



Kent Academic Repository

Javadi, Amir-Homayoun and Ifram, Fadi (2016) *Physical exercise improves long-term memory no less than transcranial direct current stimulation*.
In: 6th International Conference on Transcranial Brain Stimulation 2016,
7 – 10 September 2016, Göttingen, Germany.

Downloaded from

<https://kar.kent.ac.uk/56659/> The University of Kent's Academic Repository KAR

The version of record is available from

This document version

Other

DOI for this version

Licence for this version

UNSPECIFIED

Additional information

Versions of research works

Versions of Record

If this version is the version of record, it is the same as the published version available on the publisher's web site. Cite as the published version.

Author Accepted Manuscripts

If this document is identified as the Author Accepted Manuscript it is the version after peer review but before type setting, copy editing or publisher branding. Cite as Surname, Initial. (Year) 'Title of article'. To be published in *Title of Journal*, Volume and issue numbers [peer-reviewed accepted version]. Available at: DOI or URL (Accessed: date).

Enquiries

If you have questions about this document contact ResearchSupport@kent.ac.uk. Please include the URL of the record in KAR. If you believe that your, or a third party's rights have been compromised through this document please see our [Take Down policy](https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies) (available from <https://www.kent.ac.uk/guides/kar-the-kent-academic-repository#policies>).

PHYSICAL EXERCISE IMPROVES LONG-TERM MEMORY NO LESS THAN TRANSCRANIAL DIRECT CURRENT STIMULATION

Amir-Homayoun Javadi *, Fadi Iffram

School of Psychology, University of Kent, Canterbury, UK

* a.h.javadi@gmail.com, www.javadilab.com

Introduction

It has been shown that electrical brain stimulation, particularly transcranial direct current stimulation (tDCS), can improve memory performance¹⁻². Physical exercise has also been shown to be able to improve different aspects of cognition³⁻⁵. The aim of this study was to investigate which of these methods is more effective in the improvement of long-term memory. The tDCS and physical exercise protocols that were chosen for this study have been shown to be effective in the improvement of long-term memory: tDCS during memorisation (targeting encoding phase) and physical exercise after memorisation (targeting consolidation phase). We expected to see improvement following application of both methods. No prediction was made on which method is more effective.

Methods

Participants (n = 24) took part in three experimental sessions. They were asked to memorise a set of images ('training') for a later old/new recognition task ('testing'). In one of the sessions participants were asked to cycle for 30 minutes on an exercise bike following encoding. In the other two sessions they received either 15 minutes ('active' stimulation) or 16 seconds ('sham' stimulation) of 1.5 mA anodal tDCS, applied over the left dorsolateral prefrontal cortex (left-DLPFC). Performance of the participants in the recognition phase was recorded for analysis (Figure 1).

Results

Both physical exercise and active stimulation led to significant improvement of long-term memory performance compared to sham stimulation (paired sample t-test p s < 0.05). Physical exercise, however, led to stronger improvement as calculated by Cohen's d effect size (Figure 2).

Conclusions

- Thirty minutes of physical exercise during consolidation was more effective than fifteen minutes of tDCS during encoding.
- Considering that physical exercise tentatively leads to less adverse side effects as compared to electrical brain stimulation, physical exercise can be considered, potentially, as a more effective method of cognitive enhancement.

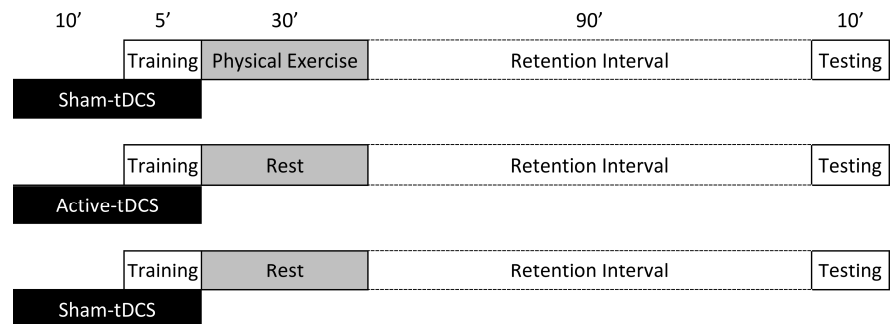


Figure 1. Procedure of the study. All participants (n = 24) took part in three experimental conditions: Physical Exercise, Active-tDCS and Sham-tDCS.

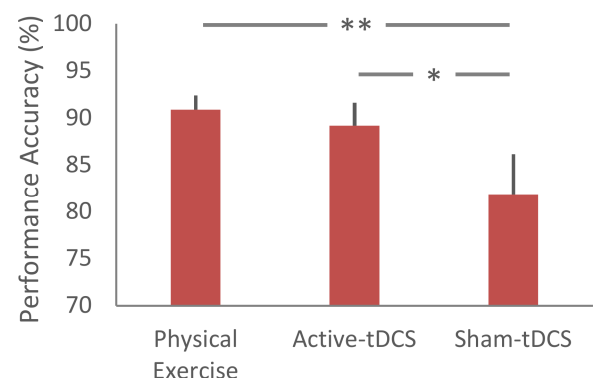


Figure 2. Mean performance accuracy in each condition. ** $p = 0.01$ Cohen's $d = 0.42$, * $p = 0.02$ Cohen's $d = 0.21$

References

- 1 Javadi A-H & Cheng P (2013) *Brain Stimulation*.
- 2 Javadi A-H, et al. (2012) *Brain Stimulation*.
- 3 Griffin ÉW, et al. (2011) *Physiology & behavior*.
- 4 Hötting K, et al. (2012) *Brain sciences*.
- 5 Erickson KI, et al. (2011) *Proc Natl Acad Sci U S A*.