



Does dopamine availability influence the effect of brain stimulation on mind-wandering?

A recommendation by [Maxine Sherman](#)  based on peer reviews by [Chris Chambers](#)  and 1 anonymous reviewer of the STAGE 2 REPORT:

Tara Rasmussen, Paul E. Dux and Hannah Filmer (2025) On the neural substrates of mind wandering and dynamic thought: A drug and brain stimulation study. bioRxiv, ver. 2, peer-reviewed and recommended by Peer Community in Registered Reports.

<https://doi.org/10.1101/2024.11.02.620526>

Submitted: 09 November 2024, Recommended: 07 March 2025

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Sherman, M. (2025) Does dopamine availability influence the effect of brain stimulation on mind-wandering?. *Peer Community in Registered Reports*, 100933. [10.24072/pci.rr.100933](https://doi.org/10.24072/pci.rr.100933)

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Mind-wandering broadly refers to the phenomenon by which a person's thoughts are directed towards internally generated states as opposed to being directed towards those that are task-relevant. It has been proposed that mind-wandering and cognitive control are supported by overlapping neural systems. While neuroimaging work has implicated prefrontal cortex in both mind-wandering and cognitive control, studies testing its causal role using transcranial direct current stimulation (tDCS) have been inconclusive. Here, Rasmussen and colleagues (2025) put to a strict test the question of whether the effects of prefrontal cortex tDCS on mind-wandering are mediated by dopaminergic availability, which is known to be important for cognitive control. Using noninvasive brain stimulation (prefrontal cortex tDCS vs sham) and a pharmacological intervention (levodopa vs. placebo), they found that contrary to some previous work, stimulation of prefrontal cortex does not alter mind-wandering. By contrast, in the absence of stimulation, increasing dopamine availability via levodopa reduced the frequency of freely moving thought. Together, these results clarify the degree to which prefrontal cortex tDCS and dopamine play a causal role in mind-wandering. The Stage 2 manuscript was evaluated over one round of in-depth review. Based on detailed responses to the reviewers' comments, the recommender judged that the manuscript met the Stage 2 criteria and awarded a positive recommendation.

URL to the preregistered Stage 1 protocol: <https://osf.io/ujp7e> **Level of bias control achieved:** [Level 6](#). *No part of the data or evidence that was used to answer the research question was generated until after IPA.* **List of eligible PCI RR-friendly journals:**

- [Advances in Cognitive Psychology](#)
- [Brain and Neuroscience Advances](#)
- [Cortex](#)
- [Imaging Neuroscience](#)
- [NeuroImage: Reports](#)
- [Peer Community Journal](#)
- [PeerJ](#)
- [Psychology of Consciousness: Theory, Research, and Practice](#)
- [Royal Society Open Science](#)
- [Studia Psychologica](#)

References:

Rasmussen, T., Dux, P. E. & Filmer, H. (2025). On the neural substrates of mind wandering and dynamic thought: A drug and brain stimulation study [Stage 2]. Acceptance of Version 2 by Peer Community in Registered Reports.

<https://doi.org/10.1101/2024.11.02.620526> <https://doi.org/10.1101/2024.11.02.620526> <https://doi.org/10.1101/2024.11.02.620526> <https://doi.org/10.1101/2024.11.02.620526>

Reviews

Evaluation round #1

DOI or URL of the preprint: <https://www.biorxiv.org/content/10.1101/2024.11.02.620526v1>

Version of the preprint: 1

Authors' reply, 19 February 2025

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Decision by [Maxine Sherman](#) , posted 13 January 2025, validated 13 January 2025

Very minor revisions

Dear Tara Rasmussen,

Happy new year and my apologies for being so late in getting back to you. Thank you for submitting your Stage 2 manuscript, which stays true to your Stage 1 protocol and presents an interesting and rigorous study. I have received reviews on your Stage 2 submission from two of the original reviewers and as you'll see they're very enthusiastic, as am I. The two reviewers only have very minor suggestions for the discussion, to add titles to Fig 6, and for mapping the results back to the hypotheses.

I look forward to receiving your revised manuscript

Best wishes
Maxine

Reviewed by anonymous reviewer 1, 11 December 2024

The study reported no significant effect of HD-tDCS on thought modulation but highlighted a potential link between dopamine availability and reduced mind wandering. While the findings were comprehensive, I have a question for the discussion. The authors emphasized task sensitivity for internal thoughts, yet HD-tDCS showed no effect on task performance. Could varying task difficulty levels increase the likelihood of observing HD-tDCS effects? Are there studies that explore this relationship? Are there methodological challenges in designing tasks with varying difficulty within subject for HD-tDCS?

Minor suggestions:

1. Add titles to the graphs in Figure 6 to provide context at a glance
2. Cross-reference the hypotheses in the results section to connect these findings back to the introduction and research plan.

Reviewed by **Chris Chambers** , 25 November 2024

This is an excellent Stage 2 submission that in my view meets the [evaluation criteria](#) in its current state. The authors stayed close to their approved protocol and the reporting is very clear throughout, with a sensible and insightful discussion.

Even though evaluation of study rigour is not part of the Stage 2 assessment (being already covered at Stage 1), in reading the manuscript again I am reminded just how careful and thorough it was in the consideration of blinding, sample size planning, and a range of other design characteristics. This is a model approach for the application of tDCS that I hope other researchers follow.

I have one very minor suggestion: in the study design table, it would be great to add a column to the far right called "Observed outcome" which states for each cell, very simply, whether the hypothesis was supported or not supported (based strictly on whether the results for that test met the preregistered inference criteria). For a complex study with many hypotheses, the inclusion of this additional column will provide a useful overview for readers and will make the outcomes easier to summarise in future SRs/meta-analyses.

Otherwise, I feel this manuscript makes an important contribution and would be happy for it to receive a positive recommendation.