Altered numerosity perception: A transcranial magnetic stimulation study

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The aim of the present study is to causally detect whether disrupting processing in the numerosity map with TMS alters numerosity perception and/or object size perception.

Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON45836

Source
ToetsingOnline

Brief title
Altered numerosity perception

Condition

- Other condition

Synonym
Not applicable

Health condition

Niet van toepassing

Research involving
Human

Sponsors and support

Primary sponsor: University of Utrecht
Source(s) of monetary or material Support: Ministerie van OC&W

Intervention

Keyword: Numerosity, Transcranial Magnetic Stimulation (TMS), Visual Perception

Outcome measures

Primary outcome

The main parameter of interest is behavioral performance measured using

response accuracy, reaction times, and/or point of subjective equality (PSE)

and slope values, depending on the behavioral task.

Secondary outcome

Not applicable

Study description

Background summary

In our daily life we constantly use numerosity, i.e. the set size of a number of items, to guide our behaviour and decisions. Functional magnetic resonance imaging (fMRI) experiments on numerosity perception in humans have reliably found that areas in the parietal lobe are activated during numerosity manipulation. Recently, we (Harvey et al., 2013; 2015; 2017) found a small region in posterior parietal cortex (PPC) were neural populations respond to specific numerosities. Although fMRI is a powerful technique for researching the human brain in vivo, it is still fundamentally correlational in nature. Using transcranial magnetic stimulation (TMS) we will investigate the causal link between this topographical map and numerosity perception. We hypothesise that the numerosity map underlies numerosity perception and consequently in these experiments we will specifically target the numerosity maps. So far we have described topographical organisation of the PPC numerosity map but no studies have causally linked the numerosity map to perception. We intend to selectively disrupt the numerosity maps to determine whether this map is causally linked to perception of numerosity. To assess the disruption of the numerosity maps, we will test performance on an enumeration task and a numerosity discrimination task, since the disruption of the numerosity maps might have a different effect on these tasks, given their distinct characteristics. Participants will also perform an object size discrimination task, which serves primarily as a control task. Moreover, Harvey et al. (2015) found that the numerosity maps partially overlap with the object size maps, so

potential disruption of the object size discrimination performance by stimulating the numerosity maps could further validate the findings of Harvey et al. (2015) and be an informative addition to existing literature.

Study objective

The aim of the present study is to causally detect whether disrupting processing in the numerosity map with TMS alters numerosity perception and/or object size perception.

Study design

Single-blind cross-over intervention with active and control sites.

Intervention

Participants visit the lab on 5 separate days. Every day consists of a one-hour session. In the first session their motor threshold value will be measured to determine the intensity of the TMS. In the subsequent sessions, the participants will receive TMS, up to a maximum of 10Hz for 0.5s at an intensity of 120% motor threshold over the right hemisphere in (1) the numerosity map in the PPC, (2) non-numerosity related area of the PPC, (3) primary visual cortex (V1), and (4) vertex.

Study burden and risks

All research procedures are well-validated and with careful screening of subjects for TMS exclusion criteria represents a very minimal risk. The stimulation combined with the tasks and measurements consists of a moderate burden for research participants. Participants are adult, mentally able healthy volunteers who give informed consent and are compensated for their time investment.

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

- Age between 18 and 65
- Right-handedness
- Written informed consent
- Participation in a previous fMRI study

Exclusion criteria

- Ferrous objects in or around the body (e.g. braces, glasses, pacemaker, metal fragments)
- Drug or alcohol abuse over a period of six months prior to the experiment
- History of closed- or open-head injury
- History of neurological illness or endocrinological dysfunction
- Major medical history
- Chronic use of medication
- History of epilepsy
- History of epilepsy in first-degree relatives
- Incapability of giving an informed consent
- Pregnancy

Study design

Design

Study type: Interventional

Masking:	Open (masking not used)
Control:	Uncontrolled
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	10-09-2018
Enrollment:	12
Type:	Anticipated

Medical products/devices used

Generic name:	TMS
Registration:	Yes - CE intended use

Ethics review

Approved WMO

Date:	22-08-2018
Application type:	First submission
Review commission:	METC NedMec

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	NL66509.041.18