# Hand Choice Lateralization as Phonologization of Sign Language Pronouns

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## Background

### Sign Language Pronouns

There is an on-going debate about the nature of pronouns in signed languages, with several competing schools of thought:

- Sign languages have lexical pronouns (Petitto 1987, Sandler & Lillo-Martin 2006)
- Sign languages use pointing rather than pronouns (Friedman 1975, Evans & Levinson 2009)
- Sign language pronouns share qualities with both pointing and spoken language pronouns (Cormier et al. 2013)

However, most scholars agree that pronouns in signed languages share a phonological form with pointing gestures. This study offers evidence of a measurable difference in production between pronouns and pointing, which suggests that sign languages treat pronouns and pointing differently.

### Lateralization

Linguistic behavior is strongly associated with lateralization, or preference for one side of the body—usually the dominant side. This is especially true for signed languages, which surfaces in a number of ways:

- Hand preference during signing is more lateralized than during manual tasks or gesture (Bonvillian and Richards 1993)
- The non-dominant hand in signing is phonologically restricted (Battison 1978, Brentari 1998)
- Use of the non-dominant hand is cross-linguistically marked (Tatman 2014)

Non-linguistic gestures, on the other hand, are generally less lateralized. Pointing, especially, is influenced by other factors, such as proximity (Leconte and Fagard 2006, Gardinier et al., 2006) or cultural taboos (Kita & Essegbey 2001).

### Hypothesis

Previous work shows that gestures and signs differ in their degree of lateralization. We can use this to determine whether sign language pronouns pattern with pointing gestures.

H0: Hand choice lateralization is the same for pronouns and other pointing gestures.

H1: Pronouns are more lateralized than pointing gestures.

## Methods for NGT

### Data

Hand choice data for the Sign Language of the Netherlands (NGT) was taken from the Corpus-NGT (Crasborn & Zwitserlood 2008). Elan annotation files from the corpus are publicly available on-line (http://www.ru.nl/corpusngten/).

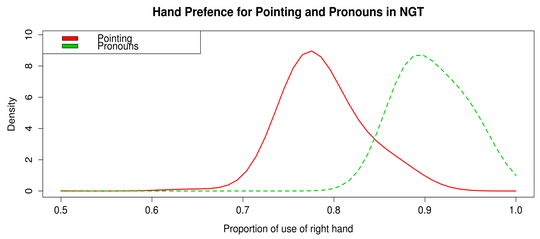
### Analysis

- Annotations were extracted from the Elan files using the pympi Python module (Lubber 2014)
- Other analysis done in R (R core team 2013)
- Any file in which more signs were made with the left than right hand was excluded to avoid including left-handed signers
- For each remaining file, the proportion of use of the right hand for both points (pt) and 1st person pronouns (pt1) was computed using:

  Number produced with right hand / total produced

- Over 2.2 million tokens included

## Results for NGT




Density curves of proportion of use of the right hand. Produced using the sm.density.compare function from the sm package (Bowman & Azzalini 2014).

While there was an overall preference for the dominant hand, it was stronger for pronouns than pointing, $X^2$ (1, N = 2,234,915) = 47,780, p < .001.

### Possible Confounds

- The Corpus-NGT only contains information on 1st person pronouns. 3rd person pronouns may also behave differently.
- Video data is not yet available, so it was not possible to visually verify the findings (and the size of the data set would render that impractical).
- Lateralization of pronouns may be a language-specific effect.

## Methods for ASL

### Data

American Sign Language (ASL) data was taken from the National Center for Sign Language and Gesture Resources (NCSLGR) Corpus (Neidle & Vogler 2012). Annotations and video files are available for use and download from http://www.bu.edu/asllrp/ and http://secrets.rutgers.edu/dai/queryPages/.

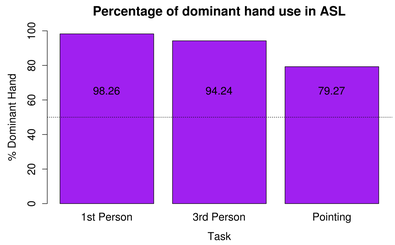
### Analysis

- Counts of locational indexing (IX-Loc), third person pronouns (IX-3p) and 1st person pronouns (IX-1p) produced with both the dominant and non-dominant hand extracted from web interface.
- Proportion of use of dominant hand calculated using:

  Number produced with right hand / total produced

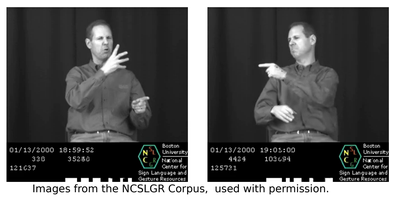
- Tokens also examined visually
- Statistical analysis in R (R core team 2013)
- 1420 tokens included

## Results for ASL




As in NGT, there was an overall preference for the dominant hand, but it interacted with the type of sign:

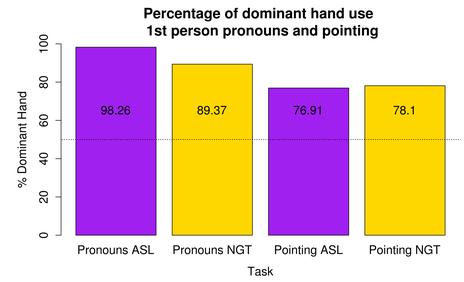
- 1st person pronouns showed a greater preference for the dominant hand than pointing, $X^2$ (1, N=934) = 103.86, p < 0.001
- 3rd person pronouns were also more lateralized than pointing, $X^2$ (1, N=732) = 38.02, p < 0.001
- 1st person pronouns *were* more lateralized than third-person pronouns $X^2$ (1, N=1174) = 12.771, p < 0.001



Images from the NCSLGR Corpus, used with permission.

Examples of pointing with the non-dominant hand during signing. On the left, the dominant hand is concurrently producing the one-handed sign MOTHER.

## Conclusion




For both ASL and NGT, pronouns are more lateralized than pointing signs.

- Pronoun production is reliably different from pointing (though it is gradient rather than categorical)
- Given the body of work tying linguistic behavior to lateralization, this suggests that pronouns are "more language-y" than pointing
- The differences between the 1st and 3rd person pronouns, however, suggest additional complexity

Future work:

- Expanding study to other, unrelated languages; NGT and ASL are genetically related, though French Sign Language (LSF)
- Investigating the difference between 1st and 3rd person pronouns
- Experimental verification of corpus results (behavioral or brain imaging studies)

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