M2L2 Accent: ASL Phonological Development in M2L2 Learners

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Roadmap for this talk

01. Background on M2L2 (hearing L2 signer) Phonological Accuracy

02. Coding sign accuracy at Parameter vs Feature level

03. Results from ASL-Phonological Elicitation Task (ASL-PET)

04. Practical applications of findings to sign language teaching
Clarifying some key terminology

**Phonologically complex signs**
Signs that involve simultaneous or sequential movements and/or changes in hand configuration.

**Parameter-level vs. Feature-level coding**
Defining errors according to entire parameters (e.g. wrong handshape) vs. individual aspects of parameters (e.g. wrong thumb position).

**Iconicity**
Subjective judgment (from 1-7) by hearing participants on "how much a sign looks like its meaning."
Background

M2L2 phonology in the lab

● More errors for complex signs, and for movement and handspe (location produced most accurately) (e.g. ASL: Chen Pichler 2011; BSL: Ortega & Morgan 2015; NGT: Jissink 2005).

● Poor visual discrimination of signed forms, especially movement (ASL: Bochner et al., 2011; Williams & Newman, 2016).

● Highly iconic signs are reproduced less accurately (BSL: Ortega & Morgan, 2015).
Background

M2L2 phonology in the classroom

● Beginner M2L2 students produce the most errors in handshape and movement (Auslan: Willoughby et al. 2015).

● Handshape and movement errors also elicited the most instructor corrections (ASL: Gil & Collins 2022).

● Accuracy improves with instruction, but movement errors are persistent (ASL: Schlehofer & Tyler 2016).
Research Questions

1. What aspects of signs are most error-prone for M2L2 signers?

2. How is M2L2 phonological accuracy affected by phonological complexity, iconicity and ASL level?

3. How does a feature-based coding system compare with parameter-based coding system for identifying M2L2 phonological errors?
Methodology: Task & Participants

ASL Phonological Elicitation Task (ASL-PET) (Gu et al., 2022)

- Videos of 12 ASL signs varying in complexity and iconicity (ASL-LEX)
- "...copy her sign as accurately as you can."
- Separate familiarity & iconicity ranking task

Remote testing (Zoom) of 31 M2L2 learners from hearing universities on the East coast of the US

- ASL 1 (n=6)
- ASL 2 (n=17)
- ASL 3 (n=6)
- ASL 4 (n=2)
Methodology: Coding & Analysis

- Each sign coded for accuracy on features (cf. next slide)
- Two trained coders for each video; intensive discussion to resolve all discrepancies
- Strict adherence to features of model, even if somewhat unusual

HOME: Location error in Height/Side for second point of contact
Sign accuracy at 3 levels

Figure 1: Schematic representation of a sign (based on van der Hulst (1996); Brentari (1998); van der Kooij (2002) with some structural relations omitted)
Results: Errors by Parameter
Results: Errors by Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Semester 1 &amp; 2</th>
<th>Semester 3 &amp; 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>100</td>
<td>90</td>
</tr>
<tr>
<td>Handshape</td>
<td>95</td>
<td>85</td>
</tr>
<tr>
<td>Orientation</td>
<td>92</td>
<td>82</td>
</tr>
<tr>
<td>Movement</td>
<td>98</td>
<td>93</td>
</tr>
<tr>
<td>Joint activation</td>
<td>96</td>
<td>90</td>
</tr>
<tr>
<td>Parameter</td>
<td>Feature</td>
<td>Average accuracy (N=31)</td>
</tr>
<tr>
<td>---------------------------</td>
<td>----------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td><strong>Handshape</strong></td>
<td>H1 finger selection</td>
<td>99.2%</td>
</tr>
<tr>
<td>(avg accuracy=83.3%)</td>
<td>H1 joint position</td>
<td>84.4%</td>
</tr>
<tr>
<td></td>
<td>H1 thumb</td>
<td>74.7%</td>
</tr>
<tr>
<td></td>
<td>H2 handshape (incl thumb)</td>
<td>70.6%</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>H1 height/side</td>
<td>64.8%</td>
</tr>
<tr>
<td>(avg accuracy=78.7%)</td>
<td>H1 body/hand contact</td>
<td>98.4%</td>
</tr>
<tr>
<td></td>
<td>H2 location</td>
<td>79.8%</td>
</tr>
<tr>
<td><strong>Joint activation</strong></td>
<td>H1 joint activation</td>
<td>90.9%</td>
</tr>
<tr>
<td>(avg accuracy=88.4%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Handshape errors involving thumb

Thumb: error in abduction/adduction (BOOK)
(Also location error in sign height)

Thumb: error in opposition (SON)
Location errors of height/side

Location: error in height or side that results in hands overlapping (ROOM)
Joint activation errors on H2

ROOM: Omission of final bouncing movement (missing activation of shoulders)
Effects of iconicity, complexity and ASL level

Phon. complexity x Accuracy: Negative correlation
ASL level x Accuracy: Positive correlation
Sign iconicity x Accuracy: No correlation
What aspects of signs are most error-prone for M2L2 signers?

Height/side of signs and thumb position.
How is the M2L2 accuracy affected by phonological complexity, iconicity and ASL level?

Phonologically complex signs show more errors.
Location and Joint Activation accuracy improve with ASL level (but not Thumb); other features already accurate at beginner levels.
No correlation with sign iconicity rating (from ASL-LEX).
How does a feature-based coding system compare with parameter-based coding system for identifying M2L2 phonological errors?

Feature-based analysis reveals useful details that refine our understanding of phonological development.

E.g. previous findings of elevated ‘handshape errors’ may be largely due to thumb, elevated 'movement errors' may be due to joint activation.
Future directions/refinements

Expanded Joint position

Applied only to hand joints, but extending to all joints would capture elbows either raised or tucked in too tightly (cf. Chen Pichler et al. 2016).
Remote data collection via Zoom worked surprisingly well. However:

- Limitation of a single camera with low-quality video, exacerbated by variable lighting conditions, made coding of joint activation very difficult.
- Angle of participant's camera sometimes too low; made sign height difficulty to judge and may have impacted sign production.
THANKS!

We gratefully acknowledge the participants in this study; Mary Cecilia Conte for coding work; the organizers, interpreters and audience of TISLR14.

Research reported in this publication was supported by the National Institute on Deafness and Other Communication Disorders of the National Institutes of Health under Award Number R01DC016901. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.
SELECTED REFERENCES

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- Chen Pichler (2011). Sources of handshape error in first-time signers of ASL. In Deaf around the world: The impact of language, 96-121.
Extra slides for Q&A
Joint activation errors on H2

ROOM: Omission of bouncing movement (missing activation of shoulders)
Finding: accuracy and ASL-learning experience

- Three levels of accuracy:
  - Overall
  - Sub-lexical (parameter): location, handshape, movement, orientation, and activation of joints
  - Featural:

- No significant difference in any levels of accuracy by ASL semester years (1 vs. 2, or 3 vs. 4)
Feature-based scoring

<table>
<thead>
<tr>
<th></th>
<th>Handshape</th>
<th>Location</th>
<th>Movement</th>
<th>Orientation</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>finger selection, thumb, joint position</td>
<td>height/side</td>
<td>direction, repetition</td>
<td>orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>body/hand contact</td>
<td>shape, alternation</td>
<td></td>
</tr>
<tr>
<td>H2</td>
<td>handshape</td>
<td>location</td>
<td>movement</td>
<td>orientation</td>
</tr>
</tbody>
</table>

Table 1 Properties coded in feature-based scoring

- Signs categorized by number of hands, body/hand contact, alternation, and special shape in path movement (e.g., circular, arc, zigzag), marked in gray
- Due to asymmetry between H1 and H2 (Battison, 1978; van der Hulst, 1996; Brentari, 1998), each H1 property contributes 1 point, while corresponding H2 properties are collapsed and scored by parameter, each contributing 1 point
- Joints of activation on H1 and H2 each contributes 1 point
- Accuracy score (range: 0) = number of the properties repeated correctly / number of all properties involved in a sign
Discussion: What features improve as students take more ASL classes?

<table>
<thead>
<tr>
<th>Significant improvement</th>
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</thead>
<tbody>
<tr>
<td><strong>Strong hand Location:</strong></td>
</tr>
<tr>
<td>- Height/Side, Body/Hand Contact</td>
</tr>
<tr>
<td><strong>Strong hand Handshape:</strong></td>
</tr>
<tr>
<td>- Finger Selection</td>
</tr>
<tr>
<td><strong>Strong hand Orientation</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(Marginal improvement)</td>
</tr>
<tr>
<td><strong>Weak hand location</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strong hand Movement:</strong></td>
</tr>
<tr>
<td>- Shape, Direction, Repetition</td>
</tr>
<tr>
<td><strong>Strong hand Handshape:</strong></td>
</tr>
<tr>
<td>- Thumb, Joint Position</td>
</tr>
<tr>
<td><strong>Weak hand:</strong></td>
</tr>
<tr>
<td>- Movement, Handshape, Orientation</td>
</tr>
</tbody>
</table>