Title: Where do our thoughts go when the mind wanders? Spatial features of sleep intrusions during wakefulness distinguish the conscious phenomenology of attentional lapses

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Abstract:

Conscious thoughts are a dynamic process that we do not fully control. When performing a task for example, our minds often wander away. This so-called mind-wandering is inescapable and takes up to 50% of our waking life. Despite such pervasiveness, mind-wandering is particularly difficult to study, being by nature elusive even for subjects themselves. It is in a way the “dark matter” of our thoughts.

Here, we instructed 24 participants to perform a go/nogo task requiring continuous attention. We regularly interrupted and asked participants to report their subjective experiences using a questionnaire. We recorded high-density electroencephalography (EEG) in parallel. This protocol allowed us to investigate the dynamics of conscious thoughts at the phenomenological, behavioural and physiological levels.

As predicted, participants spent only 50% of the time focusing on the task. They spent 40% of the time thinking about something other than the task (mind-wandering), 10% of the time, they reported not thinking about anything (mind-blanking). Interestingly, mind-wandering and mind-blanking impacted behaviour differently, with mind-blanking being characterised by sluggish responses (slower responses, more missed trials) and mind-wandering by impulsivity (faster responses, more false alarms).

Mind-wandering and mind-blanking were both associated with subjective reports of sleepiness and were accompanied by the occurrence of regional sleep-like neural activity, a phenomenon called local sleep. These local sleep intrusions within wakefulness did not only correlate with the occurrence of errors but also with the type of errors and subjective reports. Local sleep intrusions in frontal brain areas correlated with impulsivity and mind-wandering while local sleep in the back of the brain correlated with sluggishness and mind-blanking.

Our results show how local sleep intrusions can affect behaviour and subjective experience. The distinct effects of local sleep in the front or back of the brain suggest these brain regions contribute differently to the stream of consciousness.