

# fMRI in analytical vs non-analytical clinical reasoning

Published: 15-12-2010

Last updated: 30-04-2024

Can clinical experience be related to activation differences using fMRI? On the basis of previous studies by Schmidt cs. (Erasmus University Rotterdam and one of the investigators in the present study) it has been demonstrated that clinical...

<b>Ethical review</b>	Approved WMO
<b>Status</b>	Recruiting
<b>Health condition type</b>	Other condition
<b>Study type</b>	Observational invasive

## Summary

### ID

NL-OMON35101

### Source

ToetsingOnline

### Brief title

fMRI clinical reasoning

### Condition

- Other condition

### Synonym

n.a.

### Health condition

geen

### Research involving

Human

## Sponsors and support

**Primary sponsor:** Universitair Medisch Centrum Groningen

**Source(s) of monetary or material Support:** Ministerie van OC&W

## Intervention

**Keyword:** analytical, clinical reasoning, fMRI, non-analytical

## Outcome measures

### Primary outcome

(1) Does non-analytical clinical reasoning result in different activation patterns than analytical clinical reasoning?

(2) If so, is it possible to relate these activation differences in higher order reasoning processes to X- and C-systems, as described by others in simpler decision processes?

### Secondary outcome

n.a.

## Study description

### Background summary

It is now widely accepted that human thinking involves two functionally and probably anatomically separated systems.

System 1 processes are unconscious, rapid and automatic, while system 2 processes are conscious, slow and deliberative. It has been suggested that System 1 partly consists of automated System 2 responses, but System 1 in itself probably is able to learn implicitly.

System 2 thinking requires access to limited working memory systems, whereas System 1 does not. There is some evidence that System 1 is related to (or identical with) the X-system (refleXive) and System 2 with the C- system (RefleCtive). The X-system is composed of the amygdala, basal ganglia and lateral temporal cortex, while the C-system involves the anterior cingulate

cortex, prefrontal cortex and the medial temporal lobe. These systems have been constructed based on activation studies using relatively simple decision processes. As yet, no studies have focussed on higher order decision making (i.e. clinical reasoning) using fMRI and at present it is unknown whether non-analytical and analytical models of clinical reasoning can be distinguished using fMRI. The present study for the first time will address neural correlates of the X- and C-system in the field of medical expertise. Experienced neurologists will solve typical NAR- and AR cases in the scanner, allowing the study of activation occurring in different parts of the brain related to different thinking strategies.

## **Study objective**

Can clinical experience be related to activation differences using fMRI? On the basis of previous studies by Schmidt cs. (Erasmus University Rotterdam and one of the investigators in the present study) it has been demonstrated that clinical reasoning involves 2 different reasoning processes, an "automatic", fast, non-analytical form of reasoning which can deal with the majority of patient problems, and a slower, analytical, deliberative way of reasoning that has to be used when clinical problems are perceived to be difficult or unusual. Then, and only then, explicit pathophysiological knowledge will have to be accessed. There is some evidence concerning the situations in which analytical reasoning has to be used instead of the default non-analytical form of clinical reasoning. In some experiments case material and situations have been manipulated in order to study the circumstances in which doctors trust on their efficient non-analytical reasoning and in which situations even expert doctors have to rely on effortful and time consuming analytical forms of reasoning. There is circumstantial evidence (correctness of diagnoses, speed of reasoning processes) and more direct forms of evidence (analysis of thinking aloud protocols, recall studies) for the assumption that this dualism really exists, but as yet direct proof is lacking. We hope to be able to show that functional imaging using fMRI is a useful way to study this dualism from a totally different perspective. We want to study whether non-analytical reasoning (the method of the expert) results in a different activation pattern than analytical reasoning (the method of the novice and the method of the expert for difficult or ambiguous clinical presentations). We also want to study whether these higher order thinking processes can be related to X- and C-systems as described by others.

## **Study design**

In this study the subjects (20 experienced neurologists) are their own controls. Following a validation study, which at present is in the process of completion, subjects will solve 20 cases, of which 10 will (as has been demonstrated in the validation study) stimulate non-analytical reasoning and 10 that will lead to analytical reasoning. The cases consist of 10 sentences,

65-80 words in total. The 10 sentences will be projected by a beamer on a screen in 2 parts of 5 sentences. Every case has 2 variants, a NAR- and an AR-version. The AR-version has been constructed by inserting ambiguous information (1-3 noise items), each time transforming a straightforward case into a difficult one. The third condition consists of a neutral, non-medical stimulus, in order to neutralise the effect of reading. After the scanner session, a semistructured interview will be conducted in which questions as confidence in the diagnoses that were made, the effort with which the solution came and the perceived degree of complexity of each case will be addressed. The number of 20 subjects is in accordance with accepted standards in fMRI studies. In the validation study, NAR cases were solved in an average of 48 seconds (including typing of the final diagnosis), while the mean reasoning time for analytical cases was 70 seconds.

### **Study burden and risks**

Participants will be exposed to a 3 T magnetic field. No side effects have been described so far. On rare occasions a peripheral nerve (abdomen) is stimulated by the changing magnetic gradients. This will cause an itchy feeling, but is not harmful.

It is a single session of two hours (of which max. 1 hour research in the MRI-scanner, preceded by an instruction and followed by a review of max. 30 minutes).

It has been found in our earlier studies that experienced neurologists are usually very interested in their own thought processes.

## **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

1. Expert neurologists (more than 10 years clinical experience)
2. Between 40-60 y.o.a.
3. normal sight, hearing

### Exclusion criteria

1. MR incompatible implants in the body
2. Neurological complaints in the past as well as present
3. Use of medication which may influence task performance
4. Claustrophobia
5. The wish not to be informed in case of discovered brain anomalies
6. (Suspected) pregnancy
7. Tattoos

## 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): 29-04-2011  
Enrollment: 20  
Type: Actual

## Ethics review

Approved WMO  
Date: 15-12-2010  
Application type: First submission  
Review commission: METC Universitair Medisch Centrum Groningen (Groningen)

## 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	NL29988.042.10