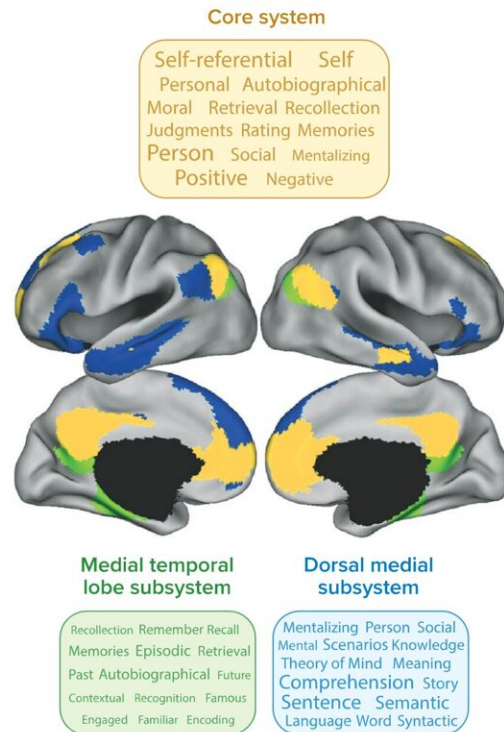


# The science of a wandering mind

September 12 2022, by Tim Vernimmen



Function so the default mode network. The brain's default mode network consists of a core and two subsystems. Jonathan Smallwood and colleagues collected the terms most used in scientific articles that report activity in one or more of these. The results, presented in these word clouds, suggest functions for each part of the network. The core: involved in thinking about oneself. The medial temporal lobe subsystem: thinking about things that happen, or episodic processes. The dorsal medial subsystem: thinking about social processes. These three aspects often come together during mind-wandering, Smallwood says. Credit: Smallwood et al, AR Psychology 2015

When psychologist Jonathan Smallwood set out to study mind-wandering about 25 years ago, few of his peers thought that was a very good idea. How could one hope to investigate these spontaneous and unpredictable thoughts that crop up when people stop paying attention to their surroundings and the task at hand? Thoughts that couldn't be linked to any measurable outward behavior?

But Smallwood, now at Queen's University in Ontario, Canada, forged ahead. He used as his tool a [downright tedious computer task](#) that was intended to reproduce the kinds of lapses of attention that cause us to pour milk into someone's cup when they asked for black coffee. And he started out by asking study participants a few basic questions to gain insight into when and why minds tend to wander, and what subjects they tend to wander toward. After a while, he began to scan participants' brains as well, to catch a glimpse of what was going on in there during mind-wandering.

Smallwood learned that [unhappy minds tend to wander in the past, while happy minds often ponder the future](#). He also became convinced that wandering among our memories is crucial to help prepare us for what is yet to come. Though some kinds of mind-wandering—such as dwelling on problems that can't be fixed—[may be associated with depression](#), Smallwood now believes mind-wandering is rarely a waste of time. It is merely our brain trying to get a bit of work done when it is under the impression that there isn't much else going on.

Smallwood, who coauthored [an influential 2015 overview of mind-wandering research](#) in the Annual Review of Psychology, is the first to admit that many questions remain to be answered.

This conversation has been edited for length and clarity.

**Is mind-wandering the same thing as daydreaming, or**

## would you say those are different?

I think it's a similar process used in a different context. When you're on holiday, and you've got lots of free time, you might say you're daydreaming about what you'd like to do next. But when you're under pressure to perform, you'd experience the same thoughts as mind-wandering.

I think it is more helpful to talk about the underlying processes: spontaneous thought, or the decoupling of attention from perception, which is what happens when our thoughts separate from our perception of the environment. Both these processes take place during mind-wandering and daydreaming.

## **It often takes us a while to catch ourselves mind-wandering. How can you catch it to study it in other people?**

In the beginning, we gave people experimental tasks that were really boring, so that mind-wandering would happen a lot. We would just ask from time to time, "Are you mind-wandering?" while recording the brain's activity in an fMRI scanner.

But what I've realized, after doing studies like that for a long time, is that if we want to know how thinking works in the [real world](#), where people are doing things like watching TV or going for a run, most of the data we have are never going to tell us very much.

So [we are now trying to study these situations](#). And instead of doing experiments where we just ask, "Are you mind-wandering?" we are now asking people a lot of different questions, like: "Are your thoughts detailed? Are they positive? Are they distracting you?"

## **How and why did you decide to study mind-wandering?**

I started studying mind-wandering at the start of my career, when I was young and naive.

I didn't really understand at the time why nobody was studying it. Psychology was focused on measurable, outward behavior then. I thought to myself: That's not what I want to understand about my thoughts. What I want to know is: Why do they come, where do they come from, and why do they persist even if they interfere with attention to the here and now?

Around the same time, brain imaging techniques were developing, and they were telling neuroscientists that something happens in the brain even when it isn't occupied with a behavioral task. Large regions of the brain, now called [the default mode network](#), did the opposite: If you gave people a task, the activity in these areas went down.

When scientists made this link between brain activity and mind-wandering, it became fashionable. I've been very lucky, because I hadn't anticipated any of that when I started my Ph.D., at the University of Strathclyde in Glasgow. But I've seen it all pan out.

## **Would you say, then, that mind-wandering is the default mode for our brains?**

It turns out to be more complicated than that. Initially, researchers were very sure that the default mode network rarely increased its activity during tasks. But these tasks were all externally focused—they involved doing something in the outside world. When researchers later asked people to do a task that doesn't require them to interact with their

environment—like [think about the future](#)—that activated the default mode network as well.

More recently, we have identified much simpler tasks that also activate the default mode network. If you let people watch a series of shapes like triangles or squares on a screen, and every so often you surprise them and ask something—like, "In the last trial, which side was the triangle on?"—regions within [the default mode network increase activity when they're making that decision](#). That's a challenging observation if you think the default mode network is just a mind-wandering system.

But what both situations have in common is the person is using information from memory. I now think the [default mode network](#) is necessary for any thinking based on information from memory—and that includes mind-wandering.

## **Would it be possible to demonstrate that this is indeed the case?**

In a recent study, instead of asking people whether they were paying attention, [we went one step further](#). People were in a scanner reading short factual sentences on a screen. Occasionally, we'd show them a prompt that said, "Remember," followed by an item from a list of things from their past that they'd provided earlier. So then, instead of reading, they'd remember the thing we showed them. We could cause them to remember.

What we find is that the brain scans in this experiment look remarkably similar to mind-wandering. That is important: It gives us more control over the pattern of thinking than when it occurs spontaneously, like in naturally occurring mind-wandering. Of course, that is a weakness as well, because it's not spontaneous. But we've already done lots of

spontaneous studies.

When we make people remember things from the list, we recapitulate quite a lot of what we saw in spontaneous mind-wandering. This suggests that at least some of the activity we see when minds wander is indeed associated with the retrieval of memories. We now think the decoupling between attention and perception happens because people are remembering.

## **Have you asked people what their minds are wandering toward?**

[The past and future seem to really dominate people's thinking.](#) I think things like mind-wandering are attempts by the brain to make sense of what has happened, so that we can behave better in the future. I think this type of thinking is a really ingrained part of how our species has conquered the world. Almost nothing we're doing at any moment in time can be pinpointed as only mattering then.

That's a defining difference. By that, I don't mean that other animals can't imagine the future, but that our world is built upon our ability to do so, and to learn from the past to build a better future. I think animals that focused only on the present were outcompeted by others that remembered things from the past and could focus on future goals, for millions of years—until you got humans, a species that's obsessed with taking things that happened and using them to gain added value for future behavior.

[People are also, very often, mind-wandering about social situations.](#) This makes sense, because we have to work with other people to achieve almost all of our goals, and other people are much more unpredictable than the Sun rising in the morning.

## **Though it is clearly useful, isn't it also very depressing to keep returning to issues from the past?**

It certainly can be. We have found that mind-wandering about the past tends to be associated with negative mood.

Let me give you an example of what I think may be happening. For a scientist like me, coming up with creative solutions to scientific problems through mind-wandering is very rewarding. But you can imagine that if my situation changes and I end up with a set of problems I can't fix, the habit of going over the past may become difficult to break. My brain will keep activating the problem-solving system, even if it can't do anything to fix the problem, because now my problems are things like getting divorced and my partner doesn't want any more to do with me. If such a thing happens and all I've got is an imaginative problem-solving system, it's not going to help me, it's just going to be upsetting. I just have to let it go.

That's where I think mindfulness could be useful, because the idea of mindfulness is to bring your attention to the moment. So if I'd be more mindful, I'd be going into problem-solving mode less often.

If you spend long enough practicing being in the moment, maybe that becomes a habit. It's about being able to control your mind-wandering. Cognitive behavioral therapy for depression, which aims to help people change how they think and behave, is another way to reduce harmful mind-wandering.

**Nowadays, it seems that many of the idle moments in which our minds would previously have wandered are now spent scrolling our phones. How do you think**



## **that might change how our brain functions?**

The interesting thing about social media and mind-wandering, I think, is that they may have similar motivations. Mind-wandering is very social. In [our studies](#), we're locking people in small booths and making them do these tasks and they keep coming out and saying, "I'm thinking about my friends." That's telling us that keeping up with others is very important to people.

Social groups are so important to us as a species that we spend most of our time trying to anticipate what others are going to do, and I think social media is filling part of the gap that mind-wandering is trying to fill. It's like mainlining social information: You can try to imagine what your friend is doing, or you can just find out online. Though, of course, there is an important difference: When you're mind-wandering, you're ordering your own thoughts. Scrolling [social media](#) is more passive.

## **Could there be a way for us to suppress mind-wandering in situations where it might be dangerous?**

Mind-wandering can be a benefit and a curse, but I wouldn't be confident that we know yet when it would be a good idea to stop it. In our studies at the moment, we are trying to map how people think across a range of different types of tasks. We hope this approach will help us identify when mind-wandering is likely to be useful or not—and when we should try to control it and when we shouldn't.

For example, in our studies, people who are more intelligent don't mind wander so often when the task is hard but [can do it more when tasks are easy](#). It is possible that they are using the idle time when the external world is not demanding their attention to think about other important matters. This highlights the uncertainty about whether mind wandering is



always a bad thing, because this sort of result implies it is likely to be useful under some circumstances.

This map—of how people think in different situations—has become very important in our research. This is the work I'm going to focus on now, probably for the rest of my career.

**More information:** Tim Vernimmen, The science of a wandering mind, *Knowable Magazine* (2022). [DOI: 10.1146/knowable-083022-2](https://doi.org/10.1146/knowable-083022-2)

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