Coarticulation in ASL Fingerspelling

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Background

There has been much work on coarticulation in speech, however fingerspelling has been explored less (Hoopes, 1998; Tyrone et al. 1999; Jerde et al. 2003).

Using a new data set of ASL fingerspelling, we have annotated pinky extension as a first step to look for coarticulation on a larger scale.

This study contributes to:

› sign phonology generally (handshape contrasts)
› articulatory theories of language production
› segmentation in language generally

Questions

1. Does the extension of the pinky finger spread to neighboring apogees?
3. Do all handshapes with an extended pinky condition coarticulation equally?

Method

Apogee Identification

1. We recorded nearly 3 hours of 2 native ASL signers fingerspelling a total of 2,400 words and 7,317 apogees.
2. We coded the video by identifying the apogee of each letter that was fingerspelled. We defined apogee as the time when the velocity of the articulators approached zero. This usually corresponded with the most canonical handshape and provides us with a point to analyze variation in handshape between apogees.
3. We extracted still images, then hand coded pinky extension for each of these apogees.

Results

Apogees that we expect to have pinky extension (-b-, -f-, -t-, -s-, -y-, and sometimes -c-) by and large do. In the apogees that we don't expect to have pinky extension we see a surprising 295 apogees have pinky extension, which is nearly 5% of all apogees in this set.

<table>
<thead>
<tr>
<th>pinky extension</th>
<th>expected</th>
<th>unexpected</th>
</tr>
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<tbody>
<tr>
<td>pinky extension</td>
<td>49</td>
<td>5870</td>
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</table>

table 1: Counts for pinky extension: note that there are a large number of apogees with unexpected pinky extension.

Coarticulation involving the pinky, involves pinky extension being anticipated and preserved in surrounding apogees, rather than pinky extension being suppressed.

Discussion

Neighboring apogees that are -t-, -s-, and -y- condition pinky extension much more than -b-, -c-, and -f-, despite the fact that both groups of handshapes canonically have an extended pinky. The only systematic difference is that in -t-, -s-, and -y- the pinky is extended without other fingers, whereas in -b-, -c-, and -f- other fingers are also extended.

There are three extensors involved in fingerspelling (excluding thumb extension) (Greftegreff, 1993; Ann, 1993):

1. extensor indicis proprius (for the index finger)
2. extensor digiti minimi (for the pinky finger)
3. extensor digitorum communis (for all of the fingers)

When extended with other fingers there are two extensors acting on the pinky, but extended alone there is only a single one. This results in slower, less controlled pinky extension when only the pinky is extended.

References


Figure 2: plots showing the effect of neighboring apogees on pinky extension

› In the handshapes where we expect extension (-b-, -c-, -s-, -f-, -t-, -y-, and -v-) nearly all apogees have pinky extension.

› In other letters (particularly -e-, -g-, -h-, -k-, -q-, -r-, -u-, -v-, -y-, and -z-) a neighboring -t-, -s-, or -y- greatly increases the probability of pinky extension.

› The lines represent model predictions.