The mouth

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What does the mouth do?

Mouth activities

- Emotional signals
  - laughing, spluttering
  - show surprise
- Sign language markers
  - Phonological elements (BEAT-A-COMPETITOR)
  - Adverbs (WALK in different ways)
- Spoken words
  - HARE = 'haas'
  - TURTLE = 'schildpad'

What are the spoken language elements?

Important components of the sign language itself vs.

A clear case of code mixing

E.g. Heßmann & Ebbinghaus 1998; Hohenberger & Happ 2001

1. VOORWOORD.

Aan de liplezers.

De kunst van liplezen is een moeilijke kunst en zal daarom alleen goed geleerd worden door degenen, die er zich met hun beheuren en willen op instellen.

Natuurlijk is het voor u nodig, les te nemen. Al werkt u, met dit boekje in een hoekje voor uw spiegel, alle oefeningen, die wij geven, trouw door, dan zal dat alleen u niet maken tot een goed liplezer. Maar: al is het noodzakelijk, dat u les neemt, zo wil dit toch ook weer niet zeggen, dat uw lerares u nu alles moet bijbrengen.
Influence of spoken Dutch on NGT

- Spoken components: derived from spoken language
- Oral components: not derived from spoken language
- Functions: disambiguate and specify meaning
- Oral components can also carry meaning themselves (and act as independent lexical items)
- Lexicon: spoken components accompany only 16% of the signs in the earliest two NGT lexicons
- The influence of Dutch is most clearly present in Dutch function words and verb inflections that do not have a place in the manual grammar of NGT

Some other previous research

- Vogt-Svendsen (1981, 2001), Norwegian SL: asserted the primacy of the hands over the mouth. Also found that mouthings are mainly nouns and uninflected verbs
- Bergman & Wallin (2001), Swedish SL: pioneered notation of mouth actions based on visual contrasts. Also found that borrowed patterns are reconstructed to native patterns
- Sutton-Spence & Day (2001), British SL: documented heterogeneity in the use of mouth actions, highlighting both register issues and sociolinguistic factors as important to future research in this area

Some other previous research, cont.

- Woll (2001); used the term 'echo phonology' to describe a subset of mouth actions that are driven by and parallel the movements of manual signs
- Schermer (1990), Happ & Hohenberger (2001), Boyes Braem (2001), and others: noted that mouthings tend to associate to open-class rather than closed-class items

Study 1

How often do different types of mouthing occur in different signed languages?
What patterns do we see in different language with respect to the spreading of mouth actions over multiple signs?


Typology of mouth actions

- Mouthings (M)
- Semantically empty mouth actions (E)
- Adverbial mouth actions (A)
- Whole face mouth actions (W)
- Mouth-4-mouth (4)

Data for this study

- Five fable stories narrated in three sign languages (Dutch, British and Swedish) by two signers each
- Average of 7.5 min/signer

Other available data
- SL poetry (NGT, SSL)
- Basic lexicon, 300 items
- Brief interviews
www.let.ru.nl/sign-lang/echo
Distributions: raw scores

<table>
<thead>
<tr>
<th>Language</th>
<th>M</th>
<th>A</th>
<th>E</th>
<th>4</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGT</td>
<td>251</td>
<td>190</td>
<td>50</td>
<td>31</td>
<td>112</td>
</tr>
<tr>
<td>SSL</td>
<td>831</td>
<td>205</td>
<td>99</td>
<td>87</td>
<td>235</td>
</tr>
<tr>
<td>BSL</td>
<td>560</td>
<td>231</td>
<td>20</td>
<td>63</td>
<td>228</td>
</tr>
</tbody>
</table>

Distributions by language

Distributions by signer

Distributions: class of mouthing (NGT)

The mouth as a separate articulator in SL

- the two hands
- the body
- head
- mouth
- time

→ No large differences between languages
Spreading of mouth actions

- Definition: synchronisation of one mouth action with multiple manual signs
- Function → marking prosodic domains?

Nespor & Sandler (1999)

Research questions

1. Do both mouthings and mouth gestures spread?
2. What is...
   a. the direction of spreading?
   b. the size of the domain?
   c. the nature of the resulting domain?

Research questions

1. Do both mouthings and mouth gestures spread?
2. What is...
   a. the direction of spreading?
   b. the size of the domain?
   c. the nature of the resulting domain?

Hypotheses

1. Spreading occurs not only for mouthings (M) but also for mouth gestures (E)
2a. Direction:
   - From content word to function word
   - From left to right
2b. Size: spreading is limited to the neighboring sign
2c. Domain: source and target word form a syntactic constituent

Hypothesis 1: both mouthings (M) and mouth gestures (E) spread

- Confirmed: in all three languages there are a few examples of mouth gestures that spread.
  - BSL: 2
  - NGT: 4
  - SSL: 8
- Low frequency of spreading mouth gestures should be seen in the light of the low frequency of mouth gestures in these stories [5-20 times as many mouthings as mouth gestures, depending on the language].

Spreading of mouth gestures (NGT)

Hypothesis 2a: spreading from left to right

<table>
<thead>
<tr>
<th>Language</th>
<th>No. of fables</th>
<th>Rightwards</th>
<th>Leftwards</th>
<th>L + R</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL</td>
<td>6</td>
<td>106</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGT</td>
<td>10</td>
<td>60</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SSL</td>
<td>10</td>
<td>74</td>
<td>12</td>
<td>3</td>
</tr>
</tbody>
</table>

Nespor & Sandler (1999)

He is really there.
Hypothesis 2a: spreading from left to right

<table>
<thead>
<tr>
<th>Language</th>
<th>No. of fables</th>
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<tbody>
<tr>
<td>BSL</td>
<td>6</td>
<td>106</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NGT</td>
<td>10</td>
<td>60</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>SSL</td>
<td>10</td>
<td>74</td>
<td>22</td>
<td>3</td>
</tr>
</tbody>
</table>

Hypothesis 2a: spreading from content word to function word

<table>
<thead>
<tr>
<th>Language</th>
<th>No. of fables</th>
<th>C &gt; F</th>
<th>F &gt; C</th>
<th>F &gt; P</th>
<th>C &gt; C</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL</td>
<td>6</td>
<td>87</td>
<td>3</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>NGT</td>
<td>10</td>
<td>50</td>
<td>0</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>SSL</td>
<td>10</td>
<td>69</td>
<td>0</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Hypothesis 2a: spreading from content word to function word

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<td>50</td>
<td>0</td>
<td>5</td>
<td>6</td>
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<td>0</td>
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Hypothesis 2a: spreading from content word to function word

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<td>0</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>SSL</td>
<td>10</td>
<td>69</td>
<td>0</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

‘There was a boy who lived in a village’
Hypothesis 2a: spreading from content word to function word

<table>
<thead>
<tr>
<th>Language</th>
<th>No. of fables</th>
<th>C &gt; F</th>
<th>F &gt; C</th>
<th>F &gt; F</th>
<th>C &gt; C</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL</td>
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<td>87</td>
<td>3</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>NGT</td>
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<td>50</td>
<td>0</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>SSL</td>
<td>10</td>
<td>69</td>
<td>0</td>
<td>5</td>
<td>25</td>
</tr>
</tbody>
</table>

Direction of spreading: hypothesis

- In BSL, mouth actions spread from left to right
- In NGT, mouth actions spread from left-to-right and from content word to function word
- In SSL, mouth actions spread from content word to function word

This study: only 15 min. for two signers per language!

Hypothesis 2b: spreading is limited to the neighboring sign

<table>
<thead>
<tr>
<th>Language</th>
<th>No. of fables</th>
<th>1 sign</th>
<th>2 signs, 1 dir.</th>
<th>3 signs, 1 dir.</th>
<th>2 signs, both dir.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSL</td>
<td>100</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>NGT</td>
<td>56</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>SSL</td>
<td>91</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

Spreading across two signs

- one neighboring sign + PU
- fixed expression
- serial verb constructions (BSL, SSL)
- modal constructions (NGT, BSL)

Hypothesis 2c: source and target form a syntactic constituent

- Only looked at NGT data
- Typically, the two or three signs that are bound together by the spread-out mouth action do indeed form a syntactic phrase:

```
NP noun, det  BEAR IND, FRIEND PERSON
VP verb, object HELP IND 'I will help you'
verb, object  HELP IND 'help me!'
```
Hypothesis 2c: source and target form a syntactic constituent

• However… there are exceptions:

\[
\text{ander} \quad \text{hond} \quad \text{IND} \quad \text{OTHER DOG} \quad \text{IND}
\]

‘There is another dog over there’

Mouth as a prosodic domain marker?

• In spoken languages, strong prosodic boundaries block assimilation; assimilation between words can indicate weak prosodic boundary

Nespor & Vogel 1986

• For sign languages, it has been claimed that spreading of mouth action can mark prosodic domains

Boyce Brown 2003 on Swiss German SL, Sandler 1999 on the prosodic word in Israeli SL

Conclusions

• Both mouthings and mouth gestures can spread from their source sign to neighboring signs

• Direction:
  – BSL: always rightward
  – SSL: content > function word
  – NGT: rightward (with one exception)

Conclusions on spreading

• Size:
  – one neighbouring sign
  – sometimes two (or even three) signs on one side
  – sometimes in both directions (SSL, NGT)

• Quite some individual variation in the amount of spreading

Study 2

• Is some of the individual variation related to age or education?
• How specific are mouth behaviour for specific registers?


Research questions

1. Do deaf native signers of different ages and in different registers use other proportions of the five sub-types of mouth actions?

2. Are there differences in the frequency of occurrence of spreading of lexically bound mouth actions between registers or ages?

3. Over how many signs and in which direction do lexically bound mouth actions spread?
Signers

Six young early learners
- <40 jaar
- Started learning NGT from birth
- NGT used by at least the parents

Six older late learners
- >50 y
- Started learning NGT at a later age (av. 4.5 y)
- NGT not used by their parents

Both groups
- Born deaf
- First language is NGT
- Member of the Deaf community

NGT acquisition:
early late

Data

- Two signers recorded in dialogue setting
- Task: re-tell fable after seeing it told on video
  - Total of 1263 mouth actions
- Discussion about deaf issues and sign language in the Netherlands
  - Total of 1843 mouth actions

Hypotheses

Register difference
- Little studied
  - Most mouthing with objects, events, abstract concepts
  - Fewer mouthing with actions, expressive behaviour, and relations between objects
  → fables: fewer mouthing

Influence of age
- No clear differences in earlier research (but: small no. of subjects)
- General idea: use of mouthing dependent on the experience with oral education
  → late learners: more mouthing

Proportions of types of mouth actions
per register

<table>
<thead>
<tr>
<th></th>
<th>Fable</th>
<th>Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>45</td>
<td>76</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>9</td>
<td>4</td>
</tr>
<tr>
<td>W</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Unclear</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Invisible</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Proportions of types of mouth actions
per age group

<table>
<thead>
<tr>
<th></th>
<th>Young early learners</th>
<th>Old late learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>64</td>
<td>67</td>
</tr>
<tr>
<td>E</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>A</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>W</td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Unclear</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Invisible</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Hypotheses

Register difference
• Little studied
  – Most mouthings with objects, events, abstract concepts
  – Fewer mouthings with acronyms, expressive behaviour, and relations between objects
  → Fables: fewer mouthings

Influence of age
• No clear differences in earlier research (but: small no. of subjects)
• General idea: use of mouthings dependent on the experience of oral education
  → Late learners: more mouthings

‘Solo mouthings’

Mouthings without a manual sign
  → Schermer 1990: ± 5% of all tokens!

More by older late learners?

<table>
<thead>
<tr>
<th></th>
<th>Young early learners</th>
<th>Old late learners</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-solo among mouthings</td>
<td>7%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Number of solo mouthings as a proportion of the total number of mouthings

M-solo as code switching

• “Obama war ja way cool!” (insert English in German)
• M-solo: bimodal code switching
  speaking signing
• Alternate between speech and gesture
  Speech speech pantomime speech
  “I was like [pantomime: duh], you know.”

Conclusion on types of mouth actions

• We find more (solo) mouthings in discussions, and more whole face actions in fables
• Late learners use more solistic mouthings than early learners
• No other differences found between age groups
  – Perhaps difference in age of acquisition or age per se is too small to see a difference
  – Large inter-personal and intra-personal differences?

Example of intra-personal variation

Two fables of S016:

<table>
<thead>
<tr>
<th></th>
<th>W</th>
<th>2</th>
<th>A</th>
<th>P</th>
<th>E</th>
<th>T</th>
<th>cumulative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage</td>
<td>10.00</td>
<td>20.00</td>
<td>30.00</td>
<td>40.00</td>
<td>50.00</td>
<td>60.00</td>
<td></td>
</tr>
<tr>
<td>Type mouthings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(same token)</td>
</tr>
</tbody>
</table>

Conclusion on types of mouth actions

• We find more (solo) mouthings in discussions, and more whole face actions in fables
• Late learners use more solistic mouthings than early learners
• No other differences found between age groups
  – Perhaps difference in age of acquisition or age per se is too small to see a difference
  – Large inter-personal and intra-personal differences?
  – Or: no influence of age on types of mouth actions because they are all equally part of NGT production
Research questions

1. Do deaf native signers of different ages and in different registers use other proportions of the five sub-types of mouth actions?

2. Are there differences in the frequency of occurrence of spreading of lexically bound mouth actions between registers or ages?

3. Over how many signs and in which direction do lexically bound mouth actions spread?

Results: spreading

• Frequent occurrence of spreading over >50% of a neighbouring sign:
  — 12% of all mouthings (238/2043)
  — 13% of all mouth gestures (8/61)

• No differences between registers or age groups

• Direction: not only rightwards from the source
  — 85% rightwards
  — 8% leftwards
  — 7% in both directions

• Mostly over one neighbouring sign; 10% over two signs or more

Conclusion: spreading

• Spreading itself is quite frequent; no difference between ages or registers

• Contrary to the findings in Study 1, mouth activity also spreads leftwards and both ways in NGT

• Potentially a rich source of evidence for prosodic domains in NGT: may mark many small domains (prosodic words? phonological phrases?)

• But: we have not yet analysed the resulting domains yet. Would a mere articulatory explanation suffice?

Problems in investigating spreading

• Mouthings are often small and hypoarticated
  — Mouthing vs. other small non-speech movements

• We can only lipread 30% of our speech
  — Start/end can be hard to determine

• Interpretation of spreading over 1 or 2 frames

Influence of the number of syllables in a spoken word?
Influence of the type of syllable or final segment?

Research questions

1. Do deaf native signers of different ages and in different registers use other proportions of the five sub-types of mouth actions?
   → no, yes

2. Are there differences in the frequency of occurrence of spreading of lexically bound mouth actions between registers or ages?
   → no

3. Over how many signs and in which direction do lexically bound mouth actions spread?
   → mostly 1, not only rightwards

Overall conclusion

• Importance of looking at different registers

• Old news: it may be difficult to distinguish age groups in signed languages given the many factors correlating with age

• Corpus data can be useful in studying signed languages
Open questions

• Is there really no influence of the age of acquisition of sign language on the use of Dutch-derived mouth actions?
• Is there an influence of the age of acquisition of spoken language or the type of speech therapy/education?
• What is the nature of spreading of mouth actions (M, E) over other signs? To what extent do mouthings ‘mark’ prosodic domains? (Are they only a correlate of prosodic structure in not spreading across certain prosodic boundaries?)
• To what extent are mouthings an obligatory phonological component of certain lexical items? How frequent are they in more recent lexicons? (1990: 16%)

Afterthought: does sign-solo ever occur?

• Claim: some NGT signs have an identical manual part, they are only differenrated by mouthings (thus, these are an obligatory part of the lexical specification of these signs)
  Schermer (1990, 2001)
  *SIBLING
  BROTHER ‘broer’
  SISTER ‘zus’

→ Never really investigated!

First look

• Corpus NGT (April 2009): ± 40,000 signs of ± 30 different signers

<table>
<thead>
<tr>
<th>Sign</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROTHER</td>
<td>54</td>
</tr>
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<td>BROTHER</td>
<td>3</td>
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<tr>
<td>BROTHER</td>
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<tr>
<td>BROTHER</td>
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</tr>
<tr>
<td>SISTER</td>
<td>16</td>
</tr>
<tr>
<td>SISTER</td>
<td>1</td>
</tr>
</tbody>
</table>

→ Always some activity of the mouth; reduced forms may not point to more lexicalisation

Acknowledgments

Study 1
• Els van der Kooij
• Johanna Mesch
• Bencie Woll
• Dafydd Waters

Study 2
• Inge van de Sande

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(Some of the) References

• Ebbinghaus, H. & Heßmann, J. (2001). Sign language as multimodal and multilingual communication: Why manual signs, mouthings, and mouth gestures are three different things, In The hands are the head of the mouth. The mouth as articulator in sign languages, (Bryan, Brown & Sutton Spencer, eds.), 133–151. Hamburg: SignumVerlag.
• van der Kooij, E., van der Waters, D., Crasborn, O. (to be submitted) Lexically bound mouth actions in sign language of the Netherlands: a comparison between different registers and age groups. Linguistics in the Netherlands.

Thank you!