# The development of a neural wayfinding mechanism: How children and adolescents process landmarks.

Published: 09-06-2011
Last updated: 27-04-2024

The aim of this study is to examine the neural correlates of landmark processing in children and adolescents. We are particularly interested in the developmental trajectory of a specific brain network that automatically distinguishes between...

| | |
|---|---|
| **Ethical review** | Approved WMO |
| **Status** | Recruiting |
| **Health condition type** | Other condition |
| **Study type** | Observational non invasive |

## Summary

### ID

NL-OMON35804

**Source**
ToetsingOnline

**Brief title**
The development of a neural wayfinding mechanism.

### Condition

- Other condition

**Synonym**
Not applicable

**Health condition**

Gezonde kinderen en adolescenten

**Research involving**
Human

## Sponsors and support

**Primary sponsor:** Radboud Universiteit Nijmegen
**Source(s) of monetary or material Support:** NWO,ERC starting grant

## Intervention

**Keyword:** Development, fMRI, Landmarks, Spatial Memory

## Outcome measures

### Primary outcome

In the proposed study, brain activation patterns are the dependent variables.

We are interested in the neural correlates of landmarks with different navigational relevance. More specifically, we would like to investigate how they change with age. Moreover, we would like to investigate whether more adult like brain activation patters are associated with better performance on the navigation task.

### Secondary outcome

In addition we are interested in behavioral measures such as response times and percentage of errors.

We will also include measurements of IQ and emotional status to describe our study population. If the scores of a subject deviate from the mean more than 2 standard deviations, the experimental scores will not be included in further analysis.

# Study description

### Background summary

Successful navigation is often facilitated by the presence of objects along the

route. However, not all objects equally support navigation. In order to navigate successfully, we need to distinguish between relevant, irrelevant and ambiguous information. Previous imaging studies in adult human beings provided evidence for the existence of a highly specific neural network that responds to the navigational relevance of objects. More specifically, the parahippocampal gyrus (PHG) (major component of the medial temporal lobe (MTL)) responds to objects that are relevant for successful navigation whereas the right middle frontal gyrus (major component of the prefrontal cortex (PFC)) responds to ambiguous information along the route.
From a developmental perspective, surprisingly little is known about spatial navigation. Even less is known about the development of neural circuitries that support this ability. Recent neuroimaging studies revealed that MTL and PFC regions develop late into adolescence. On the basis of this result, it is hypothesized that MTL and PFC maturation is a limiting factor in the use of landmark information. The proposed study aims to test this hypothesis.

## Study objective

The aim of this study is to examine the neural correlates of landmark processing in children and adolescents. We are particularly interested in the developmental trajectory of a specific brain network that automatically distinguishes between relevant, irrelevant and ambiguous information along the route.

## Study design

The proposed study has a quasi experimental design. The experiment will be divided into two parts. Those parts will take place on two consecutive days. During the first visit, the participant will be administered the Raven Standard Progressive Matrices (R-SPM) test. The R-SPM assesses cognitive functioning by means of a visuospatial task that requires participants to identify the missing item that completes the stimulus pattern. In a mean while, parents will fill out the child behavior checklist to screen the child for psychiatric conditions.
The second day is divided into three parts: A study phase outside the scanner, a recognition phase inside the scanner and a navigation phase outside the scanner. During the study phase, the participant watches a film sequence of a guided tour in a virtual museum. The museum has 120 objects at its disposal, all of which are placed on tables along the wall. Each object is assigned to one of four conditions. In condition 1, the object appears twice at different locations that are relevant for successful navigation (i.e. decision point). In condition 2, the object appears twice at different locations that are irrelevant for successful navigation (i.e. non-decision point). In condition 3, the object appears once at a decision point. And in condition 4, the object appears once at a non-decision point. Participants are instructed to attend to the route and the objects along the route. When the study phase is completed,

the participant is required to perform a recognition task of the objects inside the scanner. During this task, functional images of the whole brain are acquired. Finally, the participant will perform a navigation task outside the scanner.

**Study burden and risks**

We aim to investigate the development of a neural network that has shown to support spatial navigation in adults. We will therefore include children and adolescents in the proposed study. There are no known risks associated with participation in the study.

## Contacts

**Public**
Donders Institute for Brain, Cognition and Behaviour

Kapittelweg 29
6525 EN Nijmegen
NL
**Scientific**
Donders Institute for Brain, Cognition and Behaviour

Kapittelweg 29
6525 EN Nijmegen
NL

## Trial sites

### Listed location countries

Netherlands

## Eligibility criteria

**Age**
Adolescents (12-15 years)
Adolescents (16-17 years)
Adults (18-64 years)
Children (2-11 years)

Elderly (65 years and older)

### Inclusion criteria

Healthy children and adolescents (8 to 18 year olds)

### Exclusion criteria

Children and adolescents cannot participate in the proposed MRI-experiment if one of the following applies:
1) Metal parts, that cannot be removed, are present in or on the upper part of the body (e.g. plates, screws, aneurysm clips, metal splinters, piercings or medical plasters).
2) The participant has an active implant, such as a pacemaker, insulin pump, neurostimulator and/or ossicle prosthesis.
3) Head surgery has been performed.
4) The participant suffers from epilepsy.
5) The participant suffers from claustrophobia.

## Study design

### Design

**Study type:** Observational non invasive

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

### Recruitment

NL

| | |
|---|---|
| Recruitment status: | Recruiting |
| Start date (anticipated): | 11-07-2011 |
| Enrollment: | 74 |
| Type: | Actual |

## Ethics review

Approved WMO

| | |
|---|---|
| Date: | 09-06-2011 |
| 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 | NL35906.091.11 |