FMRI of space, number and time processing networks across the senses

Published: 19-09-2017
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To evaluate the quantifiable spatial representation of space, time and number in the normal human brain.

Ethical review	Approved WMO
Status	Recruiting
Health condition type	Neurological disorders NEC
Study type	Observational invasive

Summary

ID

NL-OMON52972

Source
ToetsingOnline

Brief title
FMRI of space, number and time processing

Condition

- Neurological disorders NEC

Synonym
Healthy brain activity in common tasks; Healthy brain activity to compare to clinical disorders

Research involving
Human

Sponsors and support

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

Intervention

Keyword: Multisensory integration, Neuroimaging, Spatial perception, Time perception

Outcome measures

Primary outcome

Spatial topographical representation of space, time and quantity (number)

perception.

Secondary outcome

Quantitative effects of stimulus features, modality and task demands on the

topographical organisation of space, time and number perception

Study description

Background summary

Large areas of the human brain are involved in sensory processing, motor processing and multisensory integration. To understand mechanisms of human brain function in health, it is desirable to understand the response properties of neural populations involved in sensory and multisensory processing, and how these change between brain areas. Functional magnetic resonance imaging (fMRI) is an excellent tool to establish the functional architecture of the brain, and is increasingly used to quantify neural response properties. Therefore, we propose to present visual stimuli, auditory stimuli, somatosensory stimuli, and/or cues to perform motor actions to healthy participants while recording fMRI responses to these stimuli. We will then use advanced fMRI analyses to quantify the response properties of each recording site, and how these response properties are organised. We hypothesise that the responses of individual recording sites are selective for particular timings and spatial distributions of sensory and motor events, forming networks of interacting topographic maps of space and time that support multisensory perception. These experiments will therefore reveal the neural mechanisms involved in sensory and multisensory processing.

Study objective

To evaluate the quantifiable spatial representation of space, time and number in the normal human brain.

Study design

Determining how fMRI voxels respond to the temporal and spatial distribution of sensory stimulation is a descriptive study design. The aim of the study is to quantify and compare fMRI responses for a number of stimuli and tasks. To measure and model fMRI responses, healthy volunteer will undergo T1-weighted structural MRI scans and T2-weighted fMRI scans. In different scanning sessions, several series of functional brain scans be acquired while participant perform the following tasks.

- Visual field mapping: Participants will view visual stimuli that change their visual field position. Periods of spatially-specific visual stimulation are alternated with blank display periods. Participant fixate (look at) a colored dot in the center of the display and press a button when in changes color, to ensure they maintain attention to a specific location. The task lasts for 7 minutes. This task is repeated several times to increase signal-to-noise ratio (SNR).
- Visual numerosity and object size mapping: Participants will view visual stimuli projected on a screen in the scanner. These stimuli will contain objects that change their numbers and/or sizes. Participant press a button when these objects change color, to ensure they maintain attention to the stimulus. The task lasts for 7 minutes. The task will be repeated several times to increase signal-to-noise ratio (SNR).
- Sensory time mapping: Participants will be presented with visual stimuli (flashed dots projected on a screen in the scanner), auditory stimuli (tones played through MRI-compatible headphones) and/or somatosensory stimuli (air puffs to the hand). The numbers, durations and appearance of these sensory events will change through the scanning run. Participants press a button when the visual stimuli change colour, the auditory stimuli change tone, or the somatosensory stimuli change location. The task lasts for 7 minutes. The task will be repeated several times to increase signal-to-noise ratio (SNR).
- Motor time mapping: Participants will view visual cues (symbolic numbers or flashed dots) projected on a screen in the scanner. They will respond to these cues by performing hand movements with numbers or durations specified by the cues, which will change through the scanning run. Participants will wear an MRI-compatible data glove to record these movements. The task lasts for 7 minutes. The task will be repeated several times to increase signal-to-noise ratio (SNR).
- Resting state: During a period of 500 seconds (i.e. 8 minutes 20 seconds), the participant is instructed to close their eyes, lie still and think of nothing in particular.

Study burden and risks

Healthy volunteers are asked to fill out several questionnaires and visit the UMC Utrecht. During the visit to the UMC Utrecht the tasks will be practiced and the fMRI scans session will be performed. There are no known risks of fMRI as it does not make use of contrast agents, etc. The fMRI procedure is painless and not uncomfortable. Participants will be asked to lay still for a maximum of

90 minutes, which has been shown to be an acceptable duration for fMRI experiments.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

Age
Adults (18-64 years)

Inclusion criteria

18 years or older
Normal or corrected to normal vision (contact lenses allowed)
Normal hearing

Exclusion criteria

Ever treated for a disease that can damage normal brain function (eg. trauma,

stroke, neurodegenerative disease)
Claustrophobia
Electronic implants (pacemaker, vagus stimulator, medical pumps etc)
Pregnancy (women will be asked to take a pregnancy test)
Ferrous metal implants

Study design

Design

Study type: Observational invasive

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

Recruitment

NL

Recruitment status:	Recruiting
Start date (anticipated):	01-10-2017
Enrollment:	90
Type:	Actual

Ethics review

Approved WMO Date:	19-09-2017
Application type:	First submission
Review commission:	METC NedMec
Approved WMO Date:	21-11-2019
Application type:	Amendment
Review commission:	METC NedMec
Approved WMO Date:	03-08-2022
Application type:	Amendment

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	NL60965.041.17