Towards multidimensional data and a mixed method approach in the research on constructed action in FinSL

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What is there in the world?


Emergent materialism

• World 1: Physical objects and activities
• World 2: Mental objects and actions (e.g. feelings, concepts)
• World 3: Socially shared products of World 2 (e.g. a unicorn)
Language in the three Worlds

Physical activity of individuals (observations and motor interactions with the environment) (W1)

Entrenched and conceptualized actions at the individual level (W2)

Social conventions which emerge from individual behaviors and conceptualizations (W3)
Linguistic utterances in the three Worlds

Conventionality → Unconventionality

Description

W3/W2

Indication

W2/W1

Depiction

Discreteness → Gradience

- Conventional and discrete language use
- Emphasis on description and indication on utterance level

- Unconventional and gradient language use
- Emphasis on depiction and indication on utterance level
**Constructed action (CA) and its degrees**

- **In constructed action**, the signers use their hands, face and other parts of the body to represent the actions, thoughts, feelings or sayings of someone they are referring to in the discourse. Constructed action has subtypes forming an articulatory continuum:

  **Overt**
  - All/many articulators,
  - Full character perspective

  **Reduced**
  - Many articulators,
  - Partial character perspective

  **Subtle**
  - Few articulators,
  - Partial character perspective

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Corpus project of Finland’s Sign Languages
Open access research infrastructure and documentation of FinSL and FinSSL

Video recordings at JyU’s television studio 2013–2017
- 6 camera angles, Full HD quality
- 104 signers
- Each signer participates in 6–7 linguistic tasks
- Edited video material altogether 80 hours x 6 cameras

Annotation in ELAN
- Signs and translations (approximately 20% finished)
- Lemmatization with the help of Finnish Signbank
- Annotations for research purposes (clause, CA, etc.)

Archiving and publication
- Goal is to archive the material in FIN-CLARIN’s Language Bank of Finland (Kielipankki)
- 15 hours of FinSL material published in May 2019

Study 1: The interplay of constructed action and the clause

Sample: The *Frog, where are you?*, 5 signers, 1473 sign tokens, 537 structurally annotated clauses, 198 tokens of CA

<table>
<thead>
<tr>
<th>Clauses with no CA</th>
<th>Clauses with strong non-referential CA</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Preference for lexical predicates</td>
<td>• Preference for depictive or non-lexical predicates</td>
</tr>
<tr>
<td>• Overt core arguments</td>
<td>• Omission of core arguments</td>
</tr>
<tr>
<td>• Relatively fixed constituent order</td>
<td>• Associative constituent order</td>
</tr>
<tr>
<td>• Also hierarchical relations between clauses</td>
<td>• Only linear relations between clauses</td>
</tr>
</tbody>
</table>

Study 2: Variation of constructed action on discourse level

Sample: The Frog, where are you? and conversations about Deaf events, the same 5 signers in both discourse types
Computer-vision processing of Corpus FinSL data

Point of departure
- Face recognition
- Detection of skin color areas
- Identification of skin color areas
- Frame-by-frame tracking of the 2D location (i.e. movement) of different skin color areas

Example: tracking head movements
- Identification of the eyes and their angles
- Trigonometric calculation of the head angle
- Three dimensions:
  - yaw (turn)
  - pitch (nod)
  - roll (tilt)


Study 3: Head movements in regular narration and strong constructed action

Sample: The *Frog, where are you?*, 5 signers, 1473 sign tokens, 537 structurally annotated clauses, 198 tokens of CA

**Fig. 1.** Head movements tend to align with clause boundaries in regular discourse

**Fig. 2.** Head movements tend to align with discourse chunks in strong constructed action


Snowfrog data @ FIN-CLARIN's Language Bank of Finland (Kielipankki)

What's included?
- Part of the 2013 recorded Corpus FinSL data
- Signing from 6 signers (ca. 20 minutes)
- Computer-vision data on head movements and facial expressions
- Annotations for signs, translations, clauses and nonmanual activity

What's missing?
- Detailed annotations for syntactic & semantic structure
- Annotations for constructed action & dialogue

How to access?
- Publically available, licensed with Creative Commons 4.0 BY-NC-SA.
- Access via kielipankki.fi
- Google: snowfrog

Video, motion capture and eyetracking data

Overview
- 6 native FinSL signers (3 female), age between 30–60 years
- Altogether 33 stories signed on the basis of textless comic strips

Video data (Fig. 1)
- One Full HD video camera
- Recording speed 30 fps (Motion JPEG Open DML, avi)
- Total duration of video data approximately 21 minutes

Motion capture data (MoCap; Fig. 2)
- Optical Qualisys Oqus motion capture system
- 8 ceiling-mounted infrared cameras, recording speed 120 Hz
- Tracking the xyz-location of 25 reflective markers
- Total size of the MoCap data over billion characters

Eyetracking data (ET; Fig. 3)
- Head-mounted Ergoneers Dikablis eyetracking system
- Two video cameras, recording speed 50 fps
- Tracking the behavior of the left pupil and gaze direction
- Total size of the ET data approximately 6 million characters
All data synchronized, annotated and visualized in ELAN
**Study 4: What is the eye behavior like at the beginning of constructed action?**

**Sample:** 5 signers, 25 stories, 5 billion characters of ET data, 13 minutes and 32 seconds, all CA tokens in the stories (n=274)

<table>
<thead>
<tr>
<th>Numerical ET data*</th>
<th>Overt (n=105)</th>
<th>Reduc. (n=109)</th>
<th>Subtle (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye gaze shift at the beginning of CA</td>
<td>81%</td>
<td>72%</td>
<td>58%</td>
</tr>
<tr>
<td>Eyes closing before CA</td>
<td>61%</td>
<td>50%</td>
<td>30%</td>
</tr>
<tr>
<td>Saccade before CA</td>
<td>19%</td>
<td>28%</td>
<td>42%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annotation cell values</th>
<th>CA involves enacting eye gaze</th>
<th>Overt (n=105)</th>
<th>Reduc. (n=109)</th>
<th>Subtle (n=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100%</td>
<td>94%</td>
<td>50%</td>
<td></td>
</tr>
</tbody>
</table>

* The analysis window of numerical ET data is +/- 3 video frames counted from the beginning of the CA-type annotation cell.

Study 5: What is the activity of the body and the head like in regular narration and CA?

**Sample:** 5 signers, 15 stories, 500 billion characters of MoCap data, 10 minutes 45 seconds, 137 dur. commensurable tokens

Study 6: What is the temporal order in which the dominant hand, the head, the upper torso and the eyes begin overt constructed action?

Sample: 2 signers, 4 stories, synchronized MoCap and ET data, 10 tokens of overt CA which are preceded by a stretch of regular narration

Results

- The articulations of the head and the eye movements begin first.
- The movements of the upper torso and the dominant hand (stroke) follow the movements of the head and the eyes in that order.


Conclusion: What the multidimensional data and a mixed method approach reveal about FinSL?

**Conventionality**
- Description and indication
- No constructed action
- Lexical predicates and indicating
- All core arguments overt
- Fixed constituent order
- Also hierarchical relations between clauses
- Nonmanuality contributes to clausal cohesion
- Head and torso have small movement amplitude
- Head and torso movements are slow

**Unconventionality**
- Depiction and indication
- Strong constructed action
- Depictive or non-lexical predicates
- Core arguments omitted
- Associative constituent order
- Only linear relations between clauses
- Nonmanuality contributes to discourse cohesion
- Head and torso have large movement amplitude
- Head and torso movements are fast

**Discreteness**

**Gradience**
Thank you!

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