From seed to system:

Non-manual markers for wh-questions in Nicaraguan Sign Language

Kat Marton '22 Data Science Major Capstone, with the Laboratory for Language and Cognitive Development

WELLESLEY

Research Question

Do the non-manual markers that accompany wh-questions in Nicaraguan Sign Language originate from the hearing community in Nicaragua? In this project, we analyzed the **frequency, duration** of non-manual markers, and the **coarticulation** with wh-questions.

Background

Nicaraguan Sign Language (LSN) is a young language conceived when a deaf education center was established in Managua in 1977. The grammar and syntax of LSN developed with each generation (cohort) of deaf children. In particular, this study looks at the development of non-manual markers that accompany wh-questions. We studied the following non-manual markers:

- Head tilt
- Shoulder raise
- Nose wrinkle
- Brow raise
- Brow furrow
- Chin lift

Non-manuals are commonly markers for wh-questions across the world's sign languages, especially the brow furrow.[1] This leads to the theory that these markers are adopted from facial expressions commonly used with speech from the surrounding hearing communities.[2]

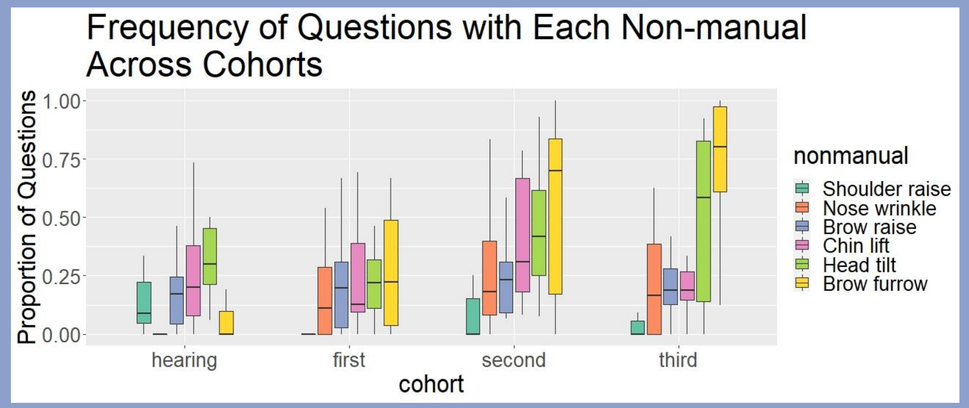
Collecting the Data

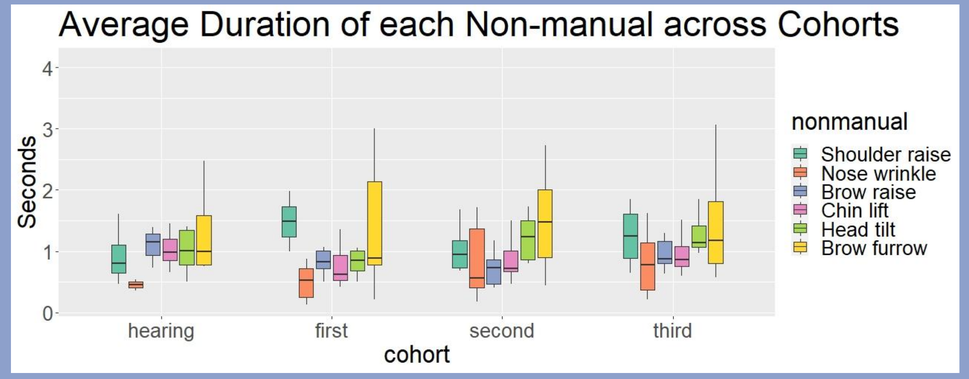
50 participants were sampled by convenience over the years 2008-2017 in Managua, Nicaragua, categorized as follows:

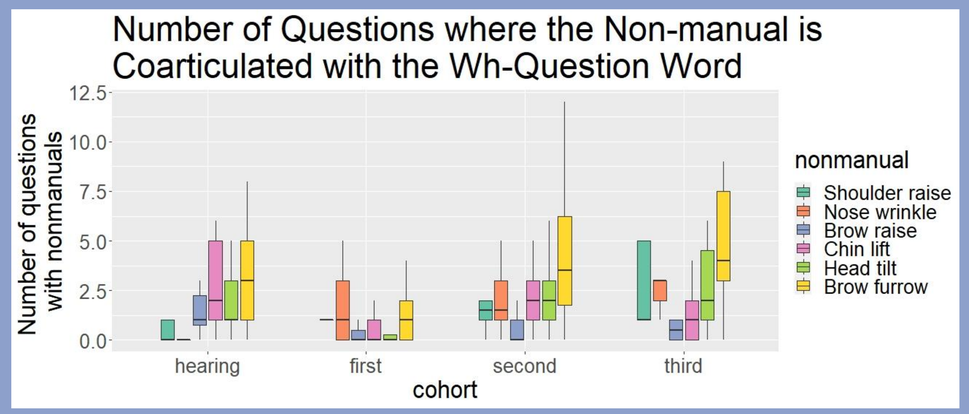
- 34 deaf participants:
  - 10 first cohort
  - 13 second cohort
  - 11 third cohort
- 16 hearing participants

An experimenter prompted the participants to ask questions to a third party by giving question item topics but not directly indicating the question words of interest. For instance, the experimenter would hold up a card with the word "birthday" or "number of siblings", which would prompt the participant to ask the third party a question relating to this topic, without giving the participant the exact wording of the question.

The participant was video recorded and the videos were later tagged and coded using ELAN 6.2[3] and exported into R for analyses.







Models and Analysis

We explored three different variables - frequency, duration and coarticulation, using mixed effects linear or logistic regression. Analyses were performed in R using the lme4 package.

In the frequency analysis, we found that the second and third cohorts produced significantly more total non-manuals ($p=0.002$ and $p<0.001$) though the first cohort signers were statistically similar. We created six additional models for each non-manual type. We found the following:

- Brow raise, chin lift, shoulder raise either decreased or had no significant change
- Nose wrinkle showed significant increase ($p=0.004$ in first, $p=0.001$ in second and $p=0.011$ third cohort)
- Brow furrow had most significant increase ($p<0.001$ in second and third cohort)
- Head tilt was most common among hearing participants, and remained common in second and third cohorts though the effect was not significant.

We did not find any significant effects in our analyses involving duration or coarticulation, though in a simple effects analysis of cohort and non-manual type on duration we did observe interaction effects that supported the findings with the brow furrow and the head tilt in the frequency analysis.

Discussion and Conclusion

We found that although the head tilt and brow furrow were the most frequent markers in the later cohorts, the brow furrow was not the most frequent among hearing participants, suggesting that frequency is not a driving force in the selection of non-manual grammatical markers in LSN. Though we found that neither duration nor coarticulation of non-manuals was strongly correlated with the most salient non-manuals in LSN, we did find that they were indicators of them. Other possible explanations for the prominence of the head tilt and the brow furrow could be their universality, or adoption from other sign languages though this is unlikely as contact was minimal. A future study could look deeper into the transition of non-manual markers. We observed the greatest change in frequency between the first and second cohorts, as the next group of children adopted LSN. This transition calls for deeper analysis in other aspects besides non-manual markers.

This poster was created based off of a project done in the Laboratory for Language and Cognitive Development, run by Professor Jennie Pyers in the Psychology department at Wellesley College. Collaborators include Kristianny Ruelas-Vargas, Sophia Fioretti, and Audrey Lin.

References

1. Benitez-Quiroz, C. F., Gökgöz, K., Wilbur, R. B., & Martinez, A. M. (2014). Discriminant features and temporal structure of non-manuals in American Sign Language. *PloS one*, *9*(2), e86268.
2. Benitez-Quiroz, C. F., Wilbur, R. B., & Martinez, A. M. (2016). The not face: A grammaticalization of facial expressions of emotion. Cognition, 150, 77-84.
3. ELAN (Version 6.2) [Computer software]. (2021). Nijmegen: Max Planck Institute for Psycholinguistics, The Language Archive. Retrieved from https://archive.mpi.nl/tla/elan