Lexical prediction during the processing of German Sign Language sentences.

The relevance of transition phases.

Jana Hosemann
The main point

- sentences in sign languages: lexical signs + transition phases
- transition phases are used to check predictions on the upcoming sign
Structure of talk

- Methodology: ERP
  - what do we measure?
  - how do we measure?

- ERP-study: Semantic prediction in DGS
  - design: whole sentences processing
  - results: the relevance of transition phases

- Conclusions
How do we come from brain activity to linguistics?
What do we measure?

- summed postsynaptic activity
- of parallel oriented pyramidal cells, perpendicular to the surface of the scalp
- activity of cell assemblies, not single cells
- difference in voltage between cortical layers
How do we measure?

Methodology: ERP

ongoing EEG

stimulus sentence

critical item

trigger

EVENT RELATED POTENTIALS

-3 μV

+3 μV

trigger

P200

P600

N400

ELAN
What can be interpreted?

- latency
- amplitude / polarity
- topography

Methodology: ERP
Potential pitfall – the inverse problem

Topography:
“Scalp recorded EEG does not allow any conclusions as to its underlying sources.”
(Schlesewsky 2010)
Potential pitfall – the inverse problem

Topography:

“Scalp recorded EEG does not allow any conclusions as to its underlying sources.”

(Schlesewsky 2010)
How do we interpret certain ERPs?

N400 – semantic expectation mismatch:

class: "I take coffee with cream and …"

expectation: “sugar”

expectation violation: “socks”

ERP:

Kutas & Hillyard (1980)
What do we look at?
Present ERP-study: Semantic prediction in DGS

Question: Lexical prediction via forward models?

Transition of sign phonological parameters:
- handshape
- hand orientation
- location
- (movement)
Present ERP-study: Semantic prediction in DGS

Question: Lexical prediction via forward models?

Transition of sign phonological parameters:

- handshape
- hand orientation
- location
- (movement)
Present ERP-study: Semantic prediction in DGS

Question: Lexical prediction via forward models?

1. Language processing
   - Input
   - bottom-up

2. Language processing
   - Input
   - top-down
Present ERP-study: Semantic prediction in DGS

Question:

- At what moment do we recognize an expectation mismatch?

Prediction:

- If language processing operates via forward modals (top-down), we expect to see expectation mismatches already within the transition phase.
Present ERP-study: Design

- 80 videos with DGS sentences, unmanipulated, (40/cond)
- 18 deaf native signers, right-handed
- expectation on sentence final verb
  - CORRECT: verb matches the expectation
  - INCORRECT: verb violates the expectation
Design: semantic expectation mismatch

expected

WOODS IX PATH RABBIT JUMP

‘A rabbit jumps across a path in the woods.’

unexpected

ZOO IX RHINO BREAD JUMP

‘A rhino jumps over bread in a zoo.’
Design: semantic expectation mismatch

**expected**

HOSPITAL IX MAN WAITING ROOM **SIT**

‘A man sits in a waiting room in a hospital.’

**unexpected**

JEWELRY STORE IX WOMAN **RING SIT**

‘A woman sits on a ring in a jewelry store.’
‘A rabbit jumps across a path in the woods.’

WOODS  INDEX  PATH  RABBIT  JUMP
previous sign

RABBIT
handshape change (hsc)
target handshape (ths)

Transition (JUMP)
sign onset (on)
movement
sign offset (off)
Present ERP-study

- **time**
  - **PATH**
  - **RABBIT**
  - **JUMP**
  - **RHINO**
  - **BREAD**

- **target handshape (ths)**
- **handshape change (hsc)**
- **sign onset (on)**
- **sign offset (off)**

Average distance in ms: 128, 185, 427 / 818
ERPs – non-action verbs... (SIT)

Handshape change

Target handshape

Sign onset

Legend:

zhf_korr (n=18)
zhf_mm (n=18)

hf_korr (n=18)
hf_mm (n=18)
ERPs – action verbs... (JUMP)

- **handshape change**
  - Neg
  - Pos

- **target handshape**
  - Neg
  - Pos

- **sign onset**
  - Neg
  - Pos

Legend:
- go_korr (n=18)
- go_mm (n=18)
- zhf_korr (n=18)
- zhf_mm (n=18)

Present ERP-study
non-action verbs – target hs
Present ERP-study

action verbs – hs change

Legend:
- HF_korr (n=18)
- HF_mm (n=18)

MILANGUAGE | May 27-29, 2015 | Hosemann 33
Summary and Conclusion

- Prediction mismatch in SL engenders an N400 effect.
- Prediction mismatch can be prior to the sign onset.
- Reason: due to (prediction on) properties of the transition phase.
  
➤ This argues for the use of forward-modals in language comprehension.
➤ Transition phases matter during sign language processing!
Thank you for your attention
And a big thank you to all participants and informants!!!