The role of theta (6 Hz) oscillations in learning during uncertainty: A transcranial alternating current stimulation study

Published: 25-09-2014
Last updated: 21-04-2024

To enhance learning by entraining theta oscillations in the frontal cortex using transcranial alternating current stimulation

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON40815

Source
ToetsingOnline

Brief title
Alternating currents and learning

Condition

- Other condition

Synonym
niet van toepassing

Health condition

niet van toepassing - onderzoek bij gezonde vrijwilligers

Research involving
Human

Sponsors and support

Primary sponsor: Radboud Universiteit Nijmegen
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: Learning, Theta oscillations, Transcranial alternating current stimulation

Outcome measures

Primary outcome

Rule learning during a reinforcement task in which fictitious monetary reward

and punishment schedules change during the task.

Secondary outcome

Spontaneous brain oscillations before and after online tACS to examine changes

in frontal cortical activity

Study description

Background summary

There is evidence from the scientific literature to suggest a relationship between 6 Hz (theta) activity in the frontal cortex and the ability to learn during uncertain situations. Transcranial alternating current stimulation (tACS) is a non-invasive and safe method that uses weak electrical oscillating currents to the scalp to influence cortical activity. This methods is able to test the hypothesis that theta tACS will improve leaning during uncertainty in a direct manner. This study will broaden our understanding of frontal brain function and provides insights possible ways of improving learning by way of non-invasive neuromodulation.

Study objective

To enhance learning by entraining theta oscillations in the frontal cortex using transcranial alternating current stimulation

Study design

Placebo controlled double-blind between subjects design.

Intervention

Online transcranial alternating current stimulation (tACS) will be delivered by a battery-driven electric current stimulator (Eldith DC Stimulator (CE 0118), Ilmenau) using a pair of electrodes (35 cm^2) over the left and right frontal scalp during the learning task (~15min): (1) active theta tACS (6 Hz, 1 mA/ 35 cm^2); (2) sham theta tACS (0 mA/ 35 cm^2).

Study burden and risks

The currently proposed tACS procedure and experiment does not carry any significant risks. Stimulation will be performed in line with the Standard Operating Procedure Non-Invasive brain stimulation of the Donders Institute for Brain, Cognition and Behaviour. Potential side-effects of tACS are perception of phosphenes, light tingling, itching or burning sensations on the under the electrodes and/or light headache. These are mild discomforts that respond promptly to common analgesics. Volunteers can withdraw from the study at any given time and there are no direct benefits for the participants. The novel insights will broaden our understanding of the brain and may contribute to the feasibility and development of possible new ways to improve learning using non-invasive brain stimulation.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)
Elderly (65 years and older)

Inclusion criteria

Between 18-35 years of age years; Right-handed; Non-smoking; Normal or corrected-to-normal vision; Willingness and ability to give written informed consent and willingness and ability to understand the nature and content, to participate and to comply with the study requirements.

Exclusion criteria

(1) Average use of more than 3 alcoholic beverages daily; (2) Use of psychotropic medication or recreational drugs; (3) Skin disease; (4) Pregnancy; (5) Serious head trauma or brain surgery; (6) Neurological or psychiatric disorders; (7) Large or ferromagnetic metal parts in the head (except for a dental wire); (8) Implanted cardiac pacemaker or neurostimulator; (9) Participation in a NBS study in the past 28 days; (10) Previous participation in 10 or more NBS studies.

Study design

Design

Study type:	Interventional
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Double blinded (masking used)
Control:	Placebo
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	29-01-2015
Enrollment:	50
Type:	Actual

Ethics review

Approved WMO

Date:	25-09-2014
Application type:	First submission
Review commission:	CMO regio Arnhem-Nijmegen (Nijmegen)

Study registrations

Followed up by the following (possibly more current) registration

No registrations found.

Other (possibly less up-to-date) registrations in this register

No registrations found.

In other registers

Register	ID
CCMO	NL49613.091.14