The neural correlates of learning by observation

Published: 02-11-2007
Last updated: 08-05-2024

The main objective of this research is to disentangle the neural mechanisms involved in two important forms of learning: trial and error individual learning vs. learning by observation.

Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Observational non invasive

Summary

ID

NL-OMON30921

Source
ToetsingOnline

Brief title
LeO

Condition

- Other condition

Synonym
it is a healthy subject study

Health condition

healthy human subjects

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: fMRI, Learning, Observation

Outcome measures

Primary outcome

Using fMRI in healthy volunteers, we will aim to identify brain regions

selectively involved in learning by observation and learning by trial and

error.

Secondary outcome

n/a

Study description

Background summary

As Bandura (1977) affirmed, new behaviours are often learned observationally through modelling: from observing others we can form an idea of how new behaviours are performed, and on later occasions this coded information serves as a guide for action.
Therefore, observational learning improves human adaptability and enables individuals to acquire a vast store of knowledge without incurring the costs of discovering and testing this knowledge themselves (Boyd & Richerson 1985, Cavalli-Sforza & Feldman 1981). Interestingly, social learning is not merely a mechanism by means of which children acquire culture, but may also have pervasive influence throughout adulthood. For example, driving a car safely in the streets necessitates a precise knowledge of the meaning of several abstract road signs, and this meaning can be learned via distinct mechanisms. It can be learned in a risky way by trial and errors, or more easily by observation of others* driving behaviour. In daily life the *rules* that guide our behaviour are very often the association between a visual stimulus present in the environment and a particular action (arbitrary visuo-motor association, see Introduction).
Several studies investigate the neural substrates of rule learning by trial and error. In general, the neural network that underlies the acquisition by trial and error and execution of arbitrary visuomotor associations includes parts of prefrontal (PFC) and premotor (PM) cortices, the hippocampal system (HS) and the basal ganglia (BG) (see Murray et al., 2000 for review).

In particular, a number of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) studies have sought to identify the neural networks involved in arbitrary sensorimotor learning by trial and errors in humans (for reviews, see Brasted and Wise, 2005). Regional cerebral blood flow have been shown to vary during conditional visuomotor learning in the frontal and parietal networks (Dieber et al., 1997) and in the prefrontal-basal ganglia pathways (Toni and Passingham, 1999). Toni et al. (2001) found that the amplitude of the blood oxygenation level-dependent (BOLD) signal measured in the temporo-prefrontal areas changed significantly during learning. Eliassen et al. (2003) confirmed that the BOLD responses vary from initial learning to rehearsal and differentiate for errors and correct responses; in addition, the BOLD signal in some areas changed very rapidly during learning between the first correct and subsequent correct trials. More recently, Law et al. (2005) identified the behavioral correlates of a class of changes in BOLD response and found that signals in the medial temporal lobe (MTL) as well as in the cingulate cortex and frontal lobe correlate either positively or negatively with the probability of correct response.
Surprisingly, despite its outstanding scientific interest, the neural bases of visuomotor observational learning have not been studied and remain obscure. Following results obtained in a precedent fMRI study (Monfardini et al, in prep.), our goal is to explore the possibility that specific neural structures contribute to generate an internal representation of an abstract rule linking environmental information (visual stimuli) with observation of another*s action.

Study objective

The main objective of this research is to disentangle the neural mechanisms involved in two important forms of learning: trial and error individual learning vs. learning by observation.

Study design

Subjects will be asked to learn arbitrary visuo-motor associations between a visual stimulus (linear segments combined to form white shapes on a black background) and a motor response (joystick movements in four directions). The subjects will learn a number of associations either by trial and error (T&E ;condition 1) or by observation of a video showing an actor executing the task (LeO; condition 2). In the T&E condition, visual-feedback (a green happy or red sad smiley-like face) will help the subject to find the correct visuo-motor association between the stimulus and a joystick movement in a given direction. In the LeO condition, the subject will learn the visuomotor association by watching a short video showing an actor performing the visuo-motor task. The visual feedback given to the actor will help the subject to learn the task by observation. After each Leo condition, the subject will be tested to assess his knowledge of the visuomotor rule he had to learn by observation. Two basic

conditions will control for both motor execution and visual observation. Details of the study and experimental design can be found in the Study Design section of this proposal.

Study burden and risks

Subjects will be exposed to a magnetic field of 3Tesla and rapidly alternating magnetic gradients and radio frequency fields. This field strength is used routinely in fMRI and MRI research. So far, no side effects have been described. On rare occasions, a peripheral nerve in the abdomen is stimulated by changing magnetic gradients. This causes an itching feeling, but is not harmful. Volunteers with MRI incompatible implants (such as pace makers, pins, or aneurysm clips) will be excluded from this study. If a subject shows a claustrophobic reaction inside the MRI scanner, the study will be terminated and the subject will be excluded from further research. Because the MRI machine generates loud noise, volunteers will wear ear-plugs.

There are no benefits for the subjects for participation in the study.

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

Healthy subjects (male or female)
Older than 18 years of age
Right handed (Edinburgh Handedness Inventory)
Normal or corrected to normal sight and hearing
Fluent english speakers

Exclusion criteria

1. MR incompatible implants in the body
2. Neurological complaints (past or present)
3. Use of drugs that may influence task performance
4. Claustrophobia
5. Wishes not to be informed of brain abnormalities that may be noticed in the scans
6. (Suspected) Pregnancy
7. Red Tattoos

Study design

Design

Study type: Observational non invasive

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

Recruitment

NL

Recruitment status:	Pending
Start date (anticipated):	01-09-2007
Enrollment:	20

Type:	Anticipated

Ethics review

Approved WMO 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	NL18498.042.07