

THE SIGN LANGUAGE WINDOW ON LANGUAGE GENESIS

Anne Baker & Bencie Woll

UvA Amsterdam UCL London

Sample of Swedish Sign Language

*So, what is your name? My name is Jenny Ingvarsson and this is my name sign. Oh, how come? Why that particular name sign? Well, first of all it indicates my curly hair, and when I was a small I always emphasized the ** when I fingerspelled my name, with real emphasis. My preschool teachers wanted to have a sign that only indicated my curly hair, but I wanted to add the ** so that is the combination. Oh, it looks nice. Where are you from? I was born in Stockholm. Did you grow up here? So you are a real Stockholmer then? Yes, I grew up in Stockholm and I still live in Stockholm. Could you tell us a bit about your family and the time when you grew up? Well, my father is hard of hearing and my mother is deaf. I have two brothers, one who is eighteen who is deaf, and one who is fifteen who is hearing.*

Sign languages as full languages

- Full grammatical system
- Not derived from spoken languages
- Change as any other languages do

- In contact with spoken languages as result of social situation of Deaf people

Why are sign languages interesting for the question of evolution?

- Possible that SL's are forerunners of spoken languages

Or

- Both have their origins in a gestural system

Theories of language origins

Ding-Dong

- The origin of human language in onomatopoeia: imitative sounds that humans make to mimic the sounds of the world around them.

Bow-wow

- Humans formed their first words by imitating animal sounds.

Pooh-pooh

- The first words developed from sighs of pleasure, moans of pain, and other semi-involuntary cries. These then became the names of the phenomena that made people say them.

Uh-oh

- human language begins with the use of arbitrary symbols that represent warnings to other members of the human band.

Theories (cont.)

Yo-he-ho

- language arose in rhythmic chants and vocalisms uttered by people engaged in communal labour.

Watch the Birdie

- human language became elaborated because humans found it advantageous to be able to *deceive* other humans. Since exclamations and vocalisms can involuntarily reveal your true mental state, humans learned to feign them in order to deceive others for selfish advantage.

Ta-ta

- According to this, human language represents the use of oral gestures that began in imitation of hand gestures that were already in use for communication.

View from:

Acquisition of sign languages (Anne)

Organization of sign languages in adults (Bencie)

Multimodality in languages

- Spoken languages use speech but are also accompanied by gesture & facial expression
- Sign languages combine manual signs with actions of other body parts:
 - eyebrows
 - eye gaze
 - head movements
 - mouth movements

Tools

Developed by the Max Planck Institute in Nijmegen with the aim of managing data and metadata files

QuickTime™ and a
TIFF (Uncompressed) decompresso
are needed to see this picture.

- ELAN annotation software



- The IMDI (ISLE Metadata Initiative) Editor & Browser

Example of ELAN transcription

Elan - BSL_PS_fab1_b.eaf

File Edit Search View Options Help

Grid Text Subtitles Controls

English Translation

There was a small boy whose job it was to tend sheep. · While the sheep were left to graze, the shepherd boy would lie back and let his mind wander. He would become bored, fidget, and gaze about distractedly, wondering what to do with himself. · It occurred to him that it would be a keen idea to play a trick on the villagers. He would raise the alarm, saying there was a wolf, and all the villagers would come running. Oh, it would be good! · So the boy ran to the village in a panic shouting, "there's a wolf, help me, come quickly!" · The villagers rushed to the scene but found nothing. The boy had fooled them and they were furious. · The boy laughed heartily and the villagers left. · Later, it happened again. · Bored and distracted, the boy could see no reason not to fool the villagers again. · **He ran to the village in a panic saying, "hey, there's a wolf. It's true, come on!"** · The villagers were fooled and ran to the boy, who laughed and laughed. · Time passed and eventually the boy was shocked to see a real wolf. · The wolf's tongue was dangling from its mouth as it stalked and bit at the sheep. · In a panic, the boy ran to the village shouting, "hey, there's a wolf!" · But the villagers had been already been fooled twice and ignored him. · "But it's true," insisted the boy, "there is a wolf!" · Dejected, speechless, and full of worry, the boy returned to see the wolf eat his way through the whole flock so that in the end they were all dead. The boy could hardly believe what had happened. · If you tell lies, people will believe you. You shouldn't tell lies. You really shouldn't.

00:00:32.280 Selection: 00:00:31.525-00:00:33.535 2010

Selection Mode Loop Mode

00:00:32.000 00:00:33.000 00:00:34.000 00:00:35.000 00:00:36.000 00:00:37.000 00:00:38.000 00:00:39.000 00:00:40.000

Gloss RH	RUN	GET-A	WOLF	TR	CO	(p-) villagers	FOOL	B	LAUGH	TIME-P	HAPPE	SEE
Repetition RH	2a					u		6				
Dir&loc RH						l						l
English Translation	He ran to the village in a panic sayin				The villagers were fooled and ran to the boy, who laughed and laugh					Time passed and eventually the boy was		
Gloss LH	RUN (-h)		IN	TR		(p-) villagers			LAUGH	TIME-P	HAPPE	
Repetition LH	2a					u		6				
Dir&loc LH			lu			l						
Head						n		t				
Brows	r	r				f				r		
Eye aperture	s					s	c		s	c	w	c
Eye gaze	r	r-90	r			l-90	bh	c		c	c	r
Cheeks										p		

Acquisition of a signed language

Same stages as in a spoken language:

- Babbling before 1 year
- One-sign stage around 1 year
- Two-sign stage around 1 year 6 months
- Multi-sign combinations from 2 years
- But variability between signed languages as to when specific structures are learned

Some claims that a sign language is learned more quickly

Video clip of Mark (3;6) and his mother in NGT

Non-manual actions in sign languages

Mouth actions

Eyes, brows, head, body...

Mouthings

derived from spoken language

Mouth gestures

not derived from spoken language

in loans

e.g. to disambiguate

Echo phonology

Adverbials

in code blending

Enactions

Use of mouth actions in signed languages

- Signs with mouth gestures not derived from spoken words
e.g. “fa” in NGT sign FINALLY UNDERSTOOD
“pa” in sign THROW AWAY
- Signs with mouthings, i.e. derived from spoken words
e.g. “bal” in NGT sign BAL
- Latter can be seen as a form of code-blending.

Types of code-blending

(1) Dutch Base Language

Signed VALLEN

Spoken die gaat vallen

English that goes fall

Translation That [doll] is going to fall

(2) NGT Base Language

Signed INDEX_{hij} JAS BLAUW

Spoken blauw

English INDEX_{he} COAT BLUE

Translation He has a blue coat

Types of Code-blending cont'd

(3) Mixed

Signed

POP SPELEN

Spoken

geel

English

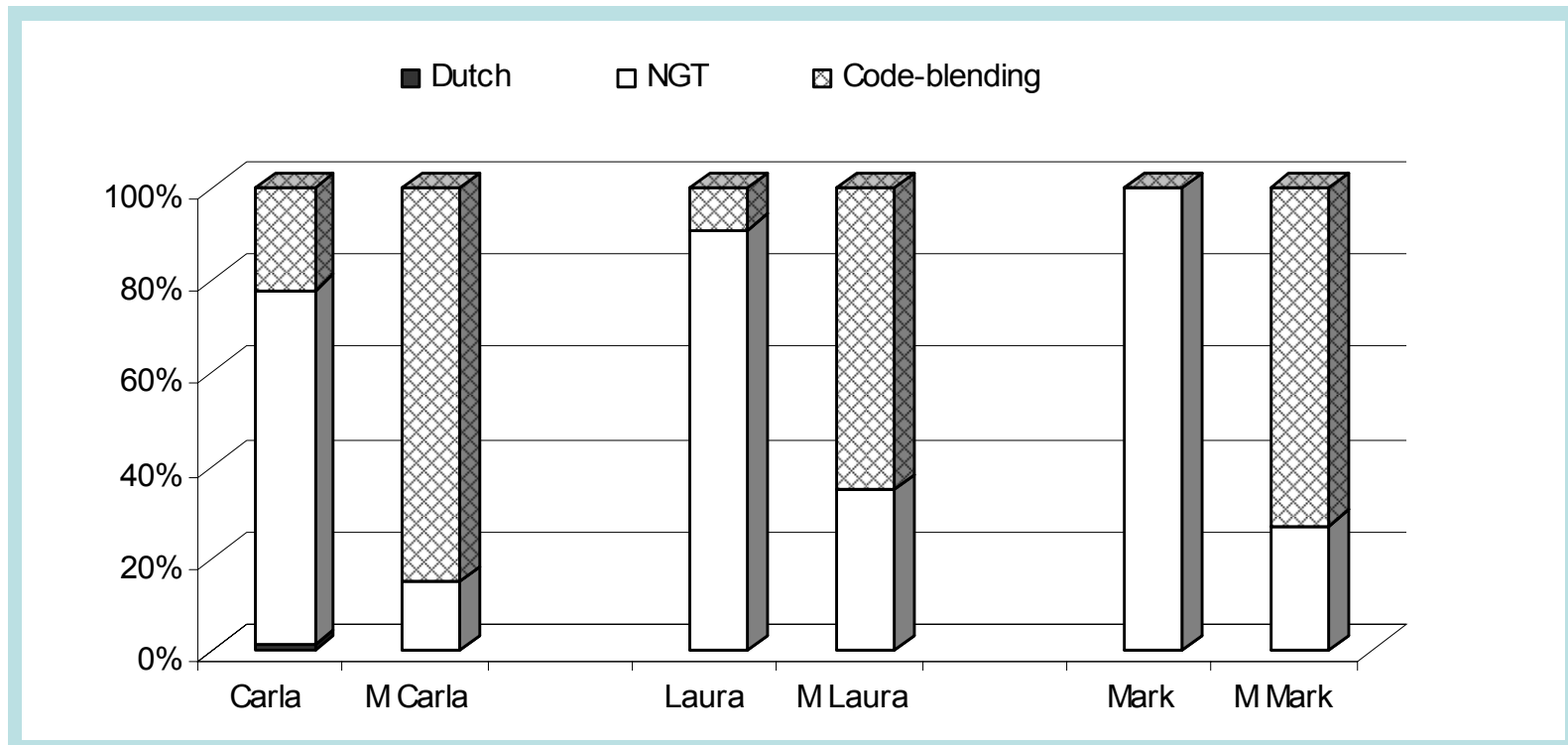
DOLL PLAY

yellow

*Translation (I want) to play with the
yellow doll*

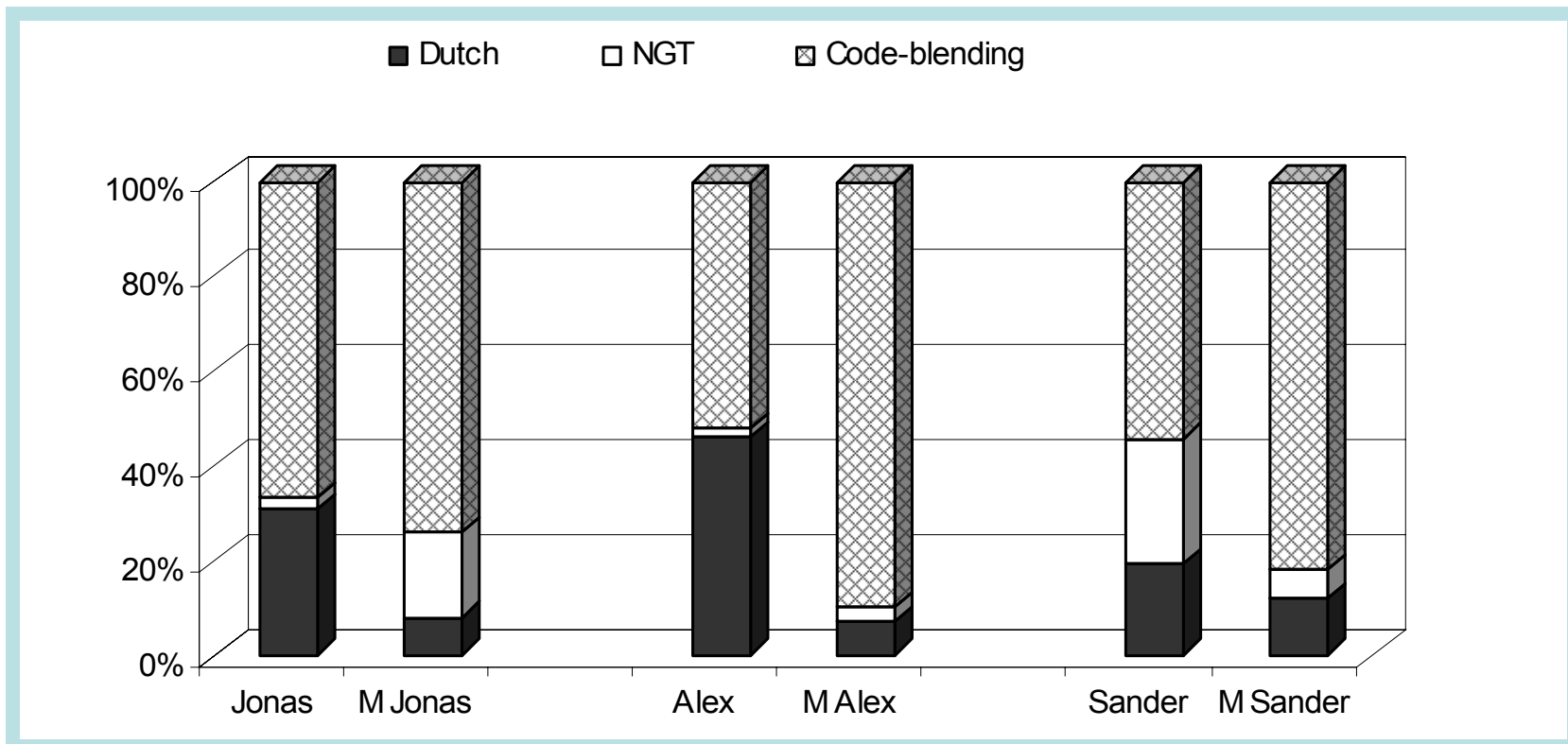
(4) Full

Amount of code-blending by 3 deaf children and their deaf mothers at 3;0



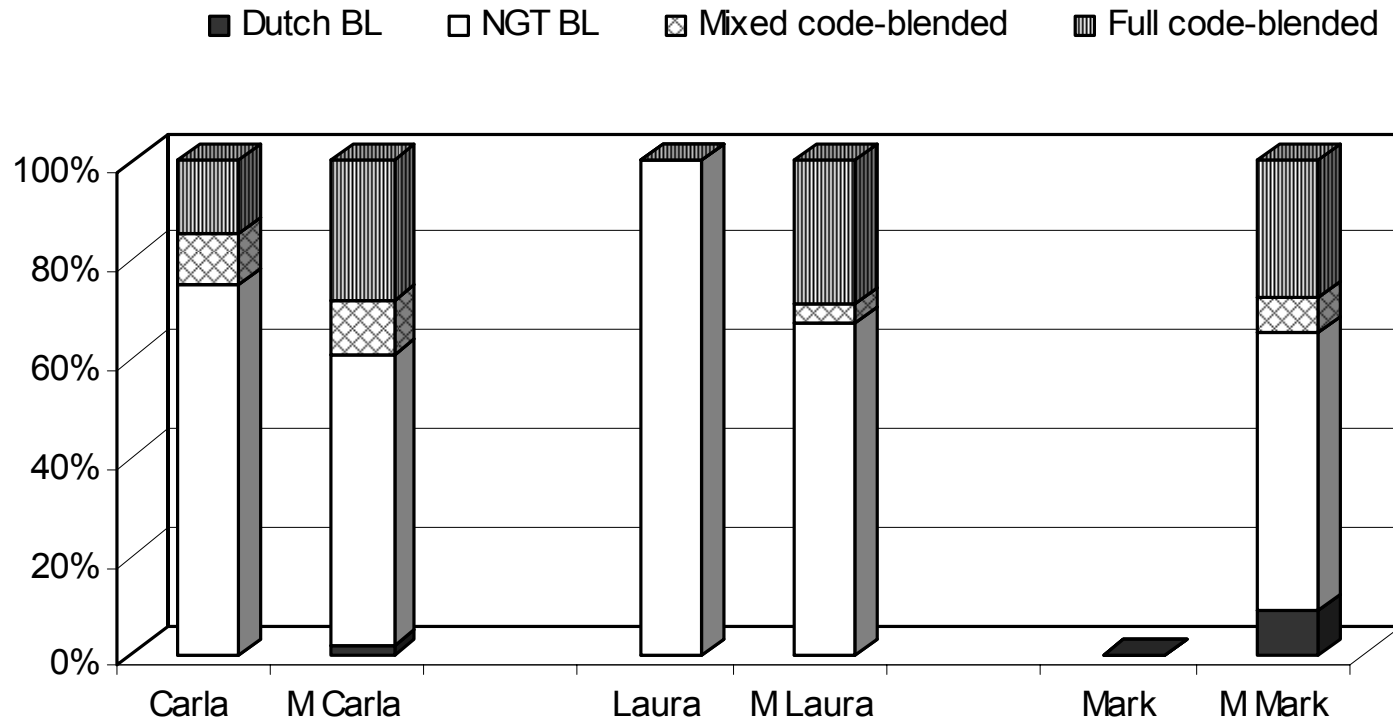
Mothers considerable amount; children little or none at 3;0.

*Amount of code-blending by 3 hearing children and their **deaf** mothers at 3;0*



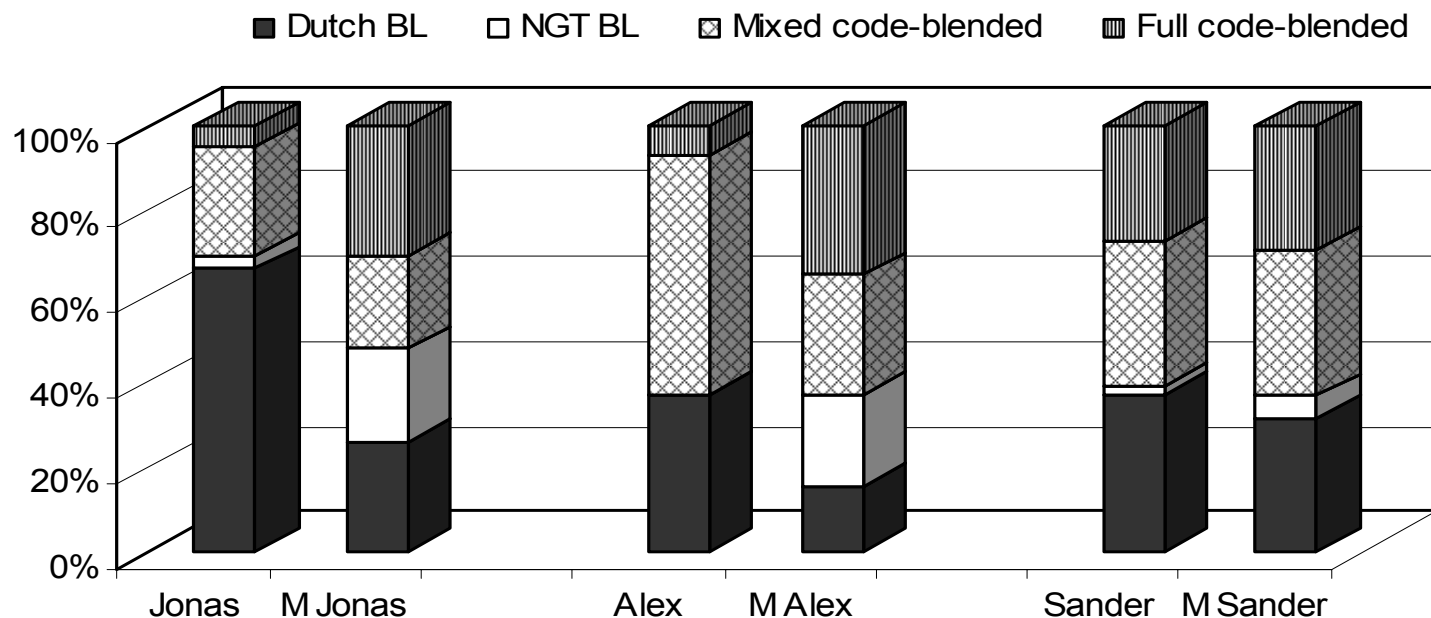
Mothers more than with deaf children; children also a considerable amount.

The types of code-blending by 3 deaf children and their deaf mothers at 3;0



Mothers have some mixture of types; Deaf children have mainly NGT based code-blends

The types of code-blending by 3 hearing children & their deaf mothers at 3;0



Mothers have a clear mixture of types; Deaf children also have a good mixture.

How to explain the **differences** between the deaf and hearing children

- Level of acquisition in the two languages
- Input
- Own language choice

Relevance to Windows project

At 3 years of age deaf and hearing children are behaving differently in their acquisition:

Amount of code-blending is different

Base language is different

Spoken language seems to be “driving” the hearing children and sign language “driving” the deaf children at this age.

What is happening in the earliest period of acquisition?

How are the two modalities combined from the beginning?

mouth actions + hand actions

mouth actions + signs

words + hand actions

words + signs

What is the timing in these combinations?

are mouth actions / words started earlier than signs or vice-versa? Is one “driving” the other?

Example of ELAN coding

The screenshot displays the ELAN software interface for the file 'sander24.eaf'. The interface is divided into several sections:

- Top Bar:** Contains the menu options: File, Edit, Search, View, Options, Help.
- Video Player:** A large black rectangle on the left side, currently showing a timestamp of 00:00:1.
- Control Panel:** Located below the video player, it includes playback controls (stop, previous, play/pause, next, full screen) and checkboxes for 'Selection Mode' and 'Loop Mode'.
- Grid Panel:** On the right side, there are tabs for 'Grid', 'Text', 'Subtitles', and 'Controls'. Below these tabs is a dropdown menu set to 'Empty' and a table with the following columns: 'Nr', 'Annotation', 'Begin Time', 'End Time', and 'Duration'.
- Timeline and Coding:** At the bottom, a horizontal timeline shows time intervals from 00.000 to 00:00:06.000. Four coding layers are visible:
 - manual child:** Contains the text 'IN og KONIJN' with a bracket spanning from approximately 00:00:00.5 to 00:00:02.0.
 - oral child:** Contains the text 'een koe' with a bracket from approximately 00:00:01.0 to 00:00:01.5, and a partial 'mo' at the end.
 - manual parent:** Contains the text 'og B1-hand og KOE' with a bracket from approximately 00:00:00.5 to 00:00:02.5, and 'welke kant og B' at the end.
 - oral parent:** Contains the text 'dat is e' (bracketed from 00:00:00.5 to 00:00:01.0) and 'mond open (n koeeee' (bracketed from 00:00:01.0 to 00:00:02.5), and 'AV' (bracketed from 00:00:05.0 to 00:00:05.5).

Argumentation

If hearing children and deaf children are **different** in this very early period, then hearing status is clearly important and there is **no** universal pattern that could point to the original relationship between the modalities.

If they are **similar**, this might indicate that there is a universal pattern that suggests the origins of language.

The hands are the head of the
mouth: echo phonology as a
window on language genesis

Echo phonology

Woll (2001); used the term 'echo phonology' to describe a subset of mouth gestures that are driven by and parallel the movements of manual signs

Hand-mouth actions and speech

- Participants brought either a cherry or an apple to their mouth and pronounced the syllable BA or observed arm actions performed by the experimenter and pronounced the syllable BA. Execution and observation of the bringing-to-the-mouth action activate a mouth articulation posture which selectively influences speech production. This supports the idea that the system involved in speech production shares and may derive from the neural substrate which is involved in the control of arm-mouth interactions and, in general, of arm actions.
- Gentilucci, Santunione, Roy, Stefanini. Execution and observation of bringing a fruit to the mouth affect syllable pronunciation. *European Journal of Neuroscience* 19(1):190-202, 2004

Questions for signers with respect to mouth actions in sign language

- How extensively are they used?
- Which brain regions are activated by watching mouth actions in sign language?
- Do these differ from those activated by watching spoken English?

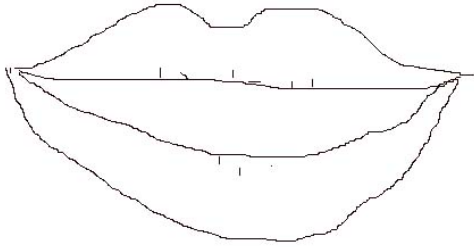
Questions for non-signers

- Are these patterns the same as in signers?
- If they are not – how do they differ?

Two data sets

- ECHO project
- Imaging the Deaf Brain project

Mouth categories

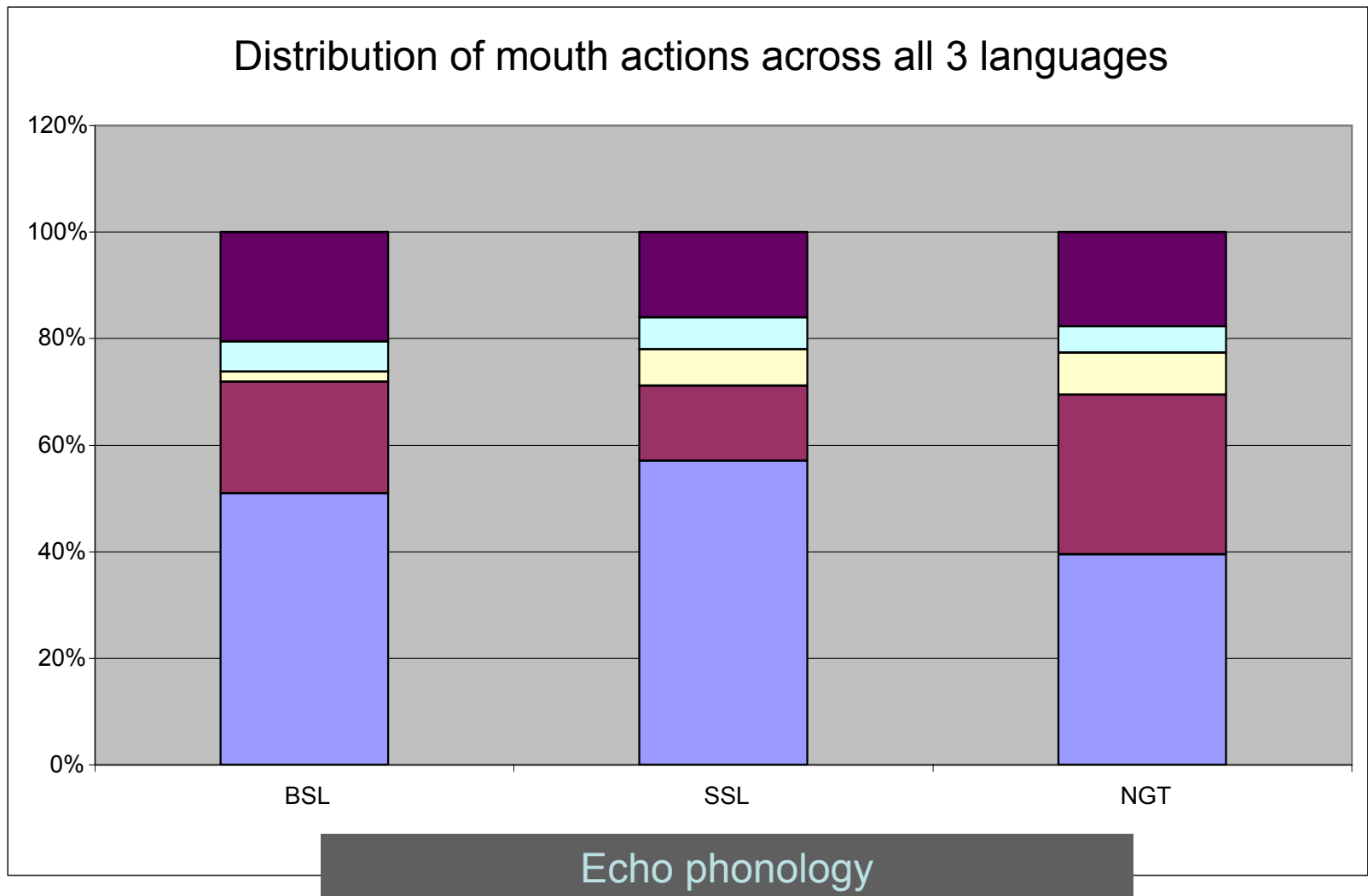


- M mouthings
- E Echo phonology
- A adverbs (modifiers)
- 4 mouth for mouth
- W character markers
(whole face)

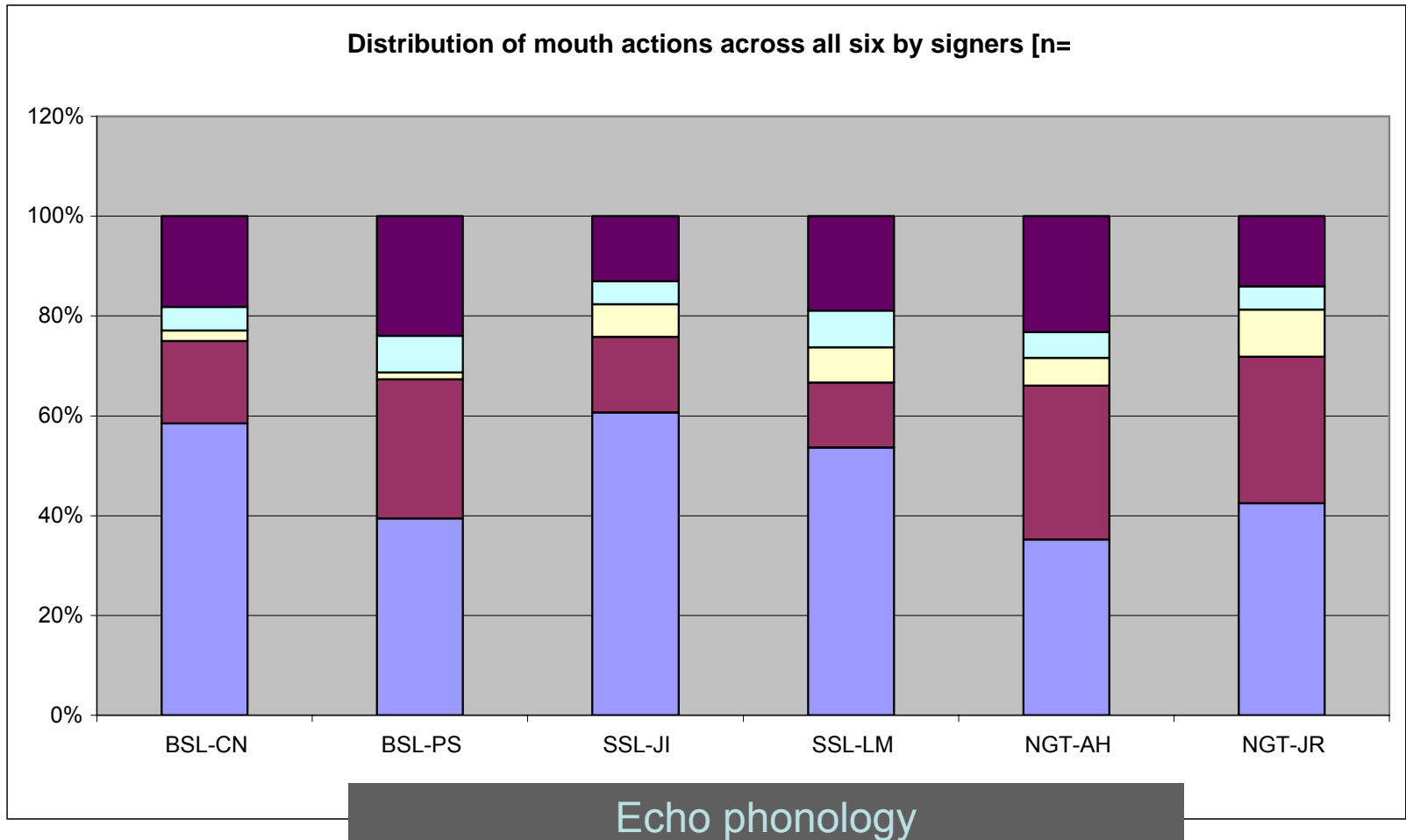
Distribution: raw scores

	M	A	E	4	W	
NGT	251	190	50	31	112	634 (1056)
SSL	831	205	99	87	233	1455
BSL	560	231	20	63	225	1099

Distribution by language



Distributions by signer



Conclusions

- Echo phonology appears with comparable frequency across signers
- Echo phonology appears with comparable frequency cross-linguistically
- Similar 'phonological' repertoire

Brain Questions

- Which brain regions are activated by watching echo phonology?
- Is the processing of echo phonology similar to processing other sorts of sign language linguistic information?
- .. and what about speech?

fMRI studies

View 4 types of silent mouth actions –

- Echo phonology EP
- disambiguating mouth DM
- no mouth NM
- English (speechreading) SR

stimulus characteristics

	mouth opening and closing	hand- arm movements (BSL)	English derived mouth
EchoPhon	+	+	—
DisambMouth	+	+	+
NoMouth	—	+	—
Speechreading	+	—	+

Experimental stimuli

EchoPh	DisambM	NoM
EXIST [š38]	FINLAND/METAL	TABLE
[ʍ]WIN	BATTERY/AUNT	CHERRY
NONE [pu]	WOOD/PROBLEM	BUTTER
SUCCESS [pa]	RUSSIA/BOY	KNOW
END [pəm]	ITALY/WIN	FAX



In the scanner

- Experimental task -
Watch the actions and press the button when you see 'yes' – in sign language or in speech
- Baseline, press when the grey cross on the model's face turns red
- Button presses sparse – once per block

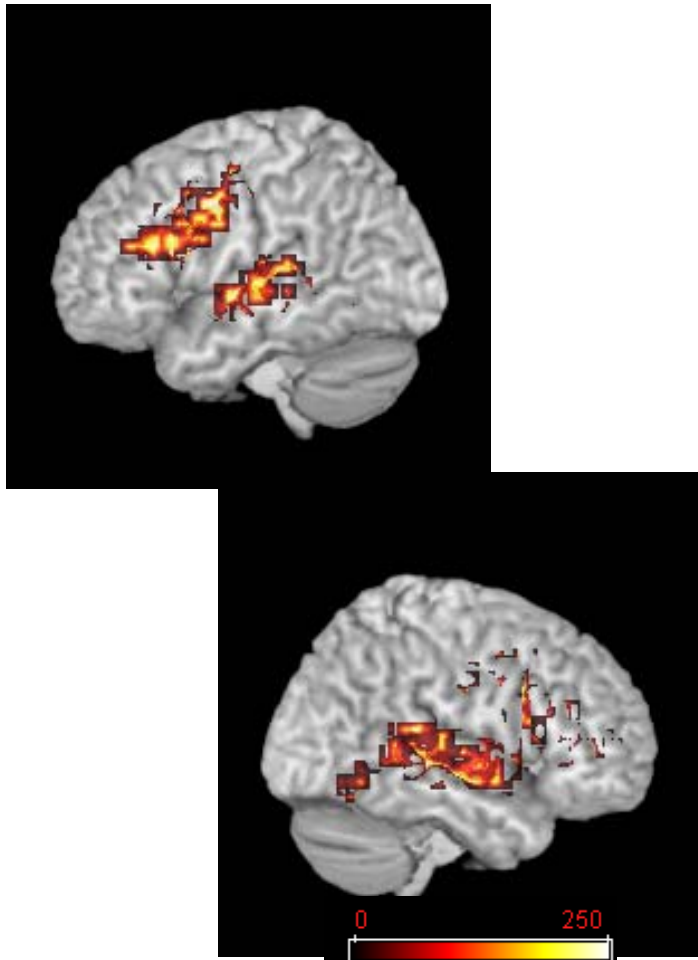


General observations for signers -

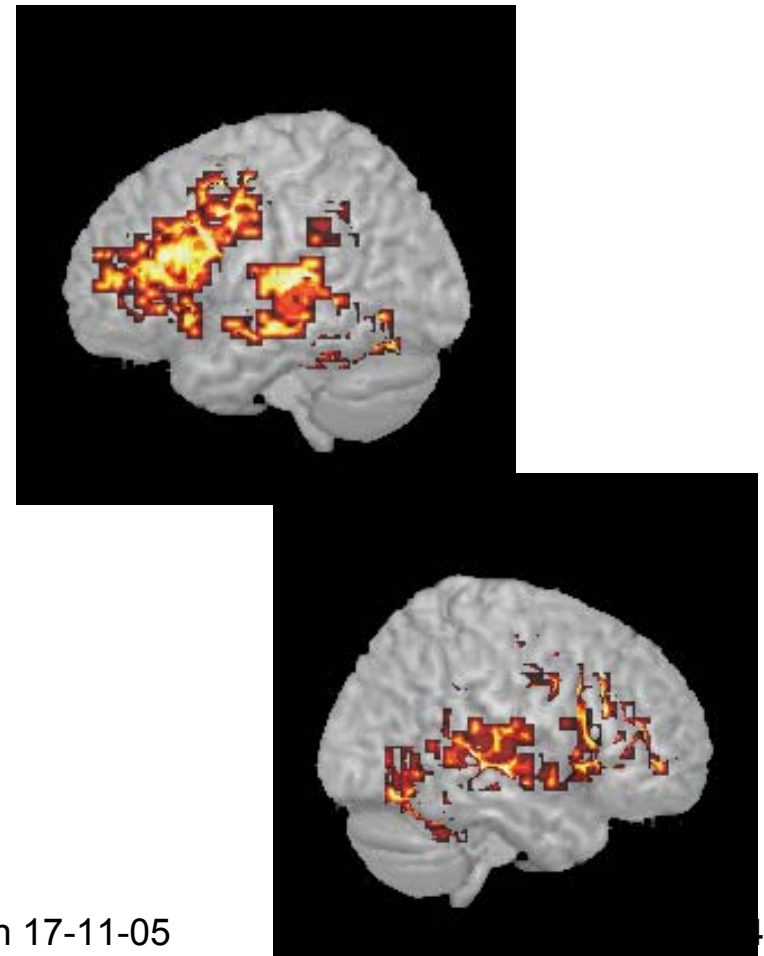
- Right Hemisphere is differentially sensitive to the articulators: lip and mouth movements are anterior; manual movements are posterior
- Left Hemisphere is **NOT SENSITIVE** to this at all

Speech-reading

Deaf signers



Hearing nonsigners



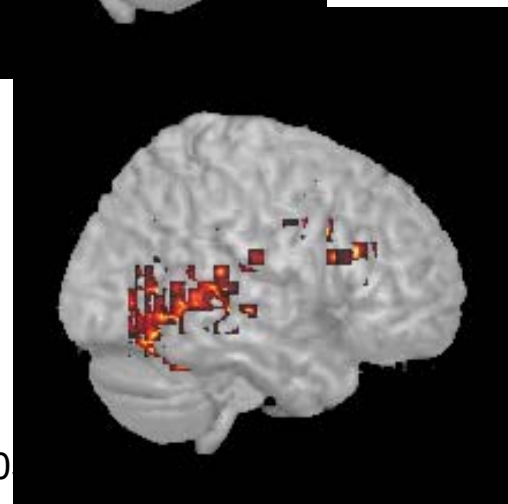
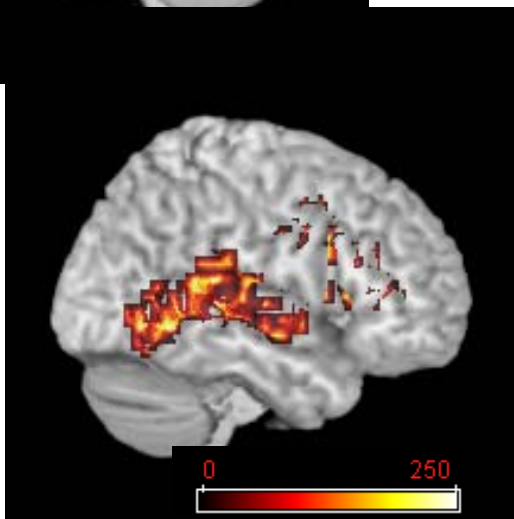
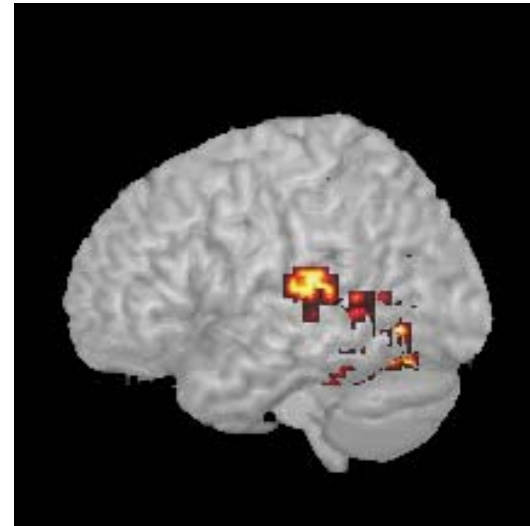
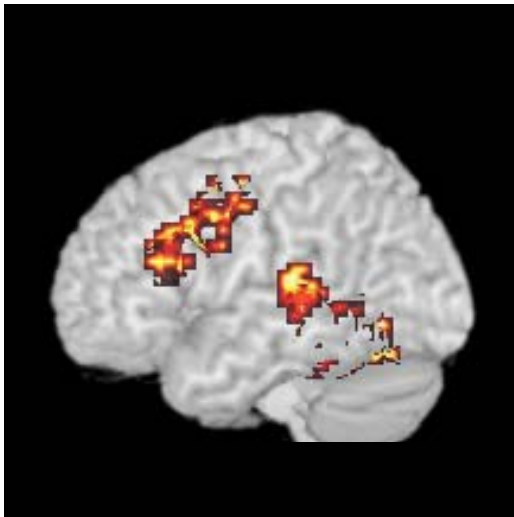
Interim conclusions – silent speech

- These are very similar for deaf and hearing subjects
- Greater activation in frontal areas probably reflects more effort by hearing subjects to process silent speech (they are not used to speechreading but can do it)
- Although the stimuli are silent, both hearing and deaf subjects use left superior temporal regions (auditory cortex) for processing speech

No mouth

Deaf signers

Hearing nonsigners



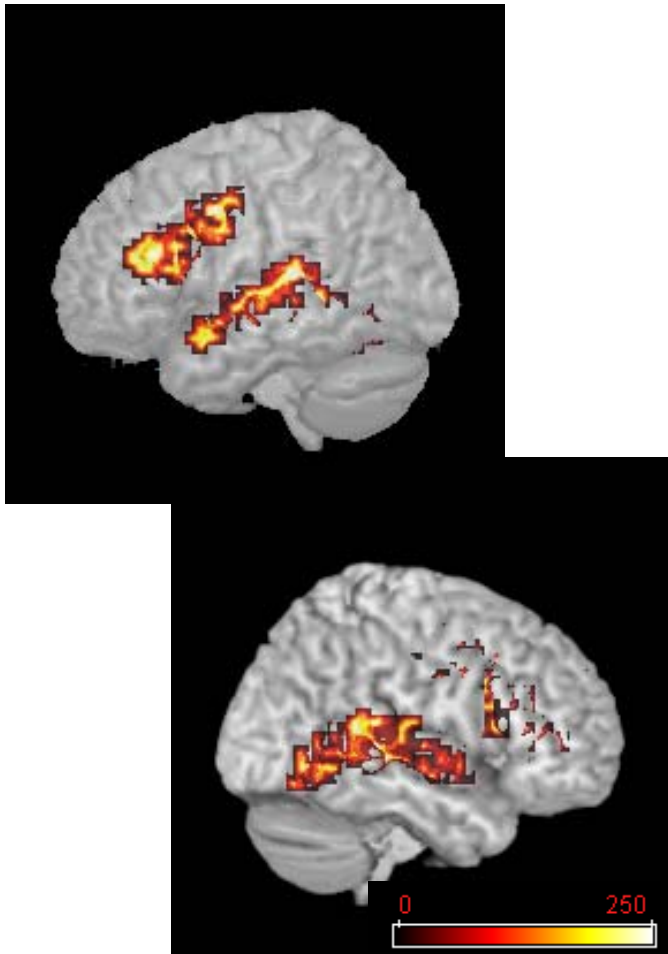
AS presentation 17-11-0

Interim conclusions – signs without mouth

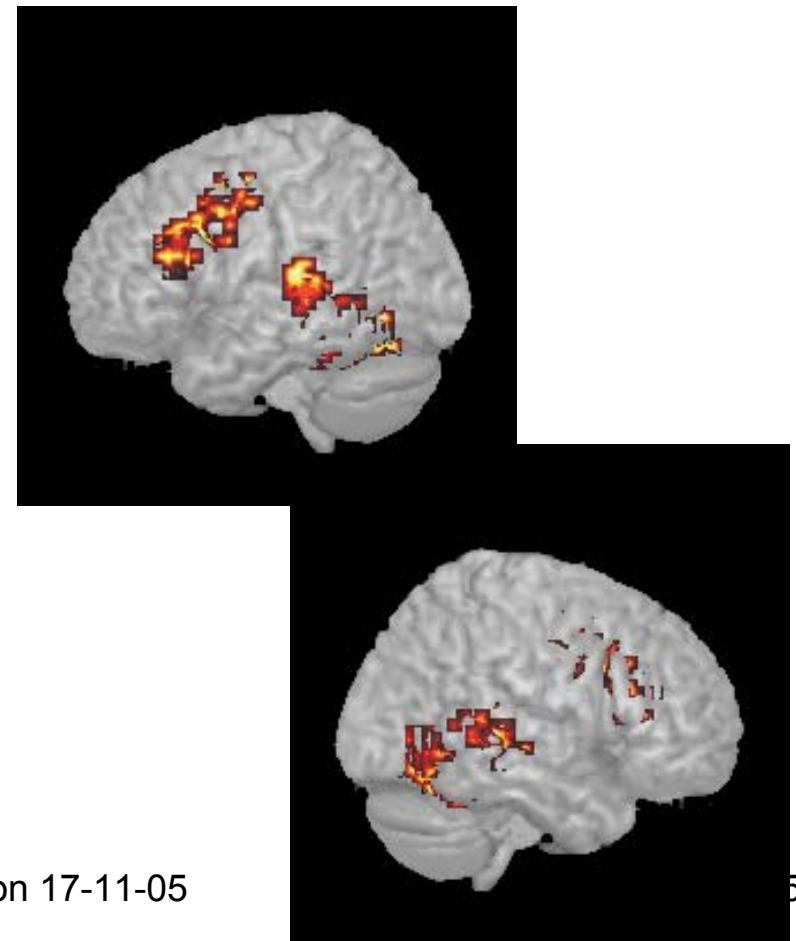
- LH activations are very different for deaf and hearing subjects.
- Total absence of frontal activation in hearing subjects probably reflects inability to access any linguistic meanings (they are not used to it and they can't do it)
- There is no obvious LH activation in auditory cortex in either deaf or hearing subjects

Echo phonology

Deaf signers



Hearing nonsigners



Interim conclusions – echo phonology

- For deaf subjects, LH activations strongly resemble those for processing silent speech. Echo phonology activates those areas of the brain used for processing phonology
- For hearing subjects, echo phonology processing does not activate auditory cortex
- Instead, there is extensive bilateral activation, which can include frontal regions in pre-motor sites

Conclusions

- The findings suggest that echo phonology occupies an intermediate position in terms of brain processing between signs and speech.
- This provides support to the notion that echo phonology may reflect a mechanism associated with language evolution
- Support for the 'Ta-Ta' theory?

Collaborators on the Acquisition project

Amsterdam University

Beppie van den Bogaerde, Roland Pfau, Marijke Scheffener, Joni Oyserman

Utrecht University

Jacomine Nortier

And all the families.

Collaborators on the ECHO project

Nijmegen University

Els van der Kooij, Onno Crasborn, Annika Nonhebel, Wim Emmerik

Stockholm University

Johanna Mesch, Brita Bergman

UCL/City University London

Dafydd Waters, Bencie Woll, Rachel Sutton-Spence

Collaborators on Imaging the deaf Brain

Cheryl Capek
Dafydd Waters
Bencie Woll
Mick Brammer
Ruth Campbell
Tony David
Philip McGuire

Mark Seal
Mairéad MacSweeney
Jordan Fenlon
Tyron Woolfe
Zoë Hunter
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