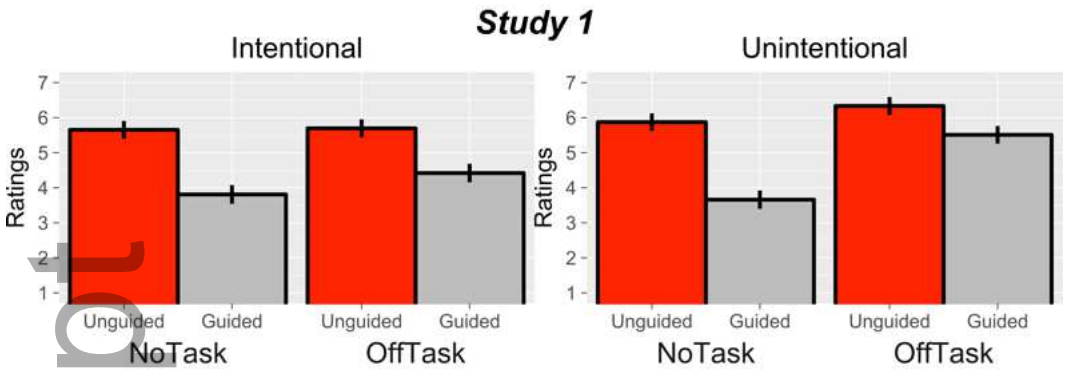

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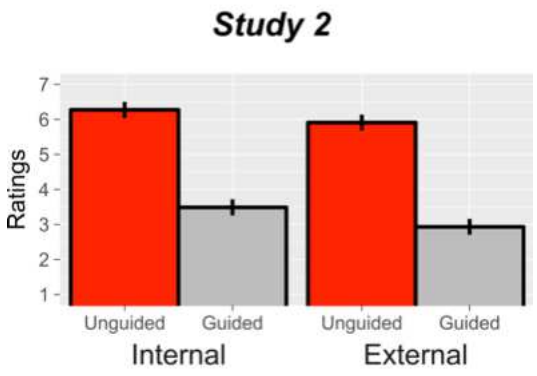

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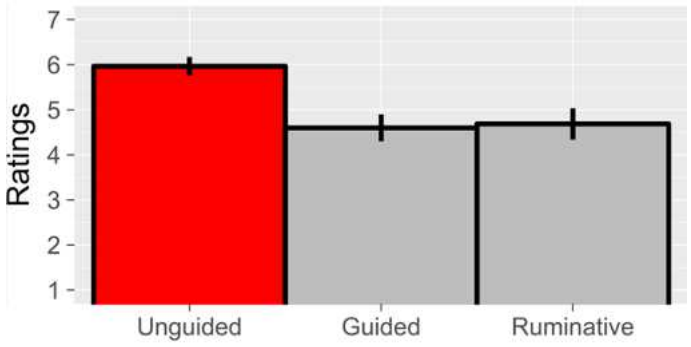

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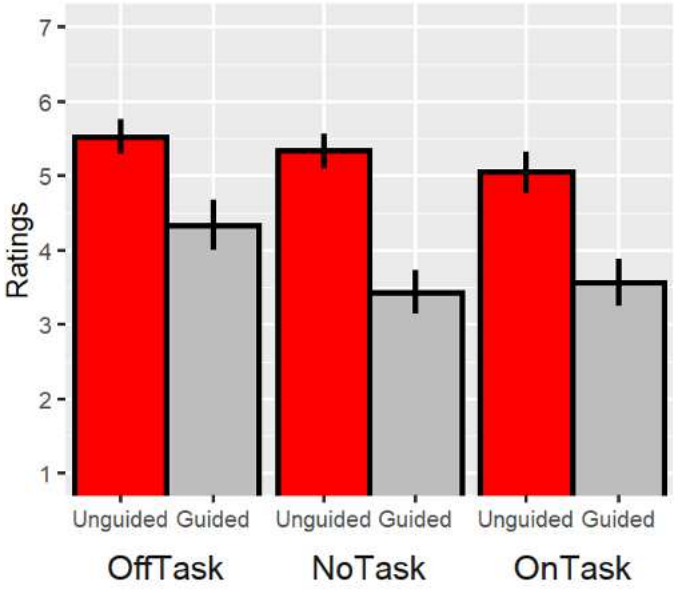

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