Functional MRI in cluttering and stuttering

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Aim of the studyThe purpose of this study is to study potential differences in brain activity involved in motor control and coordination (motor cortex, Supplementary Motor Area, medial cerebellum) as well as language areas (Broca, Wernicke) during...

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

Summary

ID

NL-OMON31589

Source ToetsingOnline

Brief title fMRI cluttering

Condition

• Other condition

Synonym

babbling;

Health condition

spraakstoornissen, vloeiendheidsstoornissen

Research involving

Human

Sponsors and support

Primary sponsor: Academisch Medisch Centrum **Source(s) of monetary or material Support:** fondsenwerving; subsidie door Damste Terpstra fonds

Intervention

Keyword: cluttering, etiology, fMRI, stuttering

Outcome measures

Primary outcome

Blood-Oxygen-Level Dependent (BOLD) fMRI was used in this study. In this research study brain areas concerned with speech motor and language were examined in a pure clutterer, a pure stutterer and a control. If cluttering is a language based fluency disorder different levels of BOLD will be observed in PWC compared to PWS in area*s of the brain that are known to be involved in language. During speech tasks in complex multisyllabic words PWC will experience different activation levels in areas concerned with speech motor planning (SMA) compared to activation levels in the same areas in PWS. These different levels of activation can be a sign of exposing subtle problems associated with speech motor planning on a higher language level in PWC. If cluttering is a language based fluency disorder that is exposed when automation and or attentional focusing are weak, different levels of BOLD will be observed in PWC in areas involved in automation (for instance cerebellum) and attentional focusing (for instance thalamus) especially in producing more complex low frequency words compared to the brain activity in PWS. When that is the case, it can be hypothesised that cluttering has a different pathogeneses

to that of stuttering.

Secondary outcome

SData on articulatory rate; articulatory accuracy and smooth-flow; frequency

and type of disfluencies will be determined in 1) monologue; 2) reading; 3)

oral motor coordination at syllable and word level. Language production skills

in written language will be analysed in a written language sample

Study description

Background summary

There is now a considerable data base of knowledge on brain functioning in stuttering (See Guitar, 2006; Ward, 2006 for recent reviews). Recent fMRI research (Viswanath et al., 2003) showed increased BOLD activity in persons who stutter during reading in motor centres in the nondominant hemisphere. These results were confirmed by several other researchers (Fox, 1996; Fox, 2000; Ingham, 2000; Neumann et al., 2003; Preibisch et al, 2003). Viswanath, et al (2003) also observed reduced activity in the gyrus precentralis (both R and L) and gyrus post centralis (left hemisphere) in word reading of PWS. Neumann et al., (2003) and Preibisch et al., (2003) observed overactivation in right side precentral sensorimotor and frontal regions amongst those who stuttered during reading amongst 9 right-handed adults who stuttered. While a number of studies implicate the anomalous cortical processing of motor speech activity, Ingham et al. (2000) found evidence that motor speech centres are affected even during imaginary stuttering (Ward, 2006, p.32).

In contrast to this literature, there are only a few imaging studies in which participants were differentiated as either PWS or PWCS. Significantly, there have been no published studies on brain functioning during speech tasks which compare those with pure cluttering, pure stuttering and control speakers. In order to examine the possibility that cluttering and stuttering are underpinned by differing neurologic processes, brain scan research which examines only pure stuttering and pure cluttering is essential.

It is hypothesized that pure cluttering and pure stuttering are two fluency disorders with different pathogenesis in which cluttering is affected by a disorder in serial (cascading) speech planning, in which previous planned syllable strings are interfering with later planned syllables, leading to non stutter like disfluencies. Alm (2006) refers to this as a disorder of the *stopsignal* in motor execution, in cluttering. Stuttering can be seen as a disorder in the *go-signal* of motor execution. In pure stuttering speech planning is affected by a disorder of starting motor execution of already planned syllables, leading to stutter like disfluencies.

Study objective

Aim of the study

The purpose of this study is to study potential differences in brain activity involved in motor control and coordination (motor cortex, Supplementary Motor Area, medial cerebellum) as well as language areas (Broca, Wernicke) during the performance of a range of spoken tasks (increasing in motor complexity) in PWC compared to PWS in order to discuss neurolinguistic processes that underly these fluency disorders.

Study design

In a observational design we specifically wish to examine whether (1) the speech planning problems of individuals that clutter are a sign of different problems in motor execution (2) the problems in speech production of PWC reflect effects of a decreased attention to motor speech planning? (3) the activity level of brain areas responsible for language planning are different in PWC compared to PWS?

Because it has been suggested that both motor and linguistic processes may underlie cluttering (Ward, 2006) a dynamical paradigm with both motor speech and language components was selected. To filter the activity of the visual cortex the speech motor and language paradigm was mirrored by a visual paradigm. Using a block design, subjects undertake three experiments with speech tasks or reading strings of signs. fMRI recordings started with recordings of rest, followed by recordings of experiment (reading signs), rest, experiment (pronouncing words) and concluded with rest. Within each experiment, four recordings were made in a shuffled order. All the words and sign strings were presented in the MRI-scanner using *Presentation* and mirrors on a big screen. Presentation produced pulses from external devices through the port device and made start of stimulus sequences on specific pulse/scan possible. Participants are trained to speak with minimum tongue, jaw and lip movement and without voicing. Possible artifactual effects because of this are supposed to be equal for all participants. Subjects are also trained to repeat the target words they saw on the screen at their fasts rate after the target was shown till the next target was on the screen. This will be exercised and trained before the subjects are placed inside the magnet. They are asked to speak as fast as they could, while still remaining intelligible. Issues concerning noise, movement, breathing and swallowing were addressed prior to the scanning procedure. Headphones were worn to protect against scanner noise, and subjects also wore a plastic stabilizing helmet in order to minimize artifacts due to head movement.

Study burden and risks

Participants experience few direct advantage of participation. Knowledge on the pathogenesis of cluttering and stuttering can result in better designed treatment protocols based on differential diagnostic criteria. This can be cost diminishing for speech language therapy to fluency disorders around the world. Participation in a fMRI study is considered to be without risks for participants when safety procedures are followed.

Participation takes a time investment of 45 minuten added with travel time.

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

to be included as a clutterer: articulatory rate is abnormally fast, irregular or both; in combination with either errors in syllable, word or sentence structure or a ratio disfluencies > 3.0; Stuttering Severity Index < 3

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to be included as a stutterer: > 3 % tensed word, syllable or sound repetitions, prolongations or blocks; Stuttering Severity Index > 3.0 A disfluent person can be included as a mix when he experiences stuttering symptoms on top of a high and or irregular speechrate

Exclusion criteria

intelligency quotient < 80 hearing or neuological disorders Dutch isn't mother tongue

Study design

Design

Study type: Observational invasive		
Masking:	Open (masking not used)	
Control:	Uncontrolled	
Primary purpose:	Basic science	

Recruitment

NL	
Recruitment status:	Pending
Start date (anticipated):	01-09-2008
Enrollment:	30
Туре:	Anticipated

Ethics review

Approved WMO	
Application type:	First submission
Review commission:	METC Amsterdam UMC

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 CCMO **ID** NL20944.018.08