How do visual modality and linguistic structure affect temporal processing of sign language?

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INTRODUCTION

Sign language temporal structure is characterized by a **parallel presentation and processing** of the linguistic information.

This experiment investigates the impact of visual modality and linguistic structure on how our **cognitive system temporally processes linguistic information**, allowing for efficient language comprehension.

Hwang, S. O. K. (2011). Windows into sensory integration and rates in language processing: insights from signed and spoken languages (Doctoral dissertation). **| Ueda**, K., Nakajima, Y., Ellermeier, W., & Kattner, F. (2017). Intelligibility of locally time-reversed speech: A multilingual comparison. Scientific reports, 7(1), 1-8.

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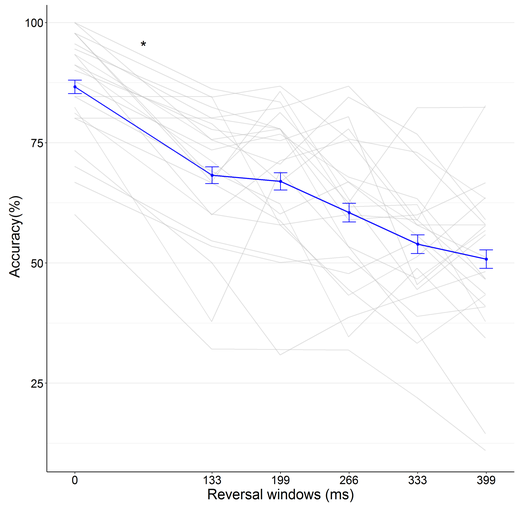
RESULTS

LSE

Intelligibility ~ Reversal window + (1 | Item) + (1 | Participant) + (0 + Reversal window | Participant)



Non-linguistic condition

Intelligibility ~ Reversal window + (1 | Item) + (1 | Participant) + (0 + Reversal window | Participant)

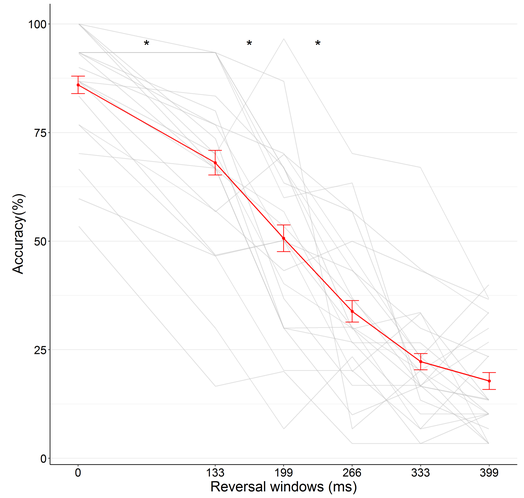


Figure 1,2: Intelligibility curve as a function of reversal window size for LSE (blue) and non-linguistic task (red). Grey lines represent observed data by participant, while blue and red lines represent mean intelligibility across participants for sign language (R^2 =0.489) and the visual non-linguistic (R^2 =0.621) models.

Comparison

Intelligibility ~ Reversal window * task + (1 | Item) + (1 | Participant)

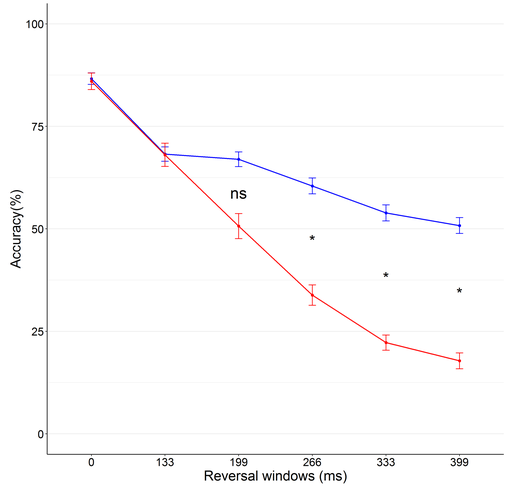


Figure 3: The model (R^2 =0.535) compares intelligibility curve in LSE (blue) and non-linguistic task (red). Post hoc

CONCLUSIONS

Intelligibility gradually **decreases with longer reversal windows**. The decrease is faster in non-linguistic task, while intelligibility stabilize at 50% in LSE.

Stimuli in the **visual modality** are **more resilient to temporal distortion** than spoken languages (Ueda et al., 2017), possibly due the importance of the spatial domain in visual modality. **LSE** also shows an advantage compared to the non-linguistic stimuli: its **spatial and temporal structure allows for redundancy of the linguistic information** which might compensate for the loss of information due to the temporal distortion.

Temporal processing of language seems to be modulated by the interaction of sensory modality characteristics and linguistic properties.

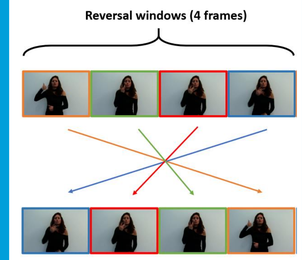
METHODS

Participants: 23 hearing highly proficient users of Spanish Sign Language (LSE).

Material: 60 semantically unpredictable sentences in LSE and 30 videos of a dot tracing a sequence of symbols.
*stimuli examples

Manipulation: Locally time-reversed signal (based on Hwang, 2011)

0 ms
133 ms
199 ms
266 ms
333 ms
399 ms



Procedure: Participants are presented with stimuli (LSE and videos) and have to reproduce as many sign/symbols as possible in the correct order.