

## **Native and non-native sentence comprehension in the presence of a competing talker**

**Valdés-Laribi, Huarda; Wendt, Dorothea; Cooke, Martin; MacDonald, Ewen; Mattys, Sven**

*Publication date:*  
2014

*Document Version*  
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

*Citation (APA):*

Valdés-Laribi, H., Wendt, D., Cooke, M., MacDonald, E., & Mattys, S. (2014). Native and non-native sentence comprehension in the presence of a competing talker. Poster session presented at 4th Annual Conference of the British Society of Audiology, Keele, United Kingdom.

## **DTU Library** Technical Information Center of Denmark

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

# Native and non-native sentence comprehension in the presence of a competing talker

Huarda Valdés-Laribi<sup>1</sup>, Dorothea Wendt<sup>2</sup>, Martin Cooke<sup>3</sup>, Ewen MacDonald<sup>2</sup>, Sven Mattys<sup>1</sup>

<sup>1</sup> The University of York, <sup>2</sup> Technical University of Denmark, <sup>3</sup> University of the Basque Country

## Introduction

> In everyday environments, we often have to attend to one person (target speech) while ignoring another (competing speech). Competing speech can mask the target through energetic masking (EM, acoustic degradation at the periphery) and informational interference (higher-order, cognitive aspects of masking).

> Many studies have investigated the effect of masking on sound and word identification. Fewer have investigated its effect on sentence comprehension.

> This study aims to test whether informational interference is especially detrimental (relative to energetic masking) to sentence comprehension, particularly to sentences requiring a greater amount of processing resources, such as syntactically complex sentences, as in the examples below.

Less syntactic complexity, less processing resources	More syntactic complexity, more processing resources
Subject relative: Show the girl who is holding the boy.	Object relative: Show the girl who the boy is holding.

## Research questions

- 1) Is a competing talker (energetic masking + informational interference) more detrimental to sentence comprehension than energetic masking alone?
  - > Yes: Koelewijn et al. (2012), Brungart et al. (2001), Brungart et al. (2013)
  - > No: Dirks and Bower (1969), Hygge et al. (1992)
- 2) Does the syntactic complexity effect (Obj Rel more difficult than Subj Rel) generalise across types of masks and language background?
  - > Yes: e.g. Just and Carpenter (1992) for unmasked sentence comprehension in L1, Carroll and Ruigendijk (2013) and Wendt et al. (2014) for energetically masked sentence comprehension in L1, Izumi (2003) for greater difficulty in relative clause comprehension in a second language.
- 3) Is a competing talker more detrimental to comprehension of more complex target sentences (Obj Rel)?
  - > Yes: if the same processing resources are involved in informational interference and syntactic complexity
  - > No: if the processing resources involved in informational interference and syntactic complexity are different, or if informational interference does not increase processing resources.
- 4) Is a competing talker more detrimental to sentence comprehension for L2 listeners?
  - > Yes: L2 listeners expend more processing resources to recognise and understand speech (Lecumberri et al., 2010). If informational interference requires more processing resources, the effect of a competing talker will be even greater for L2 listeners, in particular for complex sentences.
  - > No: when the masker is in an unknown language, listeners can show release from masking (e.g. Lecumberri and Cooke, 2006)

## Method

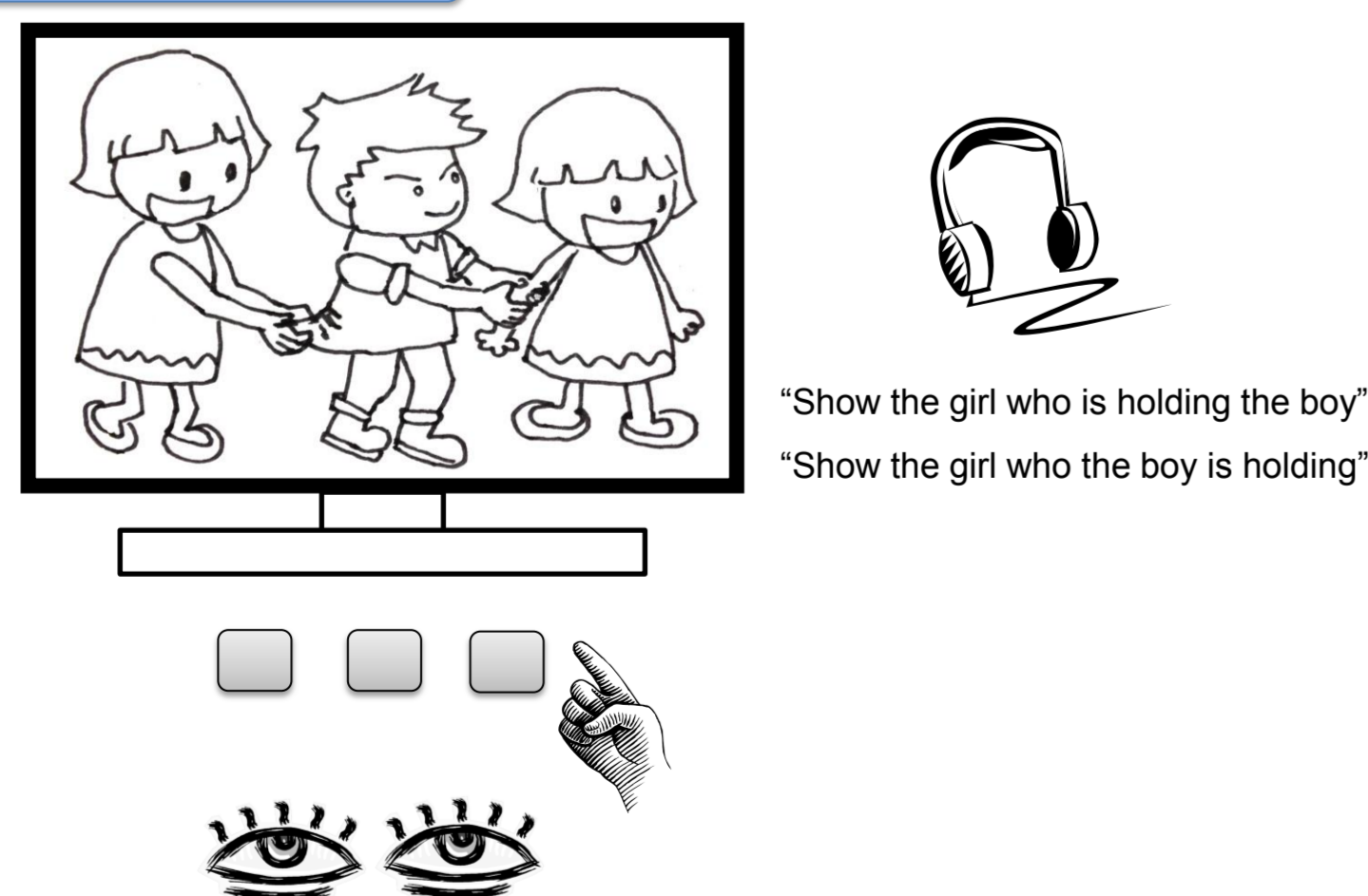
**Participants** > Native (L1) normal hearing British students, N = 36  
> Non-native (L2) normal hearing Danish students, N = 19

### Materials

SNR = -5dB	Increasing syntactic complexity of target sentence		
	Simple sentence (120)	Subject Relative (60)	Object Relative (60)
No mask	Show the girl with the red shoes	Show the girl who is holding the boy	Show the girl who the boy is holding
Reversed competing talker (EM)			
Speech-modulated noise (EM)			
Competing talker (EM+ informational interference)			

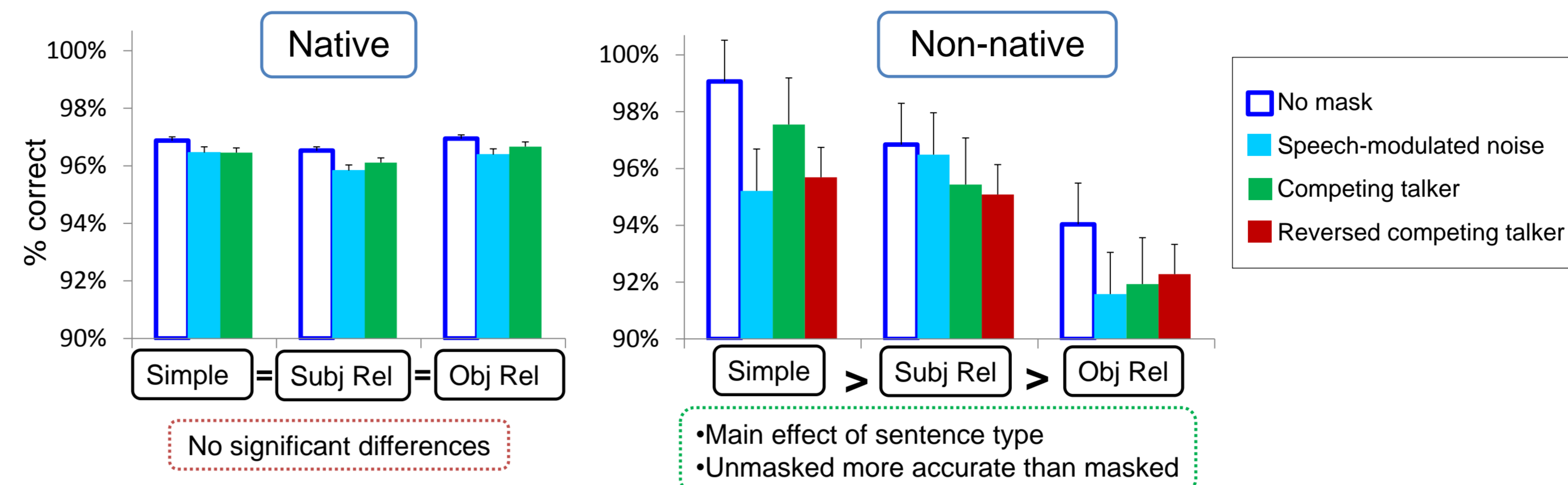
Comp Talker: "The black dog was hungry. The yellow pears taste good."

### Task: Speeded picture selection



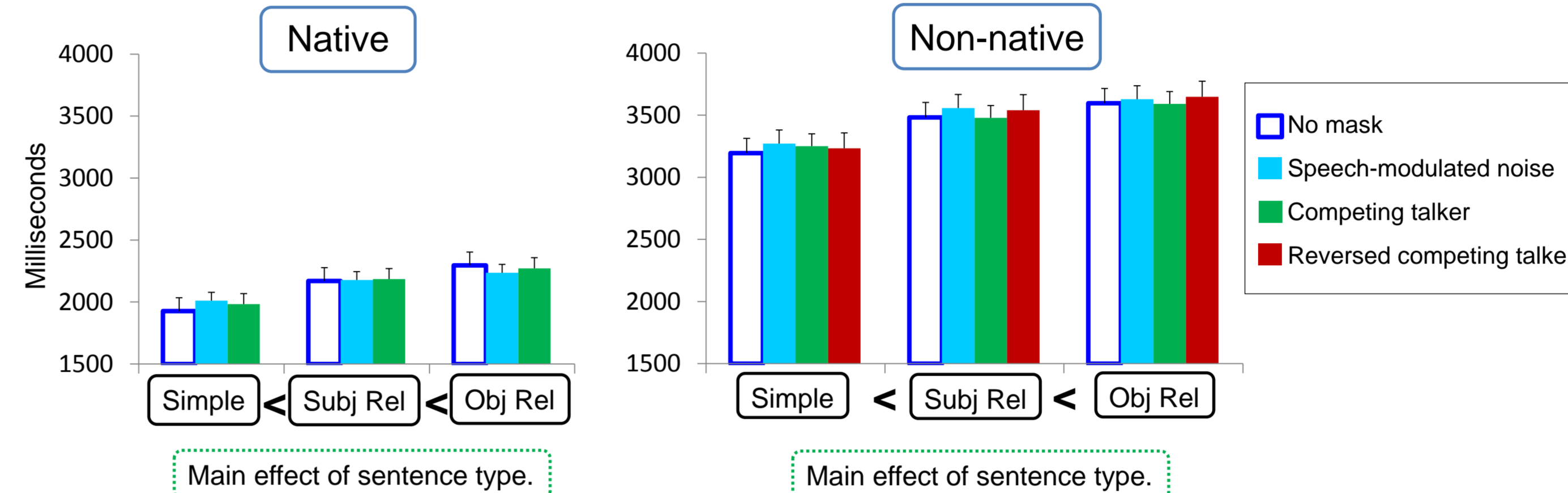
## Results

### Button press accuracy



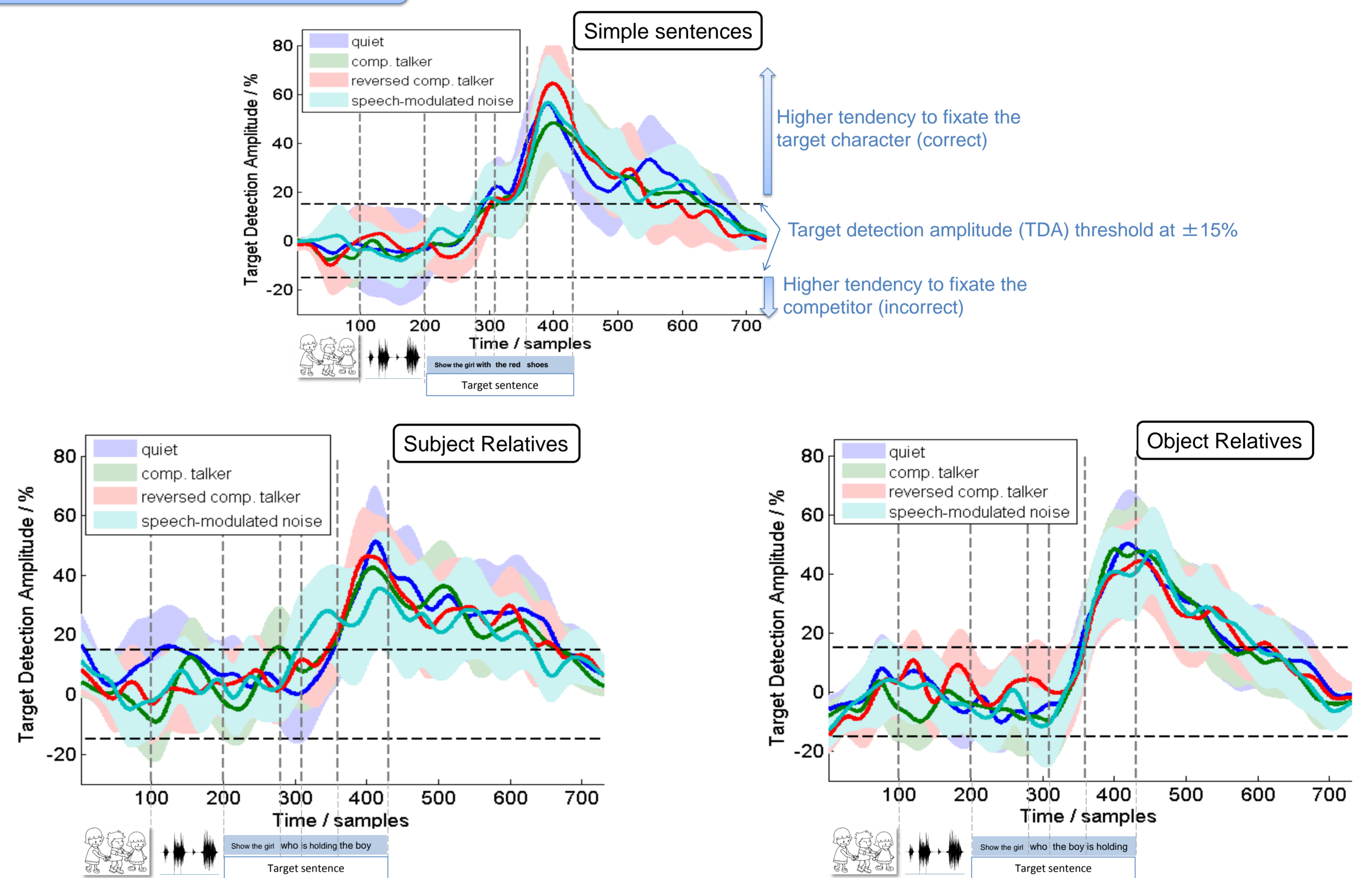
> L1 and L2 listeners highly accurate (>90%)  
> L2 listeners more sensitive to syntactic complexity  
> L2 listeners more sensitive to presence or absence of mask

### Button press reaction times



> L2 slower than L1 listeners, answered after the end of the sentences.  
> L1 and L2 listeners sensitive to syntactic complexity  
> L1 and L2 listeners are just as fast across masks

### Eye-tracking (non-native only)



- > Eye-tracking allows to measure the online processes taking place before the button press for L2 listeners.
- > Participants tended to fixate the correct character (>15%TDA) earlier for the simple sentences than for the relative clause sentences.
- > Regardless of the mask, or indeed whether the target was masked at all, participants fixated the correct character just as much in all conditions.
- > This online measure confirms that even L2 listeners can be unperturbed by masking of speech.

## Conclusions

- 1) A competing talker is not always more detrimental than energetic masking alone. In this task, listeners' processing was equally unperturbed across masks.
- 2) The effect of syntactic complexity (Obj Rel vs Subj Rel) was replicated in all masked and unmasked conditions, both in native and non-native listeners.
- 3) Even when confronted with more complex syntax, native and non-native listeners' sentence processing was singularly robust to masking.
- 4) Non-native listeners' ability to overcome energetic masking and informational interference is just as robust as native listeners', even though non-native listeners' reaction times were slower across all conditions.

## References

- Brungart, D. S. et al. (2001). Informational and energetic masking effects in the perception of multiple simultaneous talkers. *The Journal of the Acoustical Society of America*, 110(5), 2527-38.
- Brungart, D. S. et al. (2013). Interactions between listening effort and masker type on the energetic and informational masking of speech stimuli. In *Proceedings of Meetings on Acoustics* (Vol. 19, p. 9).
- Carroll, R., & Ruigendijk, E. (2013). The effects of syntactic complexity on processing sentences in noise. *Journal of Psycholinguistic Research*, 42(2), 139-59.
- Just, M., & Carpenter, P. (1992). A capacity theory of comprehension: Individual differences in working memory. *Psychological Review*, 99(1), 122-149.
- Hygge, S. et al. (1992). Normal-hearing and hearing-impaired subjects' ability to just follow conversation in competing speech, and noise backgrounds. *Journal of Speech and Hearing Research*, 35(1), 208-15.
- Izumi, S. (2003). Processing difficulty in comprehension and production of relative clauses by learners of English as a second language. *Language Learning*, (June), 285-324.
- Koelewijn, T. et al. (2012). Pupil dilation uncovers extra listening effort in the presence of a single-talker masker. *Ear and Hearing*, 33(2), 291-300.
- Lecumberri, M. L. G., Cooke, M., & Cutler, A. (2010). Non-native speech perception in adverse conditions: A review. *Speech Communication*, 52(11-12), 864-886.
- Wendt, D., Brand, T., & Kollmeier, B. (2014). An Eye-Tracking Paradigm for Analyzing the Processing Time of Sentences with Different Linguistic Complexities. *PLoS One*, 9(6)

## Acknowledgments

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no FP7-PEOPLE-2011-290000. Thanks to Ling Ge for assistance in creating the visual stimuli for this experiment.



Contact: [huarda.valdes-laribi@york.ac.uk](mailto:huarda.valdes-laribi@york.ac.uk)

