

## **Project title: Listening Effort**

**Project:** Ongoing non-project based study in the field of Psychoacoustics, Hearing Research, Audiology

**Donders Institute Theme:** Perception, Action and Control

## **Project description**

In this project, we aim to determine listening effort when listening with two different “ears”. We know that normal-hearing listeners integrate the input from both ears, which enables sound localization and speech understanding in noise environments. This integration comes with minimal effort. But how is binaural integration affected by the congruity of the two inputs? How do listeners integrate input from both ears, when one is incompatible with the other (as is the case for many hearing-impaired listeners)?

## **Project Alternatives**

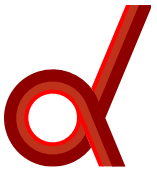
- Characterization of Pupil Light Reflex
- Characterization of Pupil Sound (Modulation) Reflex
- Relationship between objective and subjective measures of listening effort
- Neural control of pupil and effort
- *Clinically oriented (Medical Biology, Biomedical Sciences):*
  - o Listening effort in single-sided deaf, listeners with asymmetric hearing impairment, and bimodal cochlear implant users (in collaboration with the Otorhinolaryngology department of the Radboudumc)
  - o Pupil Light Reflex in individuals with multiple sclerosis
- *Modelling oriented (Physics, AI, Informational and Computer Sciences):* Characterizing and Modelling the Pupil Light, Sound, and Effort Response (e.g., Linear Systems Theory)
- *Thesis/Review Article:* How can listening effort be quantified?

## **Key words**

Humans | Pupillometry | Speech Recognition | fNIRS | Signal-to-Noise Ratio | Hearing Research | Auditory System | Eye Trackers | Psychophysics | Psychoacoustics | Perception

## **Relevant literature**

- Pichora-fuller, M. K., Kramer, S. E., Eckert, M. A., Edwards, B., Hornsby, B. W. Y., Humes, L. E., ... Wingfield, A. (2016). Hearing Impairment and Cognitive Energy: The Framework for Understanding Effortful Listening (FUEL). *Ear and Hearing*, 37(July). <https://doi.org/10.1097/AUD.0000000000000312>
- van de Rijt, L. P. H., van Opstal, A. J., & van Wanrooij, M. M. (2021). Multisensory Integration-Attention Trade-Off in Cochlear-Implanted Deaf Individuals. *Frontiers in Neuroscience*, 15, 878. <https://doi.org/10.3389/FNINS.2021.683804/>



## Tasks & skills

You will become familiar with pupillometry, psychophysics and psychoacoustics. At the end of this internship, you will be able to:

- Design and develop speech recognition experiments in state-of-the art sensorimotor labs
- Measure pupil dilation in response to light and cognitive effort (with eye trackers)
- Analyze data in Matlab and quantify speech recognition behavior and pupil dilation (through systems analysis)
- Write a report in the form of an academic paper (IMRaD)

## Background

*Master Cognitive Neuroscience:* Perception and action track

*Biology/Sciences/Physics:* Psychophysics I and II, Neurobiophysics, Neural Basis of Cognition and Perception, The Auditory System

**Supervisor:** dr. Marc M. van Wanrooij

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