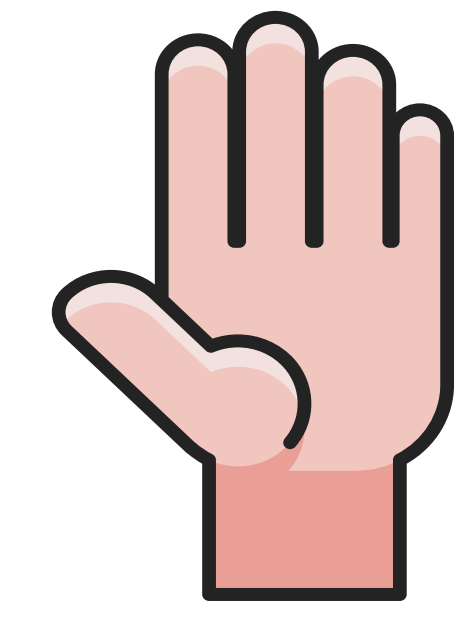# From seed to system:

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

Presentation by Kat Marton based on a project done in the Laboratory for Language and Cognitive Development.
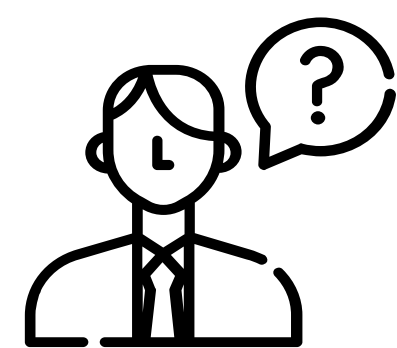
## Research Question

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 and duration of non-manual markers as well as their coarticulation with wh-questions.

## Background

Nicaraguan Sign Language (NSL) is a young language conceived in the 1970s with the creation of a deaf school in Nicaragua. The grammar of NSL developed with each 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
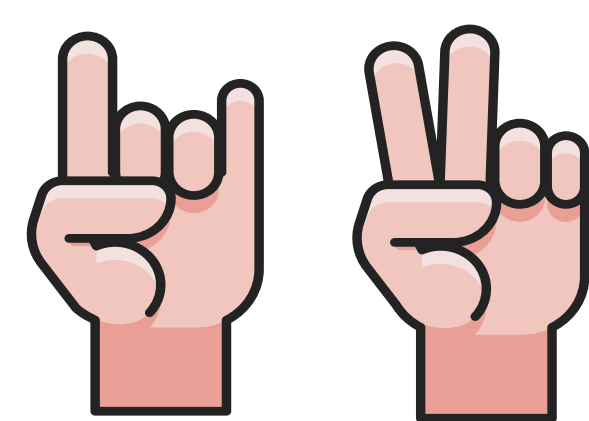- Nose wrinkle
- Brow raise
- Brow furrow
- Chin lift

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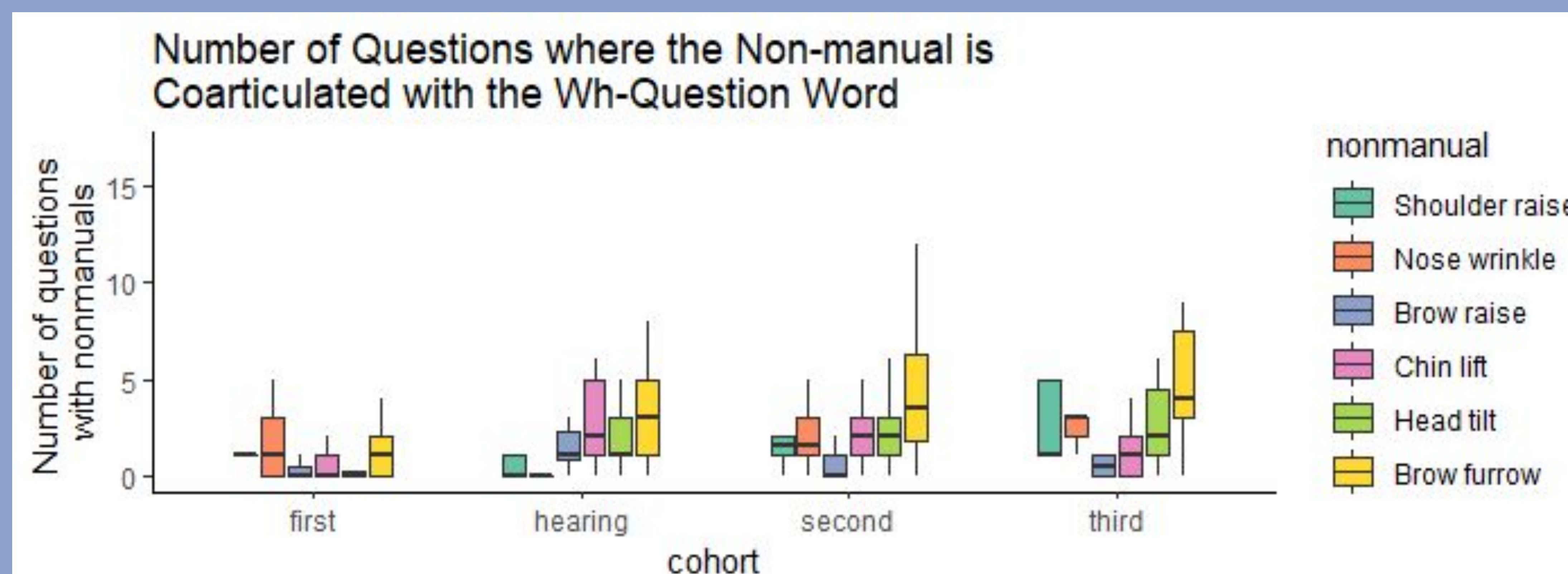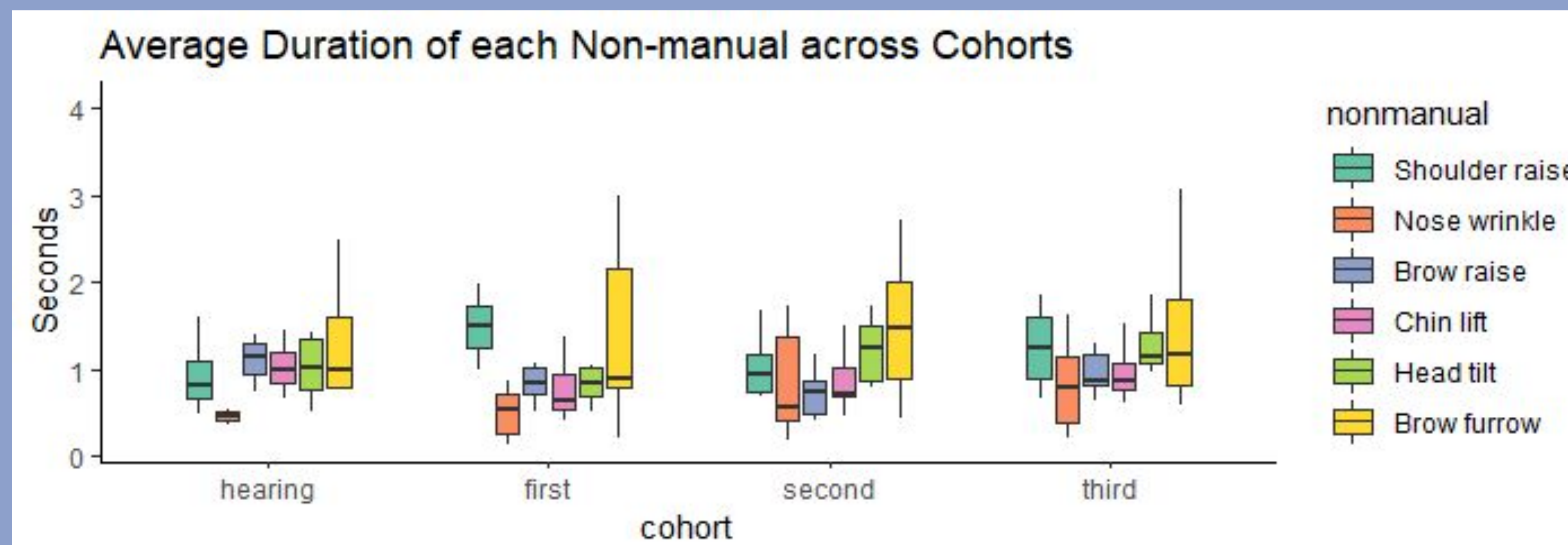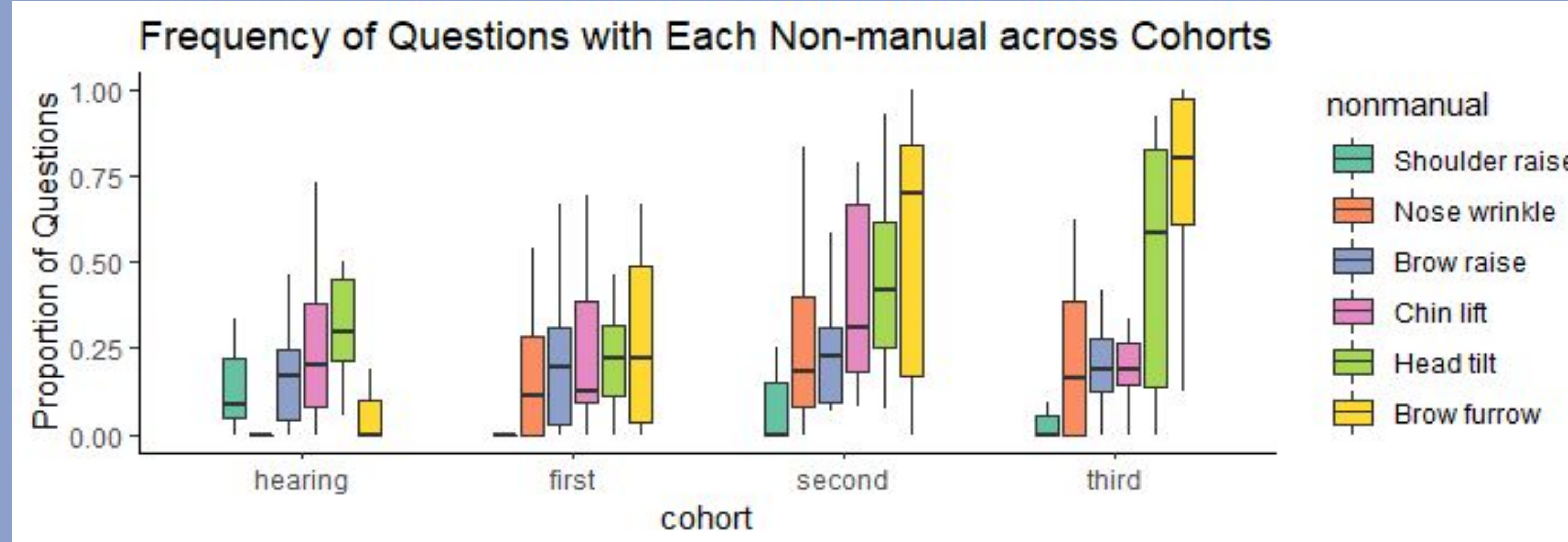
## Collecting the Data

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 interviewee by giving question item topics but not directly indicating the question words of interest. (e.g. "birthday" or "number of siblings"). The participant was video recorded and the videos were later coded using ELAN 6.2[3] and exported into R.


Frequency of Questions with Each Non-manual across Cohorts


Average Duration of each Non-manual across Cohorts


Number of Questions where the Non-manual is Coarticulated with the Wh-Question Word

## Models and Analysis

We explored three different variables, all visualized to the left. The first two used mixed effects linear regression and the third used logistic. Analyses were performed in R using the lme4 package.

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. Among the non-manual types, we found the following:

- Brow raise, chin lift, shoulder raise and head tilt 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)

We did not find any significant effects in our analyses involving duration or coarticulation, though we did observe interaction effects in the duration analysis.

## Discussion

This project sought to explain the origins of the wh-question markers in NSL. We found that although the head tilt and brow furrow were the most salient markers in the later cohorts, they were not the most salient among the Spanish speakers. We did not find that duration or coarticulation caused either of these non-manuals to become markers, but rather indications of their grammaticalization.

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