Contributions of the supplementary motor area and the pre-motor cortex to skilled sequential action: a TMS study.

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The main objective is to investigate the involvement of the supplementary motor area (SMA) and the premotor cortex (PMC) in skilled sequential action.

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

Summary

ID

NL-OMON37597

Source
ToetsingOnline

Brief title
SMA and PMC involvement in sequential action.

Condition

- Other condition

Synonym
n.v.t.

Health condition

geen aandoeningen

Research involving
Human

Sponsors and support

Primary sponsor: Universiteit Twente
Source(s) of monetary or material Support: NWO

Intervention

Keyword: Motor skill, PMC, SMA

Outcome measures

Primary outcome

The main study parameter is the difference in response time on a motor

sequencing task between subjects in three rTMS conditions (SMA, PMC, sham).

Secondary outcome

We will measure the number of correctly performed sequences in each condition

for all subjects. Also, subjects will be asked to recall the sequences that

they have performed during the experiment and recognize these sequence from a

list of 12 alternatives.

Study description

Background summary

The ability to execute movements in a fixed sequential order and thus to develop sequencing skills is fundamental to human behaviour. Sequential skills have often been studied in the domains of cognitive psychology as well as neurology, and models on the production of such skill have been developed in both domains. Cognitive psychology has distinguished three modes of sequence execution, namely the reaction mode, the associative mode and the chunking mode. Regarding the neural domain, two brain areas have been found to be differently involved in sequential behaviour: the premotor cortex (PMC) is thought to be responsible for externally guided and/or triggered behaviour, while the supplementary motor area (SMA) is involved in internally guided (i.e., self-initiated) behaviour. The present study aims to converge the cognitive and neural domains - and their respective models of sequential action - in order to better understand the foundations of skilled sequential action.

We hypothesize that the reaction and associative modes can be mapped onto PMC function, due to the continued need for stimuli. Conversely, the chunking mode seems to relate to SMA functioning, due to the highly internalized triggering of movement.

Study objective

The main objective is to investigate the involvement of the supplementary motor area (SMA) and the premotor cortex (PMC) in skilled sequential action.

Study design

The study is an interventional study.

On the first day of the experiment, subjects practice two keying sequences in the discrete sequence production (DSP) task. This practice phase will consist of 10 blocks, so that subjects can take a short break (~2 minutes) between blocks. The duration of the practice phase will be about 2,5 hours. On the second day of the experiment, subjects will first practice the learned sequences for two blocks. Next, they will undergo 20 minutes of low-frequency (1Hz) rTMS and then have a 20 minute break - inhibitory effects of rTMS on motor performance have been shown to be larger after a 20min. interval compared to no interval (Verwey et al., 2002). Finally, subjects will complete the four test blocks and fill out a questionnaire regarding the practice sequences. This final phase will take about 2,5 hours.

Intervention

Twenty minutes of repetitive transcranial magnetic stimulation (rTMS) targeted to either the supplementary motor area (SMA group) or the premotor cortex (PMC group), or twenty minutes of sham stimulation (control group).

Study burden and risks

The duration of rTMS application will be 20 consecutive minutes during the second day of the experiment. During rTMS the subject will be seated in a comfortable chair. Repetitive TMS is generally well tolerated. Possible side-effects and risks are:
- Headache and/or local pain: The most common side-effect of rTMS is the experience of pain. It is most frequently reported when rTMS is applied to non-motor areas. We will warn subjects that rTMS may not be pleasant and may cause some pain. If subjects do not tolerate rTMS, the experiment is stopped and will not be continued.
- Hearing problems: Releasing the TMS pulse is accompanied by a clicking sound, which may be experienced as quite loud by subjects. Therefore, subjects will wear hearing protection.

- Syncope: When a subject reports nausea, dizziness or feelings of (almost) fainting, the experiment is stopped and will not be continued. During the experiment, the subject will be asked frequently if he/she experiences any of these feelings.
- Seizures: There have (rarely) been reports of seizures during or after rTMS. Rossi et al. (2009) describe two of such instances. However, these instances either occurred when subjects were taking pro-epileptogenic medication, or may have represented a syncope. Subjects in the present study will be screened and excluded from the study if they are on pro-epileptogenic medication.

According to the guidelines provided by Rossi et al. (2009), the risk of an epileptic seizure during or after rTMS is extremely low, especially if the guidelines are followed. As the parameters that will be used in the study fall within these guidelines, the risk of this study is low. Twenty minutes of rTMS may be intense, but we believe that it will be well tolerated by the subjects. We will make sure that the subject is comfortable, by providing a comfortable chair and frequently asking the subject if he/she experiences any discomfort.

There are no risks involved in performing the motor sequencing task.

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

Subjects should be 18 years or older (capable of giving informed consent), and right handed (as indicated by the Annett Handedness Inventory).

Exclusion criteria

Subjects are excluded if they:
- have a personal history of epilepsy;
- have a lesion in the brain, be it vascular, traumatic, tumoral, infectious or metabolic;
- have hearing problems;
- might be pregnant;
- have metal objects in their brain/skull;
- have a cochlear implant, implanted brain electrodes or pacemaker;
- suffer from a severe medical condition;
- use medications that form a relative hazard for application of TMS due to a seizure threshold lowering potential;
- had spinal surgery, or have drains in their spinal cord or ventricles;
- have used any illegal drugs in the last month.

Study design

Design

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

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	29-05-2012
Enrollment:	48
Type:	Actual

Ethics review

Approved WMO

Date:	03-04-2012
Application type:	First submission
Review commission:	METC Twente (Enschede)

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	NL38075.044.11