# Towards an Investigation into Audio-visual Integration in Children with Hearing Impairment: Introduction and Preliminary Work

Lyan Porto, Jan Wouters, Astrid van Wieringen
KU Leuven, Leuven, Belgium

## Introduction

Much like adults, children often occupy busy, noisy environments where multiple sound sources makes listening effortful. Classrooms, for example, have a clear target – the teacher – and many distractors, and children must be able to distinguish these different streams and focus on the target. Children with hearing impairment presumably face additional challenges due to signal degradation. Our aim is to investigate whether having hearing impairment affects children's listening, including working memory, language, and attention capacity.

## Methods

Our main task is a listening in noise task, to be carried out using **AVATAR** (Audiovisual True-to-life Assessment of Auditory Rehabilitation)[1]. This paradigm developed at KU Leuven consists of a virtual 3D environment presented on a screen where virtual humans can be made to realistically move their mouths in synchrony with auditory stimuli. Additionally, it can present a number of other tasks to add cognitive load to the main listening task. Specifically for this study, we developed the functionality to allow the system to present audio from two virtual speakers simultaneously. We are also using a selection of tasks from standardized tests to assess working memory[2], language (CELF[3]), and attention (TEA-Ch[4]).
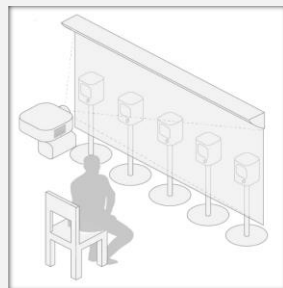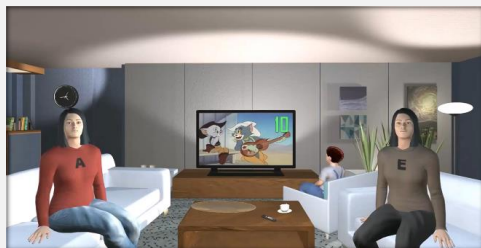


## Methods (cont.)

We are coupling AVATAR with **Pupil Core Eye-tracking**. This objective measure captures pupil positions and diameter over time, allowing us to investigate looking patterns, which we expect to be a proxy for attention. The integration and validation of this paradigm is still ongoing.



## Materials

The auditory stimuli presented through AVATAR is based on the LIST sentences[5], a Dutch corpus developed in Leuven and used extensively in adults. For use with children, a subset of these sentences was selected and will first be validated with a population of children with normal hearing aged 8-12 years old.

## Next Steps

Data collection for material validation should begin still in 2021.
Normative data collection using AVATAR and eye-tracking will first be collected from children with typical hearing in 2022; children with hearing impairment to be tested thereafter.

## References

1 Devesse, A., van Wieringen, A., & Wouters, J. (2020). AVATAR Assesses Speech Understanding and Multitask Costs in Ecologically Relevant Listening Situations. Ear & Hearing, 41(3), 521-531.
2 Corsi, P. M. (1972). Human memory and the medial temporal region of the brain. McGill University.
3 Kort, W., Schittekatte, M., & Compaan, E. (2010). Clinical Evaluation of Language Fundamentals-4-NL. Amsterdam, The Netherlands: Pearson Assessment.
4 Manly, T., Robertson, I. H., Anderson, V., & Nimmo-Smith, I. (1999). TEA-Ch: The Test of Everyday Attention for Children Manual. Bury St. Edmunds, UK: Thames Valley Test Company Limited.
5 van Wieringen, A., & Wouters, J. (2008). LIST and LINT: Sentences and numbers for quantifying speech understanding in severely impaired listeners for Flanders and the Netherlands. International Journal of Audiology, 47(6), 348-355.

KU LEUVEN