

# Headshakes in NGT

## Relation between Phonetic Properties & Linguistic Functions

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### Headshake in NGT

Three different linguistic types of negative headshake (Oomen & Pfau 2017):

- **Lexical headshake** on the negative sign
- **Morphological headshake** on the negated predicate
- **Prosodic headshake** elsewhere

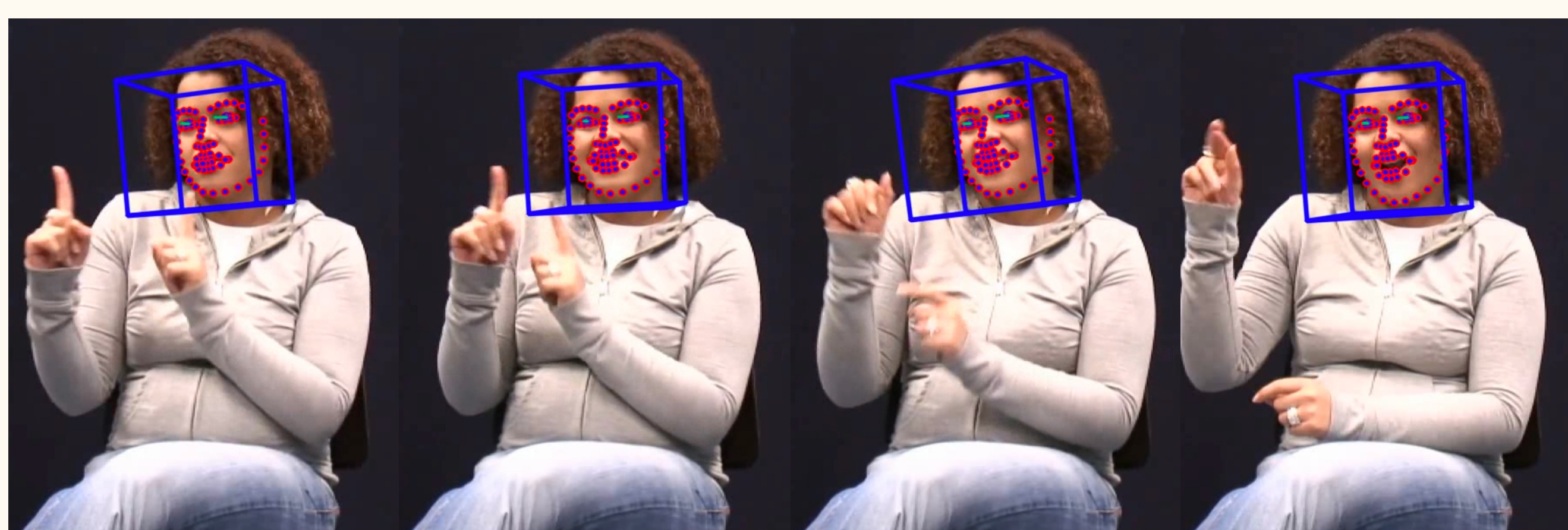
**DEAF SELF IX<sub>3</sub> hs-M HAVE.PROBLEM hs-L NOT hs-P PU**  
'The deaf themselves don't have a problem (with it)'

### Research questions

1. What linguistic factors influence headshake phonetically?
2. Do the three types of headshake differ phonetically?

### The data

- Corpus NGT
- 22 signers from Groningen region
- 220 instance of headshake



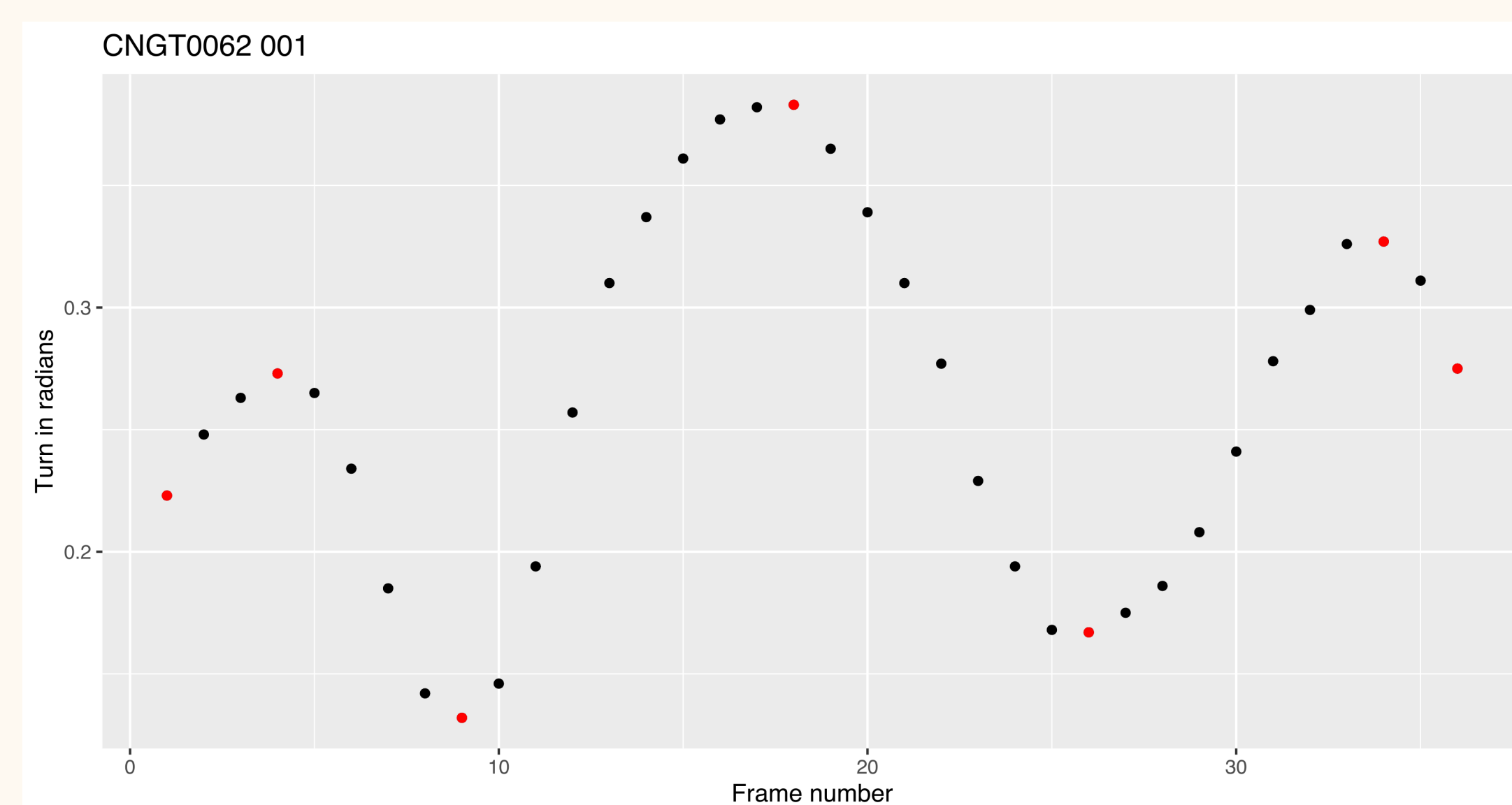
Example of a headshake (CNGT0062), with tracking in OpenFace

### Computer Vision

- OpenFace 2.0 (Baltrusaitis et al. 2018) measures head rotation
- Headshake: yaw (pose\_Ry)
- Peak detection to identify the individual head turns
- Calculation of phonetic measures
  - duration, maximal amplitude, mean velocity, peak velocity, number of peaks, frequency of turns, average turn amplitude

### Limitations

- Small dataset
- No smoothing (measures based on raw OpenFace outputs)
- Precision of OpenFace measurements



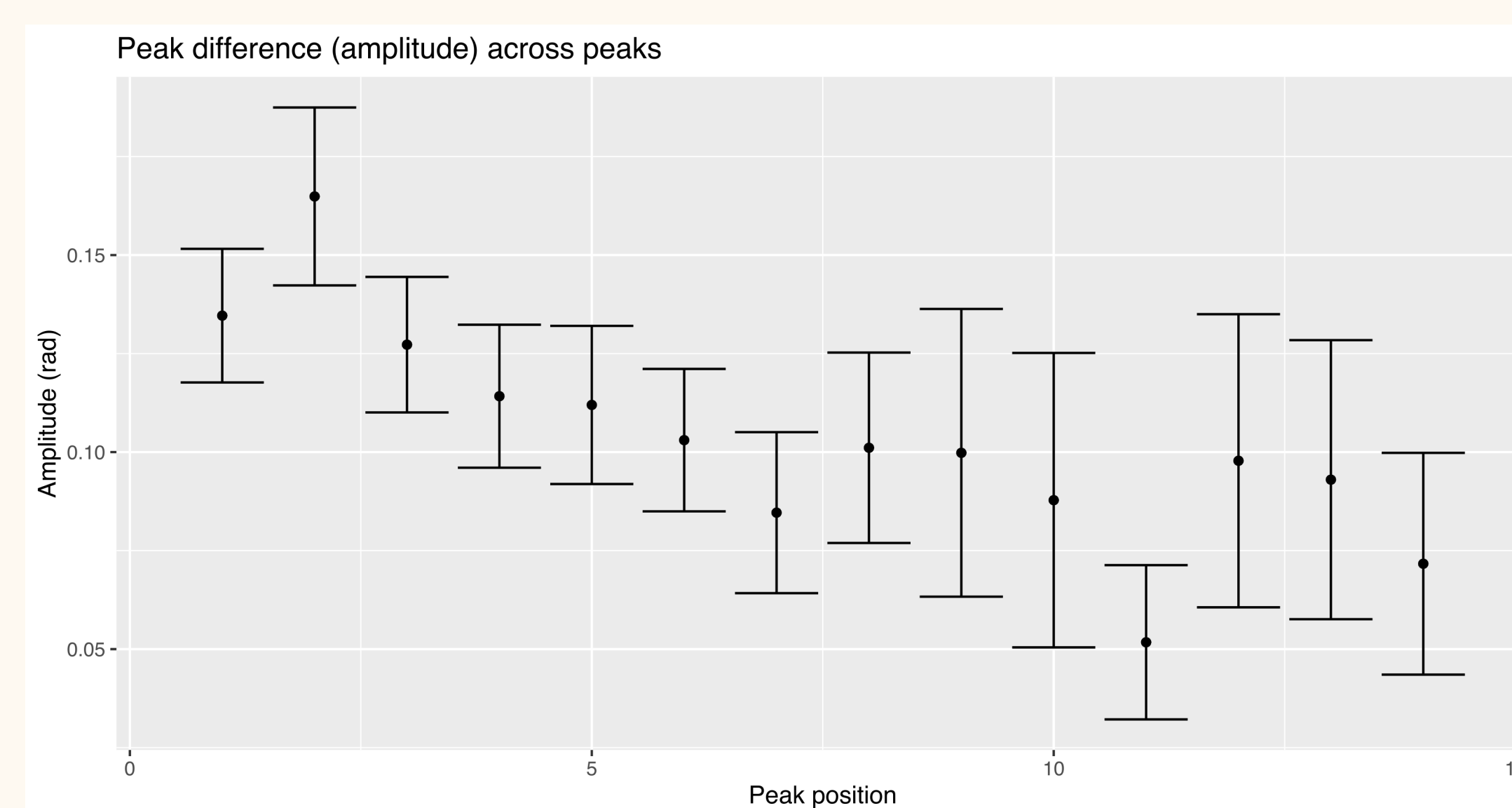
Yaw measures from OpenFace for headshake from CNGT0062, with peaks identified (in red).

### Results

- Longer duration and higher number of peaks with spreading (but no effect on amplitude or velocity)
- Lower frequency with spreading (compensation?)
- **Prosodic** headshake has lower amplitude and peak velocity than **morphological** and **lexical** headshake, but higher frequency

### Overall amplitude development

- The amplitude diminishes over time within a headshake
- Parallel to downstep in spoken languages?



Mean difference in amplitude between adjacent peaks based on peak position. Error bars indicate 2 standard errors.

## Phonetic properties of headshake in NGT are affected by linguistic factors

### Outlook

- Cross-linguistic comparison
- Improved Computer Vision solutions
- Improved statistical measures and analysis

References and full paper here:



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