The function of nonmanuals in word order processing – Does nonmanual marking disambiguate potentially ambiguous argument structures?

Julia Krebs & Dietmar Roehm

Workshop „SignNonmanuals“ - University Klagenfurt
Subject preference

- Potentially ambiguous argument structures in spoken languages - First argument NP may be ambiguous with regard to its syntactic function

  Example from German (SOV):
  …dass Maria Sängerinnen folgt, obwohl…
  [...]that Maria_{NOM/ACC/DAT.SG} singers_{NOM/ACC/DAT.PL} follows_{SG.DAT}]
  ...that Maria follows singers although...

- How does the human processing system deal with these ambiguities?
  - Universal processing strategy: The first NP argument is preferential interpreted as the subject of the sentence
Subject preference

- Strategy of a subject-first interpretation is problematic with regard to the processing of OSV-sentences

  Example from German (OSV):
  …dass Maria Sängerinnen folgen, obwohl…
  [...that Maria_{NOM/ACC/DAT.SG} singers_{NOM/ACC/DAT.PL} follow_{PL.DAT}]  
  ...that singers follow Maria although...

- Reanalysis is reflected in:
  - longer reaction times
  - lower acceptability ratings
  - longer reading times
  - more regressions and longer fixations
  - different ERP-effects
Subject preference

• In typologically very different languages
• Robust effect:
  - Semantic properties of the first argument (e.g. animacy, definiteness) may facilitate the processing of OSV-sentences but do not avoid reanalysis
  - observed in sentences which become implausible due to the subject-initial reading (first NP is interpreted as the subject although the sentence is already implausible at the verb (Schlesewsky & Friederici 2003):

Die Blinde beobachtete die Ärztin.
*The blind woman watched the doctor.*

Are there similar potentially ambiguous argument structures in sign languages?

If yes, how does the processing system deal with these structures?

Is there a subject preference in sign languages?
Austrian Sign Language (ÖGS)

- Basic sign order in ÖGS: SOV (Skant et al. 2002)
- No obligatory subject position: in certain environments OSV-orders are possible (agreeing verbs, plain verbs and classifier constructions)
- EEG-study on word order processing in ÖGS – Is there a subject preference in ÖGS?

Materials & Design

- Object-initial vs. subject-initial structures involving different verb types which show different structural behaviour (agreeing verbs, plain verbs and structures with whole entity classifiers)

- 2x3 Design:
  3 verb types have been presented in 2 conditions (SOV- and OSV-order)
Person agreeing verbs

GRANDCHILD \textsubscript{IX} \textsubscript{3b} GRANDMOTHER \textsubscript{IX} \textsubscript{3a} \textsubscript{3b} VISIT \textsubscript{3a}

*The grandchild is visiting the grandmother.*

GRANDCHILD \textsubscript{IX} \textsubscript{3b} GRANDMOTHER \textsubscript{IX} \textsubscript{3a} \textsubscript{3a} VISIT \textsubscript{3b}

*The grandmother is visiting the grandchild.*

- Video 1
- Video 2
Agreement in plain verb condition: Person agreement marker (PAM) in ÖGS
Plain verbs – PAM1

DAUGHTER  IX₃b  MOTHER  IX₃a  3b PAM₁₃a  RESPECT

The daughter respects the mother.

DAUGHTER  IX₃b  MOTHER  IX₃a  3a PAM₁₃b  RESPECT

The mother respects the daughter.

• Video 1
• Video 2
Participants

- 17 deaf ÖGS-signers (10 female)
- Mean age: 39.8 (21-60 years)
- All participants acquired ÖGS at the age of about 4 years except one
- Live in the area of Salzburg
- Questionnaire (acceptability judgement)
Task & procedure

Acceptability judgement (by mouse click: Yes/No)
Trigger marking

- For data analysis of the EEG-signal it is necessary to determine „trigger markers“, time points which denote the „onset of the critical sign (agreeing verb/PAM)“
  - Necessary for statistical averaging

- Due to the fact that the time point of sign onset in a signed sentence is not clearly defineable: setting of different trigger points for each video
1) both arguments are referenced by index sign

2) The hand which yields the subject position starts to move

3) Eye gaze and/or head position moves towards the subject- or object position

4) The handshape of PAM/agreeing verb is formed

5) The path movement of PAM/agreeing verb towards the object begins

6) The path movement PAM/agreeing towards the object is clearly identifiable
# Results: Behavioral data

<table>
<thead>
<tr>
<th>Condition</th>
<th>Mean acceptability rating</th>
<th>Mean reaction time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% (sd)</td>
<td>ms (sd)</td>
</tr>
<tr>
<td><strong>Agreeing verbs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO</td>
<td>80.01 (26.81)</td>
<td>934.27 (331.06)</td>
</tr>
<tr>
<td>OS</td>
<td>59.76 (21.33)</td>
<td>1101.43 (404.68)</td>
</tr>
<tr>
<td><strong>Plain verbs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SO</td>
<td>76.21 (24.37)</td>
<td>932.96 (323.42)</td>
</tr>
<tr>
<td>OS</td>
<td>60.10 (19.83)</td>
<td>1056.02 (346.14)</td>
</tr>
</tbody>
</table>
ERP-Results: plain verbs
Trigger 2
ERP-Results: person agreeing verbs
Trigger 1
Results

• Effect for OSV compared to SOV - different processing pattern

• Negativity-Positivity ERP-pattern

• Effects occurred in a very early time-window compared to effects observed for spoken languages (before the manual verb)
Early effects?

- One possible explanation for early disambiguation: specific nonmanual markers before the manual verb give information about the argument structure.
- Visual inspection did not reveal one systematic nonmanual which may indicate the argument structure before the manual verb has been established.
- But: it seems that a set of nonmanuals can be used to mark transitive events (e.g. body shift, eye-gaze, head tilt).
  - Second argument and/or its corresponding index sign were accompanied by body shift towards the subject position, and there is a tendency that eye-gaze is directed towards the object which appears sometimes before the handshape of the verb-sign is fully established.
Body shift towards the subject-position

SOV-order

OSV-order

Time point when both arguments have been referenced in signing space by index sign
Early effects – an alternative explanation

- Effects do not result from the disambiguation of an ambiguous argument structure, but rather result from the processing of a marked/dispreferred structure (and thus there is no local ambiguity involved in signed structures).

- If this is the case we would expect an effect already at the first argument NP. Is the first NP ambiguous with regard to an S or O interpretation?

  - No ERP-effect on the first argument, no effect on the IX which refers to the first argument and no effect on the second argument.

  - Visual inspection did not reveal any specific nonmanual marking.
Conclusion

- The first argument in our video material is indeed ambiguous (although there may be strategies to unambiguously mark the syntactic function of the first argument)
- Nonmanual markers may enable early disambiguation of potentially ambiguous argument structures (before manual verb)
- Deaf ÖGS signers use the „ambiguity-resolution“ strategy during word order processing