

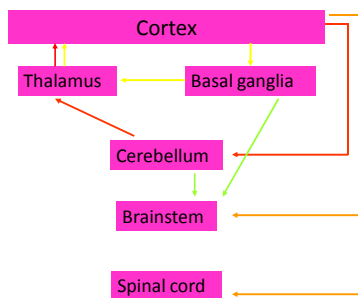
Neurophysiological analyses of speech perception and production in adults who stutter

Sarah Vanhoutte

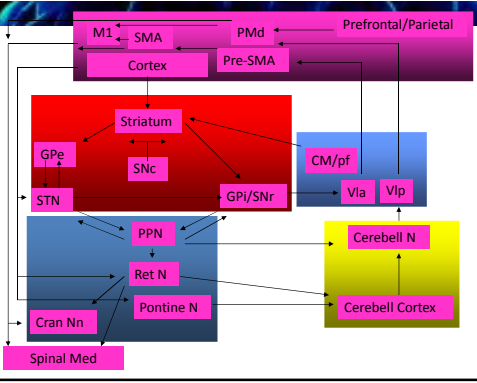


Promotor: P. Santens
Co-promotor: J. Van Borsel
Guidance committee: M. De Letter & P. Corthals

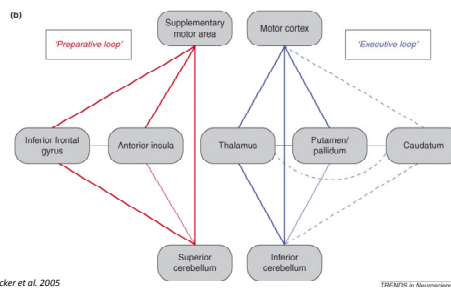
Speech is a complex form of movement



Motor networks : the extended version



Importance of timing



Importance of timing

Neurophysiological tools (EEG and MEG)

Fluent speakers (FS):

Left inferior frontal cortex

Left motor cortex

Adults who stutter (AWS):

Left motor cortex

Left inferior frontal cortex

→ AWS initiate motor programmes before preparation of the articulatory code (Salmetti et al. 2000)

Reduced white matter underlying laryngeal and tongue representation in left sensorimotor cortex (Sommer et al. 2002)

~ abnormal myelination (Cykowski et al. 2010)

Importance of timing

Auditory tasks:

- Listening to sentences in order to repeat them or to transform them into passive form (Biermann-Ruben et al. 2005)
 - In AWS: activation left IFG from 95 to 145 ms
 - In FS: absent
- Listening to the vowel 'ah' (Liotti et al. 2010)
 - AWS present with:
 - Early hyperactivation right rolandic area
 - Late hypoactivation right auditory area

Visual tasks:

- Reading aloud of nouns (Wallo et al. 2004)
 - In FS: increased activity (close to motor cortex before articulation)
 - In AWS: absent

Aim of the present research

Temporal aspects of speech perception and production

Kell et al. 2009

Silent reading:

- Increased activation Broca + ACC (De Nil et al. 2000)
 - Covert articulatory practice
- Early increased activation IFG (Biermann-Ruben et al. 2005)
 - Anticipation high load articulatory planning

Listening:

- Early hyperactivation right rolandic area (Liotti et al. 2010)

Perception - production link

Perception paradigm



- Tool: EEG (elektro-encephalography)
- Task: silent single word reading

Exclude influence of speech preparation/execution

Exclude syntactic processes

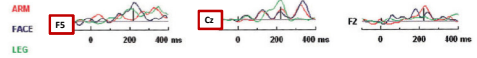
Exclude primary auditory processing deficits

Perception paradigm

- Stimuli: action verbs
 - Motor functions:  Pulvermüller et al., 2005
 - Word-related memory networks: 

Mirror neurons: action execution + action imagery + action observation
~ important role in effect of chorus speech (Kalinowski et al.)

- ERP (event-related potential)
 - Visual stimuli: 200 – 250 ms
 - = Time-locked averages of stereotype electrophysiological responses of the brain

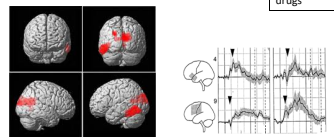


Perception paradigm

- Arm-related action verbs vs non-action verbs
 - e.g. to throw (*gooien*) vs e.g. to may (*mogen*)

		Criteria	
		Age: 18 – 60 year	
		FS: no family history of stuttering AWS: developmental stuttering	
		Native language: Dutch	
		No dyslexia	
		No history of neurological or psychiatric disorders	
		No antipsychotic or antidepressant drugs	

- ERP (latency – amplitude – topography)
- Source estimation technique



Future...

- Production paradigm:
 - ERP: contingent negative variation (CNV)
 - Motor preparation
- Both men and women (right-handed)
 - Evidence for differences (Ingham et al. 2004, Chang et al. 2009)
- Other analyses
 - Correlation analyses
 - ...

Thank you for your attention

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