On the role of attention in modulating the alpha oscillation phase-dependency of cortical excitability and visual perception

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Ethical review	Approved WMO
Status	Will not start
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON37887

Source
ToetsingOnline

Brief title
Attention and alpha oscillation phase-dependency

Condition

- Other condition

Synonym
na

Health condition

nvt

Research involving

Human

Sponsors and support

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

Intervention

Keyword: alpha oscillation, attention, phase-dependency, TMS

Outcome measures

Primary outcome

We aim to determine the relation between the amplitude of alpha oscillations and the effect of their phase on visual cortical excitability and phosphene probability. We expect the validation of the *pulsed inhibition theory* postulating that perception is only decreased during the inhibitory phase of the alpha oscillation.

Secondary outcome

In addition to the assessment of visual cortical excitability and perception by means of phosphene probability, the amplitude of simultaneously recorded TEPs will be employed as an additional measure of phase-dependent cortical excitability (Bergmann et al., 2012).

Study description

Background summary

Over the occipital region, shifts in covert visuospatial attention are associated with a lateralization of posterior alpha band power (8-14 Hz). Alpha power is higher in the hemisphere ipsilateral to attention (Jensen and Mazaheri, 2010). Recently, Transcranial Magnetic Stimulation (TMS) has been used to causally link ongoing oscillations, cortical excitability and visual

perception. Thus, we know that over the occipital region, alpha power is negatively related to cortical excitability (Romei et al., 2008) but also that alpha phase mediates the causal relation between brain excitation and visual perception (Dugué et al., 2011). Using attention to modulate ongoing alpha amplitude, we aim to determine how the phase effect behaves depending on alpha power (i.e., depending on attention). In particular, a stronger phase effect is expected for the unattended condition.

Study objective

We aim to test how attention exerts its facilitative effects on perception. We expect a validation of the *pulsed inhibition* theory, i.e., that - for an unattended location - perceptual probability is normal during the excitatory phase but decreased during the inhibitory phase of the alpha oscillation.

Study design

This study will combine TMS with EEG. Two TMS coils will be positioned over the left and right primary visual cortex (V1) to induce phosphenes (illusory flashes) by single pulses. For both target areas, TMS intensity will be set to phosphene threshold (i.e., evoking phosphenes in 50% of the cases). Subject will perform two tasks, intermingled on a trial-by-trial level: a Gabor orientation task (determining the orientation of a tilted Gabor patch in the cued hemifield) and a phosphene localization task (perceiving and localizing a TMS-induced phosphenes in the left or right hemifield). The Gabor spatial attention task is used to warrant that subjects covertly orient their attention to the cued hemifield and allows us to test phosphene probability depending on alpha power as modulated by visuospatial attention.

Intervention

Participants will receive single pulses of TMS over left or right V1 at the individual subject*s and target site*s phosphene threshold.

Study burden and risks

TMS of the visual cortex is not painful, even at maximum stimulator output. From the literature we know that, in rare cases, participants could report a (light) headache. Paracetamol is sufficient to treat these symptoms. On the basis of incidental epileptic seizures triggered by TMS in early 90*s, safety-guidelines were established (Wassermann, 1998) and recently updated (Rossi et al., 2009). All stimulation parameters in this study will follow these safety guidelines. Furthermore, all participants will be pre-screened for relevant medical history, epilepsy, drug abuse, head trauma, neurological or psychiatric illness, pregnancy, heart disease, cardiac pacemakers, medication pumps, tricyclic antidepressants, neuroleptics and a family history of

neurological illness, psychiatric illness or epilepsy. Because the risk associated with participation can be considered negligible and the burden can be considered minimal, we do not expect adverse events during the project.

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

- 18-45 years old
- Right-handed
- Normal or corrected-to-normal vision
- No history of mental or psychological disorders

Exclusion criteria

- Pacemaker or (history of) heart rhythm disorder
- Metal parts in head or mouth*
- History of brain surgery
- History of epilepsy or first-grade family member with epilepsy
- Psychological or neurological disorder
- Skin allergies
- Pregnancy
- Prescription medication
- Being treated or having recently been treated by a medical specialist.

* with the exception of a wire behind the teeth.

Study design

Design

Study type:	Interventional
Intervention model:	Crossover
Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Will not start
Start date (anticipated):	01-03-2012
Enrollment:	20
Type:	Anticipated

Ethics review

Approved WMO

Date:	01-03-2012
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	NL39390.091.12