

## Mind-wandering as a natural kind: A family-resemblances view

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### Abstract:

As empirical research on mind-wandering accelerates, we draw attention to an emerging trend in how mind-wandering is conceptualized. Previously articulated definitions of mind-wandering differ from each other in important ways, yet they also maintain overlapping characteristics. This conceptual structure suggests that mind-wandering is best considered from a family-resemblances perspective, which entails treating it as a graded, heterogeneous construct and clearly measuring and describing the specific aspect(s) of mind-wandering that researchers are investigating. We believe that adopting this family-resemblances approach will increase conceptual and methodological connections among related phenomena in the mind-wandering family and encourage a more nuanced and precise understanding of the many varieties of mind-wandering.

**Keywords:** mind-wandering | family resemblances | definition | heterogeneous | varieties

### Article:

#### **‘Mind-Wandering’ Encompasses a Broad Range of Phenomena**

Introspection indicates that our conscious experiences are not always tied to ongoing events or to tasks that we are performing. Scientific investigation of this phenomenon, commonly referred to as ‘mind-wandering’, has recently accelerated. Laboratory and daily-life studies of mind-wandering amply demonstrate the prevalence and importance of this aspect of human experience. Estimates suggest that we spend upwards of half our waking lives engaged in mind-wandering [1]. Moreover, this ubiquitous experience predicts a range of important functions and outcomes. On the one hand, mind-wandering has been associated with beneficial processes such as goal-directed thinking [2], planning [3], and creativity [4]. On the other hand, it correlates with costly outcomes such as attenuated processing of the environment [5, 6], driving accidents [7], disruptions to learning [8, 9, 10], affective dysfunction [11], and impaired performance in daily life [12]. A broader theme that has also emerged is that ‘mind-wandering’ encompasses a range of experiences that vary in terms of content, intentionality, task-relatedness,

and relationship to external stimuli (among other things). This heterogeneity suggests that, similar to other natural constructs (e.g., mindfulness [13], intelligence [14], and creativity [15]), mind-wandering is best considered from a family-resemblances perspective; that is, as a heterogeneous, fuzzy-boundaried construct that coheres amid patterns of overlapping and nonoverlapping features.

In this article, we first examine prominent definitions of mind-wandering, considering the benefits of viewing them as complementary, and necessarily incomplete, rather than competing. We then outline a family-resemblances framework for mind-wandering research and consider its utility. Finally, we explain how adopting this framework will facilitate development of more nuanced scientific accounts of mind-wandering, and we provide empirical strategies for achieving this goal.

### **Different Definitions of Mind-Wandering Are Best Viewed as Complementary, Not Competing**

To date, the most common definitions of mind-wandering include task-unrelated thought (TUT), unintentional thought, stimulus-independent thought (SIT), stimulus-independent and task-unrelated thought (SITUT), and meandering, unguided thought. Although investigations of these varieties of mind-wandering have been fruitful, challenges arise from such conceptual heterogeneity: Researchers have treated these perspectives on mind-wandering as theoretical competitors. Indeed, some published definitions of mind-wandering are exclusive of others (e.g., mind-wandering must reflect TUT and not task-free thought [16] or mind-wandering must reflect unguided, and not guided, thoughts, even if such thoughts are unrelated to one's ongoing task [17]). Given that each of these varieties of mind-wandering captures features shared by some, but not all experiences that emerge when the mind wanders, we suggest that these different definitions complement, rather than compete with, one another. We ultimately argue that the field cannot viably assume a single definition of mind-wandering based on a circumscribed set of necessary and sufficient features.

### **Task-Unrelated Thought**

TUT refers to thoughts that are unrelated to one's ongoing task [16]. The TUT definition of mind-wandering helpfully allows researchers to identify contexts requiring people to attend to certain tasks, as well as the consequences of attention failures. Moreover, studies examining TUT mimic the daily-life activities in which people engage, which helps researchers understand the contribution of mind-wandering to everyday pursuits (e.g., 12, 18). However, a disadvantage of defining mind-wandering exclusively as TUT is that it discounts many experiences that most people recognize as mind-wandering. Introspectively, we know that our minds do not stop wandering when we sit idly (e.g., while riding a bus). In addition, empirically, mind-wandering is frequently studied in contexts lacking any focal task to perform; indeed, much of our knowledge about the neural correlates of mind-wandering comes from resting-state studies that simply require participants to lie in a MRI scanner (e.g., [19]). Thus, both intuition and scientific research demonstrate the insufficiency of TUT as an exclusive definition of mind-wandering.

### **Unintentional Thought**

Another common definition of mind-wandering is thought that occurs without intention (e.g., 16, 20, 21). However, this excludes situations in which people sit dreamily, purposely allowing their thoughts to drift, or cases in which people deliberately neglect a task, or seek mental escape from unpleasant situations, in the service of entertaining TUT. Not only have researchers considered such scenarios to reflect mind-wandering (e.g., [22]), but the assumption that participants' reports of 'mind-wandering' uniformly lack intention has been questioned by daily-life findings that people often report engaging in 'intentional mind-wandering' (e.g., 23, 24). In the laboratory, as well, many TUTs that people report are, in fact, engaged intentionally (e.g., 25, 26, 27). Thus, defining mind-wandering strictly in terms of unintentional thought appears too exclusive of experiences commonly recognized and self-reported as mind-wandering.

### **Stimulus-Independent Thought**

SIT refers to thoughts that 'arise from intrinsic changes that occur within an individual', as opposed to 'stimulus-dependent thoughts', or, 'extrinsic changes that are cued directly from perceptual events occurring in the external environment' [i.e., 'stimulus-dependent thoughts' ([28] p. 490)]. Although some researchers have proposed that mind-wandering must reflect SIT (e.g., [1])\*, stimulus independence also characterizes certain forms of task-related, goal-oriented cognition. Indeed, many tasks require information to be buffered over time in a stimulus-independent form. For example, while completing a working-memory task, participants consciously maintain information across stimulus events. Similarly, good task performance sometimes requires people to retrieve and generate information, as in creative-problem-solving activities.

Given that most researchers do not conceptualize mind-wandering as task-relevant cognition, and that SIT can include task-relevant thought, the SIT definition appears overly inclusive and, thus, conflicts with people's general understanding of mind-wandering. At the same time, defining mind-wandering as SIT can be overly restrictive. Consider, for example, the scenario in which you are eating dinner with your family and your thoughts drift to an argument you just had with your sibling, who is seated next to you. Such stimulus-associated thoughts would qualify as 'mind-wandering' to many people. Yet, because these thoughts were triggered by (and continue to feature) an environmental stimulus, the SIT definition rejects them as mind-wandering.

### **Stimulus-Independent Task-Unrelated Thought**

Defining mind-wandering as SITUT (e.g., [29]) circumvents the previously discussed problem with SIT; namely, that task performance can require people to think about stimuli no longer in the environment, but these goal-directed, on-task thoughts are nevertheless classified as 'mind-wandering'. This is no longer problematic with a SITUT definition because, to qualify as mind-wandering, thoughts must be both stimulus independent and task unrelated. Nonetheless, SITUT is limited as a gold-standard definition of mind-wandering (e.g., [30]) because it excludes thoughts commonly recognized as mind-wandering in a similar manner as do both the SIT definition (e.g., mentally replaying the argument with a sibling) and TUT definition (e.g., task-free mind-wandering on the bus).

## Meandering, Unguided Thought

Researchers have recently proposed that, to qualify as mind-wandering, a thought must be meandering and unguided (e.g., [17]). Although investigations of this variety of mind-wandering have provided theoretical insights [31], as with the other definitions, this definition excludes thoughts that are commonly recognized as mind-wandering (e.g., perseverative TUTs. Therefore, we cannot endorse adopting unguided thought as an exclusive definition of mind-wandering.

## Interim Conclusions

Specific and exclusive definitions of mind-wandering do not, and perhaps cannot, adequately capture the rich variety of this experience (and some definitions may incidentally include experiences that do not appear to reflect ‘mind-wandering’). Moreover, despite clear differences in conceptualizations of mind-wandering (e.g., TUT, SIT, and unguided thought), researchers often adopt a broad-brush focus on ‘mind-wandering’ when drawing conclusions, rather than constraining theoretical discussions to the specific variety of mind-wandering investigated. For instance, now-common claims in the literature are that ‘people spend up to 50% of their waking lives mind-wandering’ and ‘mind-wandering predicts creativity’. Importantly, however, the researchers who initially reported these findings examined only the TUT variety of mind-wandering. Nevertheless, such broad claims are frequently made in separate studies and opinion pieces examining different varieties of mind-wandering, implying that these claims generalize (e.g., [32]). Thus, researchers may be lumping together fundamentally different experiences into the same category, which could lead not only to conceptual confusion, but also to theoretical conflicts and inappropriate applications (for an example, see Box 1).

### **Box 1.** Lumping Varieties of Mind-Wandering Together Can Cause Theoretical Complications

McVay and Kane proposed what later became an influential theoretical account of mind-wandering [20]. Their Executive Control Failures × Concerns account argued that mind-wandering occurs when a person fails to ‘defend primary-task performance against interference from ... thoughts’ ([20] p. 195). One important implication of this account is that mind-wandering reflects unintentional thoughts cued by context; indeed, deliberate, willful shifts of attention would hardly qualify as control failures (and might be best categorized as controlled processing). Thus, although the Executive Control Failures account helped guide the development and refinement of mind-wandering theory, it does not capture well certain varieties of thought that many theories and laypeople would classify as ‘mind-wandering’; for example, allowing one’s mind to wander while sitting by a lake, or deliberately planning a dinner date while sitting in calculus class, would not qualify as mind-wandering because such thoughts would not reflect control failures. Given that the Executive Control Failures account does not pertain to all varieties of mind-wandering, one may be tempted to simply reject it, particularly if one views mind-wandering as a unitary construct caused by a single mechanism. By contrast, the family-resemblances account of mind-wandering allows for the possibility that the Executive Control Failures account does, in fact, provide a reasonable explanation of certain varieties of mind-wandering only (particularly those that are unintentional and task-

unrelated). Thus, the family-resemblances view allows room for numerous mechanisms that underpin different types of mind-wandering.

## **Potential Solutions to the Conceptual and Definitional Challenges of Mind-Wandering**

If no single definition of mind-wandering is universally adequate or acceptable, should the field simply abandon its use in favor of more nuanced, qualified terms, such as ‘unintentional task-unrelated thought’ or ‘intentional stimulus-independent thought’? This strategy would undoubtedly increase clarity, but ‘mind-wandering’ is a useful umbrella term, just as ‘cognition,’ and ‘creativity’ are (and it hardly appears sensible to abandon the term ‘cognition’ because definitions of visual cognition do not encompass those of numerical cognition).

Moreover, adoption of the term ‘mind-wandering’ in 2006 [16] appears to have inspired an acceleration of research. Perhaps most important, introducing the term ‘mind-wandering’ to the scientific literature encouraged crosstalk among researchers who were separately studying related phenomena (e.g., TUT and daydreaming). Thus, abandoning the term ‘mind-wandering’ does not appear advisable.

Perhaps the field should instead propose a definition of mind-wandering with necessary and sufficient conditions, as belonging to a ‘classical view’ of category membership? Many researchers (ourselves included) have tried this approach. Classical definitions of mind-wandering are appealing, but as we demonstrated above, no single definition can capture all the facets and subtleties of mind-wandering, and neither logic nor empiricism can select among them. The fact that different researchers have thoughtfully developed conflicting definitions of mind-wandering amply demonstrates the perils of pursuing a unitary but arbitrary conception.

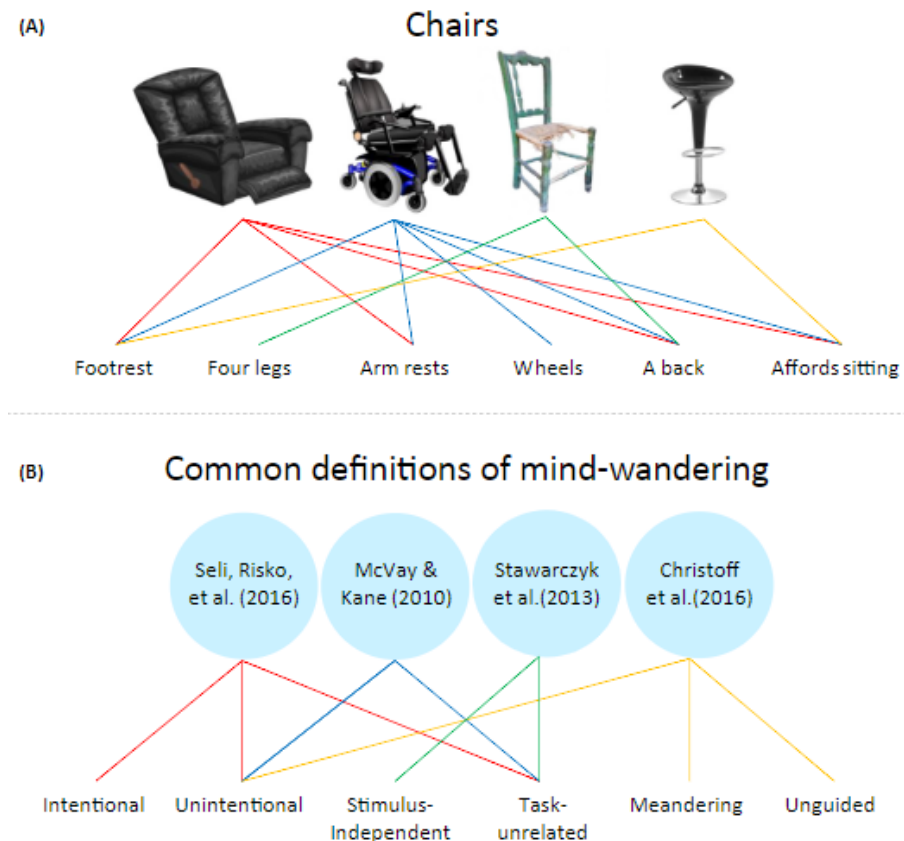
The heterogeneity of mind-wandering experiences and definitions implies that the best way forward may be to adopt a new approach. We propose that the field acknowledge mind-wandering to be a multidimensional and fuzzy construct encompassing a family of experiences with common and unique features<sup>†</sup>.

## **A Family-Resemblances Approach to Mind-Wandering**

‘Consider the proceedings that we call “games.” I mean board-games, card-games, ball-games, Olympic-games, and so on. What is common to them all? —Don’t say: “There must be something common, or they would not be called ‘games’”—but look and see whether there is anything common to them all. —For if you look at them you will not see something that is common to them all, but similarities, relationships, and a whole series of them at that’ (Wittgenstein [33] pp. 31–32).

As Wittgenstein noted, some categories have necessary and sufficient defining features that apply to all category members (e.g., prime numbers), but most human-created categories are held together by overlapping subsets of similarities, or ‘family resemblances’, rather than a common thread running through all members. Eleanor Rosch and colleagues similarly distinguished digital categories, for which membership is all-or-none, from natural categories, for which membership is analog. Natural categories are characterized as ‘networks of overlapping attributes’ [34], and exemplars of natural categories vary in terms of their ‘graded membership’

within their categorical family: Whereas highly prototypical members have attributes that overlap with most other exemplars of the category, low-prototypical members have little overlap (Figure 1A, Key Figure).



**Figure 1.** Key Figure: Schematic for a Family-Resemblances View

In (A), there are four chairs that share one or more features with the each other. For example, the first, second, and fourth chairs all afford sitting (the third chair has a broken seat), and the first, second, and third chairs all have backs. However, no single feature runs through all members of the family of chairs. Hence, there is no universal feature that defines membership. Instead, the ‘family’ of chairs is held together by overlapping features. In (B), there are examples of different definitions of mind-wandering from four articles (17, 20, 29, 54, respectively). Across these articles, mind-wandering is defined with reference to specific aspects of conscious experiences, including intentionality, stimulus dependence, task relatedness, and/or content stability. However, the family-resemblances view posits that, just as there is no single feature that defines the chair family, there are no specific features that a thought must have to be granted membership in the mind-wandering family. Instead, by the family-resemblance view, mind-wandering is a collection of related experiences that share some, but not all, features.

### Prototypicality and Graded Membership within the Mind-Wandering Family

A family-resemblances view characterizes mind-wandering as a natural category with graded membership (i.e., some exemplars are more prototypical than others; Figure 1B). For instance, within the family of mind-wandering definitions presented in Figure 1B, graded membership can be determined by identifying the number of shared features that each definition, or exemplar, shares with the others. The most frequently endorsed features of mind-wandering across these definitions include ‘unintentional’ and ‘task-unrelated’ thought, so thoughts characterized by these features would be considered more prototypical cases of mind-wandering than thoughts

characterized by less frequently shared features (e.g., intentional, or unguided thought). To empirically (and more systematically) quantify graded membership in the mind-wandering category, researchers could examine all definitions of mind-wandering reported in the literature and determine the extent to which features associated with each (e.g., task unrelatedness, intentionality, stimulus dependence, and level of guidance) overlap with features associated with the other definitions.

Alternatively (or additionally), as in Rosch's seminal research on graded membership [34], researchers could ask people (experts, laypeople, or both) to report exemplars of mind-wandering and assess which features of these exemplars overlap with others. However, across different samples, there may arise some variation in graded membership. For instance, the 'most prototypical' case of mind-wandering identified by researchers may appear as a slightly less prototypical case in another sample, say, of novelists (although with sufficiently large data sets, increased stability should be achieved). In any case, such variation in prototypicality motivates rather than impedes a family-resemblances approach, since this conceptualization treats mind-wandering as a heterogeneous construct whose members share features with some but not other members (in the same way, we can reasonably disagree about whether tennis or solitaire are more prototypical games without threatening our understanding of the 'game' category).

### **The Mind-Wandering Family: Inclusion and Exclusion**

One unavoidable complication with natural categories is that their boundaries are not clearly demarcated. Indeed, absent a classical definition, there are no necessary and sufficient defining features with which to include or exclude exemplars from the category. For instance, whereas a four-legged object that affords sitting would be classified by most as a 'chair', the point at which an object is granted or denied membership in the 'chair' family is unclear. More prototypical 'chairs', such as Adirondack and Windsor chairs, elicit little dispute, but objects such as a tuffet, or even a large, flat rock, may generate disagreement. The rock shares at least one feature with prototypical chairs (it affords sitting), but few others. In the same way, for example, intentional, guided, SITUT might be considered analogous to the rock because it shares few features with common mind-wandering exemplars; and just as one cannot definitively state, 'the rock is/is not a chair', one cannot definitively conclude whether intentional, guided, SITUT should be granted or denied membership in the mind-wandering family (for more on this topic, see Box 2). Nevertheless, this critical characteristic of natural constructs need not stifle investigations of mind-wandering. In fact, because the family-resemblances approach motivates more precise specification of the dimensions associated with the thoughts in question, we will be better able to investigate the causes, consequences, functions, and correlates of such thoughts. Moreover, by quantifying graded membership in the family, we can avoid erroneously equating all exemplars within the family (i.e., we can identify exemplars that better capture the essence of mind-wandering via quantitative assessments of prototypicality).

#### **Box 2. Characterizing Graded Membership in the Mind-Wandering Family**

According to our argument, neither logic nor data can determine the types of thought that should be included or excluded from the mind-wandering family. This may appear problematic (if not perturbing) and, thus, presents itself as a strike against the family-

resemblances approach. However, this inability to definitively include or exclude thoughts from the mind-wandering family is not a consequence of the family-resemblances approach, per se. Rather, it is a problem that necessarily arises with natural constructs that are not classically defined. A classical definition is required for determining not only which constructs ought to be included in a given family, but also those to be excluded. Thus, if one commits to an approach to mind-wandering that avoids this inclusion–exclusion problem, one must also commit to a reasonable, tractable, classical definition of mind-wandering with unanimous agreement. Given that multiple definitions of mind-wandering already exist, some of which are mutually exclusive, this appears a fruitless endeavor: any disagreement would render the classical definition problematic, since it would exclude forms of thought that people recognize as mind-wandering. Thus, we suggest that the field cannot tenably reject the family-resemblances approach while also failing to generate an accepted classical definition.

Importantly, mind-wandering as a fuzzy-boundaried and heterogeneous construct does not bring its scientific study to a halt. Rather, it should prove theoretically fruitful because, by quantifying graded membership, we can determine more and less prototypical instances of mind-wandering and more accurately investigate their features and functions. As long as researchers are careful to report the specific (whether more or less prototypical) variety of mind-wandering they are investigating (an obligation derived from the family-resemblances approach), we can effectively isolate different types of mind-wandering, along with their causes, consequences, and associates, rather than conflating these unique experiences and inappropriately generalizing our results across all exemplars of mind-wandering.

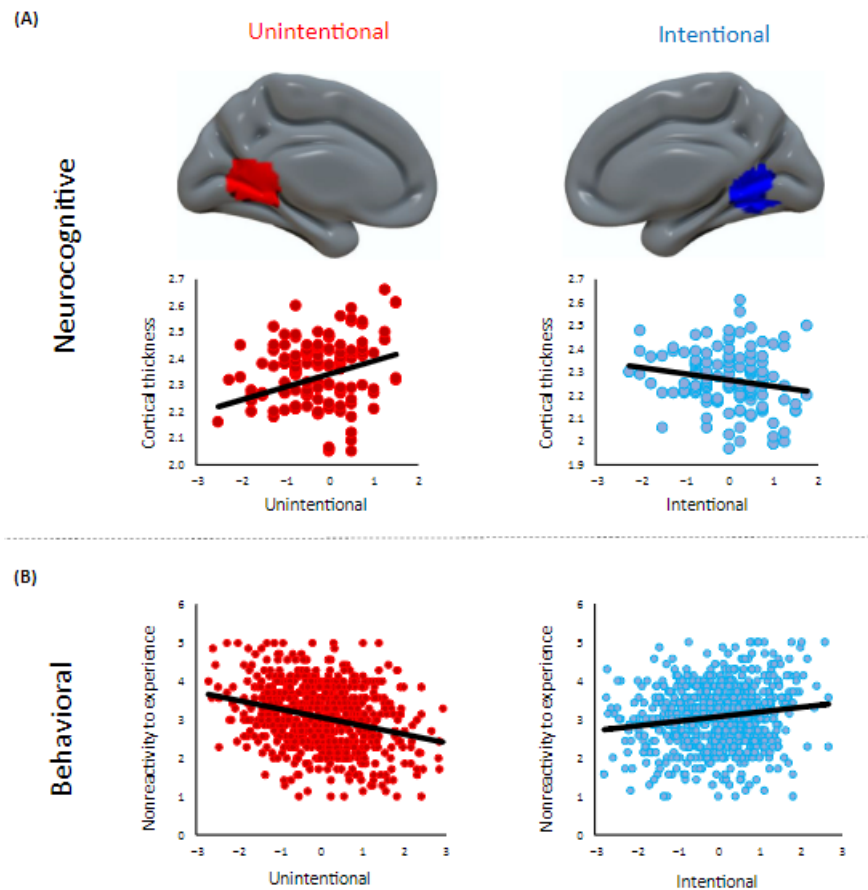
### **Evidence Supporting the Utility of a Family-Resemblances View of Mind-Wandering**

Scientific benefits of adopting a family-resemblances view of mind-wandering are evident when different members of the mind-wandering family demonstrate distinct causes, consequences, or associates. Indeed, if different varieties of mind-wandering behave differently, and evidence suggests that they do, then ignoring their diversity may lead to underspecified or erroneous conclusions. Take, for instance, a study of the effects of mindfulness meditation on rates of stimulus-dependent TUT and SITUT [35]. Participants first completed a sustained-attention task intermittently interrupted by ‘thought probes’ that asked whether any TUTs they experienced were stimulus dependent or independent (pretest). Participants then either engaged in mindfulness meditation or listened to an audiobook(control condition), after which they recompleted the sustained-attention task with thought probes (post-test). Whereas rates of SITUT remained unchanged across pre- and post-tests for meditation subjects, they significantly increased for controls; by contrast, whereas rates of stimulus-dependent TUT did not vary from pre- to post-test in the meditation condition, they significantly decreased in the control condition (for similar dissociations of stimulus-dependent TUT and SITUTs, see 36, 37, 38). This dissociation reinforces the utility, if not necessity, of the family-resemblances approach to mind-wandering research: If these varieties of mind-wandering had been treated as reflecting a single, unitary construct, their unique behaviors would have been undetectable, and the potential effects of meditation would have been misinterpreted.

Another dissociation supporting a family-resemblances approach to mind-wandering comes from an examination of task-related versus task-unrelated mind-wandering during video lectures (here,



task-related mind-wandering was operationalized as elaborations or reflections on lecture material that did not correspond to the momentary video content [39]). Students who engaged in more task-related mind-wandering tended to recall more lecture-related details than did students who engaged in less, whereas students who reported higher rates of task-unrelated mind-wandering tended to recall less information about the lecture than did those who reported lower rates.



**Figure 2.** Distinct Neurocognitive and Behavioral Correlates of Unintentional and Intentional Mind-Wandering.

(A) Dissociation between intentional and unintentional mind-wandering in correlations with thickness of the retrosplenial cortex and lingual gyrus [40]. Participants reporting higher rates of trait-level unintentional mind-wandering tended to show greater cortical thickness in the retrosplenial cortex and lingual gyrus in the left hemisphere than did participants reporting lower rates of unintentional mind-wandering. Conversely, participants reporting higher rates of trait-level intentional mind-wandering tended to show less cortical thickness in the retrosplenial cortex and lingual gyrus in the right hemisphere than did participants reporting lower rates of intentional mind-wandering. (B) Dissociation between intentional and unintentional mind-wandering in their relations to self-reported mindfulness (i.e., the nonreactivity to experience facet of the five-facet mindfulness questionnaire [55]). Whereas participants reporting higher rates of unintentional mind-wandering tended to report lower levels of mindfulness, those reporting higher rates of intentional mind-wandering tended to report higher levels of mindfulness.

The utility of a family-resemblances view may be best illustrated by studies examining the correlates of mind-wandering experiences that are engaged with versus without intention. A large-scale neuroimaging study of trait variation in intentional and unintentional mind-wandering

([40]; Figure 2B) found distinct neural correlates for these two thought types. Indeed, analysis of the whole-brain thickness of gray matter indicated mind-wandering-related differences in the retrosplenial cortex and the lingual gyrus: whereas higher rates of unintentional mind-wandering were associated with greater thickness in the retrosplenial cortex and lingual gyrus in the left hemisphere, higher rates of intentional mind-wandering were associated with less cortical thickness in these same areas in the right hemisphere. A similar dissociative pattern emerges in behavioral data (Figure 2B): whereas trait levels of intentional mind-wandering correlate positively with people's tendency toward nonreactivity to internal experiences (a facet of mindfulness), trait levels of unintentional mind-wandering correlate negatively with it [41]. Likewise, separate work [25] showed that, whereas people reported more intentional mind-wandering during easy versus difficult tasks, they reported more unintentional mind-wandering in difficult versus easy tasks (for similar dissociations, see 42, 43, 44, 45).

These results, taken together, highlight the utility of a family-resemblances framework for mind-wandering research. The typical practice of treating mind-wandering as a unitary construct precludes important discoveries about the diversity of the mind-wandering family.

### **Implications of a Family-Resemblances Approach to the Study of Mind-Wandering**

Acknowledging that mind-wandering is a heterogeneous concept and that a universally agreed-upon definition of mind-wandering, with necessary and sufficient conditions, is not forthcoming has implications for future scientific investigations. First, because family resemblances arise from common and distinct features, research may benefit from assessing multiple features of experience at the same time. This approach, which is common to daily-life investigations of mind-wandering (e.g., 46, 47, 48), but rare in laboratory studies (but see 26, 49, 50), asks participants to answer consecutive probe questions about immediate thought content, allowing researchers to identify common and distinct elements of experience. Multivariate statistical techniques can then reduce respondents' data into a few dimensions that can be compared with other measures (such as neural function) to assess common versus distinct features or mechanisms. Limited but growing evidence suggests stable features of experience across participant samples, and that, consistent with a family-resemblances account, these features differentially predict neurocognitive measures [50].

Second, a family-resemblances approach encourages the field to consider which dimensions of experience should be studied in the first place. One approach to this problem is to have participants provide open-ended reports about their experiences. These could then be categorized (by participants or independent raters) based on established or novel dimensions of interest. Although open-ended reports can present interpretive challenges (such as requiring verbalization of potentially nonverbalizable experiences, reporting deeply personal thoughts, or 'punishing' mind-wandering reports by making them more effortful than on-task reports), they have been successfully used in some studies examining the temporal focus of mind-wandering 51, 52. Collecting large corpuses of open-ended reports would allow text-mining techniques to reveal novel and potentially unknown dimensions of the mind-wandering state.

A family-resemblances approach might also increase the intellectual, if not methodological, connections among related phenomena that some might consider nonprototypical mind-

wandering, such as spontaneous autobiographical semantic memories, earworms, depressive rumination, and so forth. The heterogeneous view of mind-wandering facilitates the realization that neighboring constructs may be directly relevant to each other, which suggests that they should not be studied in isolation or reside in separate scientific literatures.

Perhaps most importantly, a family-resemblances framework will encourage researchers to specify the mind-wandering feature(s) under study in their experiments, both to participants and readers. Methodological and conceptual clarity will simply require, in empirical manuscripts, something like the following sentence: ‘Here, we conceptualized mind-wandering as \_\_\_\_\_, and operationally defined it for our participants as \_\_\_\_\_.’ Critically, this approach allows researchers the freedom to study whatever features of mind-wandering they wish, while providing the required specificity about aspects of the experience being explored. Theorists will more easily compare results across studies, and researchers will carefully consider and motivate the specific type of mind-wandering they are studying, while ensuring that their conceptualizations of mind-wandering are not misaligned with their operational definitions, as in previous work (e.g., 1, 21, 53).

## **Concluding Remarks**

Mind-wandering encompasses diverse subjective experiences that vary in their defining properties and, in some cases, in their causes, consequences, and correlates. As such, we think that mind-wandering is best considered and researched within a family-resemblances framework, which entails recognizing mind-wandering as a heterogeneous construct and clarifying the dimensions that are under investigation. The family-resemblances framework (i) eliminates unproductive disagreement about ‘mind-wandering’ definitions; (ii) embraces all commonly recognized forms of mind-wandering as worthy of study (e.g., deliberate daydreaming); (iii) adds precision to operational definitions of mind-wandering; and (iv) allows the field to retain the broad term ‘mind-wandering’, which helpfully denotes the mind-wandering family and implies that distinct concepts within this family may be fundamentally similar to each other. Moreover, the family-resemblances perspective raises new questions regarding conceptual and methodological approaches to future research (see Outstanding Questions). By acknowledging the diversity of states and experiences that can be reasonably characterized as mind-wandering, while simultaneously specifying the dimensions that are relevant to any particular investigation, psychologists and neuroscientists can begin to unravel the many strands that contribute to this ubiquitous yet elusive category of mental life.

### **Outstanding Questions**

How are different dimensions of mind-wandering associated and/or dissociated with each other? Studies examining the overlap and differences among different varieties of mind-wandering could provide important insights. For instance, unintentional TUT and task-free rumination may have similar causes, in which case methods of remediation for these two thought types may be similar. Moreover, whereas meandering, unguided thoughts may be particularly likely to lead to creative insights, perseverative, guided thoughts may not.

Do different external contexts (e.g., task difficulty or lab versus daily-life) or internal contexts (e.g., arousal or motivation) differentially evoke distinct varieties of mind-wandering? Understanding the causes of different types of mind-wandering could be important in cases where people seek to reduce or increase the rate of occurrence of such thoughts. This could also inform theoretical accounts of mind-wandering. For instance, research has already suggested that manipulations of task difficulty can differentially affect rates of intentional and unintentional mind-wandering, and this has led some to propose separate mechanisms to explain the maintenance and occurrence of each thought type.

How many dimensions of mind-wandering can be reasonably measured during a single thought probe? Although we have argued that it will be important for researchers to concurrently assess numerous features of participants' thoughts, it is unclear how many features of thought a participant can accurately report on. One concern is that participants' memories for the features of their thoughts may be somewhat transient and, thus, assessments of multiple features of thought may be problematic. Although research has suggested that participants are able to accurately report on various aspects of their thoughts, it will be important to closely examine this issue in future work, and to determine a limit for the number of dimensions that can be reasonably indexed.

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