

NEWSLETTER

HEARING SYSTEMS IN PROFILE

February 2022



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News, awards, prizes



PhD student wins pitch battle at Danish Sound Day

On Danish Sound Day 2021, November 17, Rasmus Malik Thaarup Høegh won this year's pitch battle with his excellent presentation of his PhD project on probabilistic deep learning for hearing aid speech separation. Rasmus Malik Thaarup Høegh is an industrial PhD student at DTU Health Tech/Compute/Widex.

With the award comes a travel grant worth 8.000 DKK for scientific research or educational purposes.

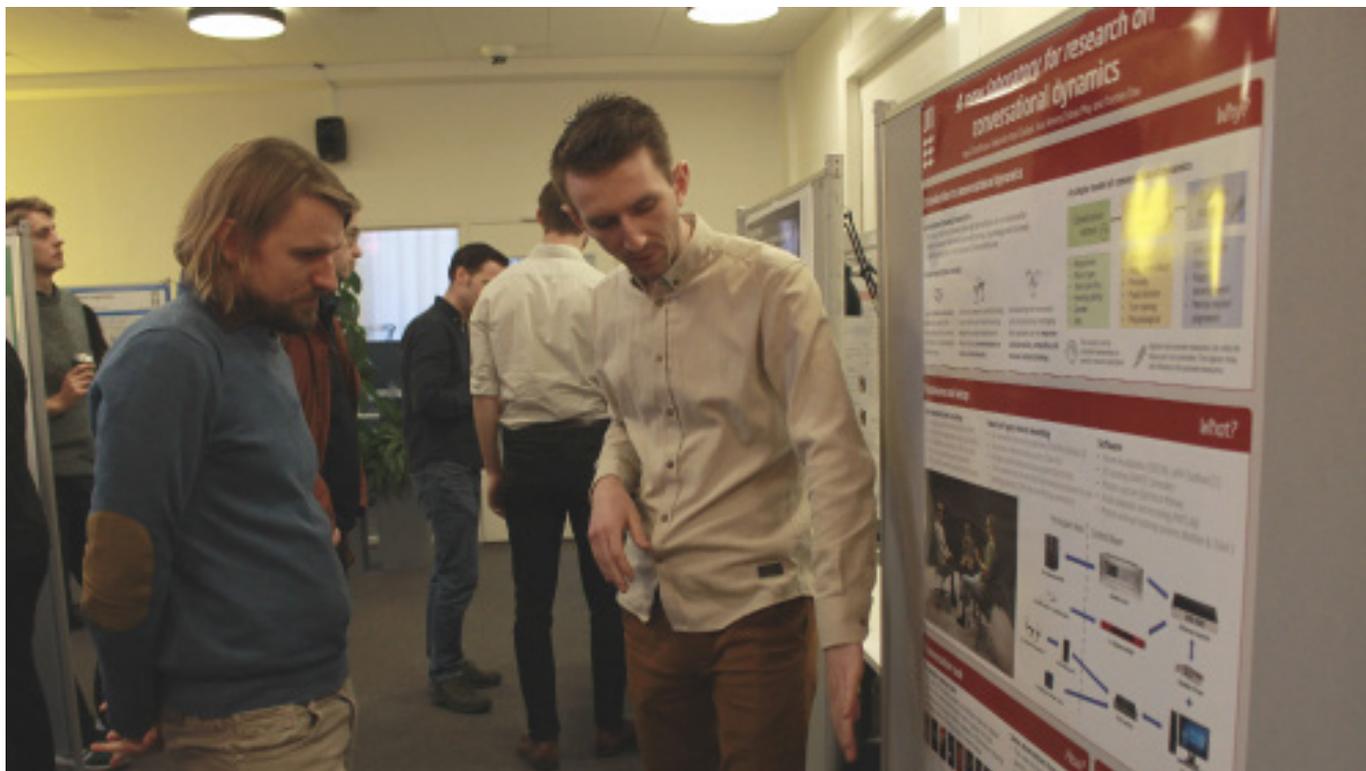
Director of Danish Sound Cluster Torben Vilsgaard presents the award to Rasmus. Photo Birger Schneider.

This year's award was sponsored by Jabra and EPOS.

Jury: Cheol-Ho Jeong, DTU Electrical Engineering, Søren Kamaric Riis, Oticon Medical and Jesper Bünsow Boldt, GN Group.

Young researchers based at Danish Universities are annually invited to join the Danish Research Talent Pitch Battle at the Danish Sound Day to present their research to leading industry representatives, investors, researchers and organisations from the Danish Sound ecosystem. Read more about the motivation behind the winning application [here](#).

News



Presentation Day 2021

On November 12, 2021, Hearing Systems invited collaboration partners, colleagues and alumni for this year's Presentation Day to give an overview of the activities in the research section. The event took place at the laboratory building and attracted about 40 guests during the afternoon.

Torsten Dau, Head of Hearing Systems, gave an introduction to the research group and the activities.

The PhD students and Postdocs presented their research projects through eight talks (grouped into three sessions: "Imaging the ear and EEG correlates of perception", "Behavioral measures of normal and impaired hearing" and "Machine learning approaches to speech processing in complex environments") as well as 16 posters.

Several PhD graduates from the group, many of whom are now working in hearing aid industry, turned up at the occasion.

There was a very positive and engaged atmosphere at the event. Torsten Dau emphasized in his closing remarks how valuable these presentation days are for Hearing Systems because this is a platform particularly for the young researchers

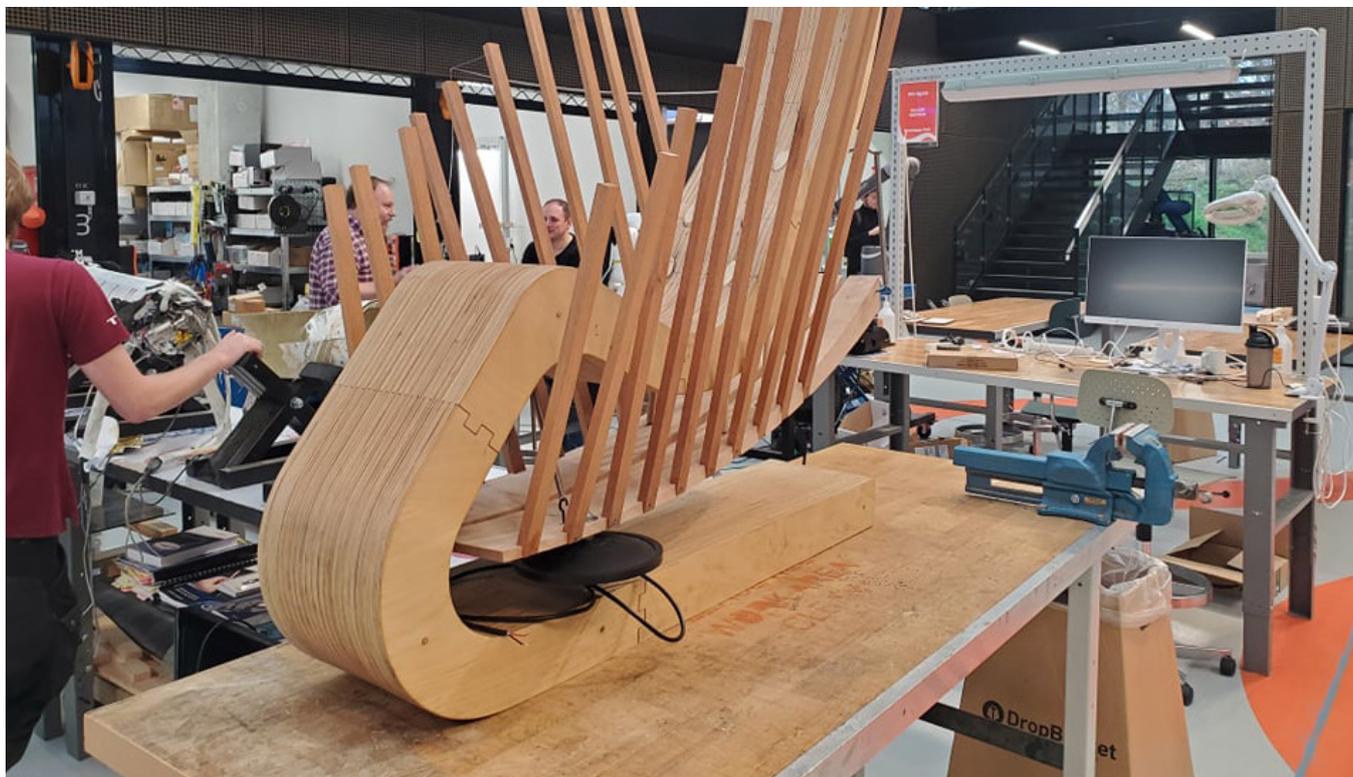
PhD student Ingvi Örnolfsson is explaining the poster "A new laboratory for research on conversational dynamics" to PhD Johannes Käsbach, now employed in GN Resound. Photo: Eva Helena Andersen.

to present themselves and their exciting research to our most important collaborators and network partners. Read more [here](#).

Danish Sentence Test Project (DAST)

Many research and development projects in the fields of speech and hearing sciences rely heavily on speech corpuses. Although speech corpuses large enough for sentence testing exist in other languages, a large enough corpus in Danish does not. As a result, Denmark-based researchers and developers in both academic and industrial settings working within speech and hearing sciences have been somewhat handicapped in comparison to, for example, researchers and developers working in English-speaking countries. The main objective of this project is therefore to create a new sentence test together with a new, larger corpus of Danish sentences. Read more about the project [here](#).

News



Audio tactile chairs will help hearing impaired people enjoy music

Within the project 'Augmented Music', Associate Professor Jeremy Marozeau collaborates with two Swiss musicians to create art installations to provide people with a handicap a richer music experience. Under his supervision, three master students in acoustics designed and built the first two installations at DTU Skylab. The goal was to create an art installation that allows people with a handicap to regain a full experience of music through vibrations. In December 2021, the prototypes were shown to the audience at DTU where everybody could try it out and feel the music and vibrations before the chairs were sent on to Geneva. The two chairs are now exposed in the most prestigious room at the Museum of Art and History in Geneva in 2022, Jeremy Marozeau and his team are planning to build three new prototypes based on the feedback from the first concerts.

The first prototype is designed to convey the low and mid frequencies to different body parts. The second decouples the

One of the prototypes of the tactile chairs in the Skylab developer hall at DTU. Photo: Brent Reissman .

vibrations from the structure supporting the body to increase frequency selectivity and decrease vibration damping by the user's weight. Additionally, sympathetic bars transmit the vibrations directly to the users. This mechanism was inspired by the basilar membrane that decomposes the sound into filter bands before activating individual nerve fibers. The prototypes were developed by students from the Master of Engineering Acoustics: Brent Reissman, Tomer Tchelet and Gabriele Ravizza.

Read more about the project [here](#):

News



Head of Copenhagen Hearing and Balance Center Mads Klokker with Assistant Professor Abigail Anne Kressner. Photo Jesper Scheel

New research laboratories and facilities

At the Copenhagen Hearing and Balance Center (CHBC) at Rigshospitalet, we are continuing our push to build up our new research facilities. These facilities have been designed to mimic the functionalities of both the clinical facilities at CHBC and the research facilities at DTU in Lyngby, effectively facilitating synergies between the two domains. We go above and beyond this by outfitting these facilities with equipment that will help to catalyze brand new, clinically-oriented research streams. At the start of 2021, we focused primarily on the sound booth, and more recently, we have set our focus on the spatial hearing lab. To build this lab space, we collaborated with Sonible, the Austrian-based consultants who we also collaborated with on the design and construction of our Audio Visual Immersion Lab (AVIL) in Lyngby. As a result of this co-creation process, we designed and outfitted the spatial hearing lab with a novel, state-of-the-art loudspeaker array consisting of 41 individual loudspeakers that have been embedded within the walls and ceiling of an otherwise ordinary clinical room that has been acoustically treated. Within this room, we replicated the setup of the clinical rooms at CHBC designated for counseling and rehabilitation sessions by placing a round table and three chairs in the center. This spatial hearing lab will enable us to better link to the work we do at DTU with virtual sound and virtual reality to the patients at CHBC, giving us unparalleled possibilities to design, develop, and test novel ways to bring realism and



Eye tracking glasses from Com Lab with point-of-view cameras and motion tracking allow recording where participants look during conversation, as well as how they move their heads. Photo Jesper Scheel.

ecological validity to the clinic. We anticipate that this lab space will help revolutionize spatial hearing and listener behavior diagnostics, accelerate the optimization of fitting procedures for hearing aid and cochlear implants, and catalyze rehabilitation that is more transferrable to daily life.

We have gone one step further to expand our lab facilities by building a new conversation lab at DTU. Specifically, this lab has been constructed at DTU in Lyngby to facilitate new explorations of conversational dynamics. The lab contains a 16-channel circular loudspeaker array surrounding three chairs intended for experiment participants. The participants can be equipped with various sensors and microphones to record their speech, motion and eye gaze behavior, making it possible to capture multimodal, egocentric recordings of behavior during realistic and natural conversations. Such metrics will serve as valuable research tools, and could potentially play a central role in moving towards a research paradigm based on dynamic conversations rather than individual passive listening. The end goal of the new lab is to gain a deeper understanding of behavior in more realistic, dynamic conversations and to investigate how we can evaluate the ability of hearing interventions to promote active conversation and social engagement. Furthermore, by funneling learnings from the conversation lab at DTU into translational research streams in the spatial hearing lab at CHBC, we will be well-equipped to make breakthroughs in the modernization of clinical care for promoting better hearing health.

More info [here](#).

PhD defence



The tradition is that the fellow PhD students in the group build a PhD hat at each PhD defence related to the topic. Photo: Niclas Janssen.

On November 11, 2021, Thirsa Huisman successfully defended her thesis "The Influence of Vision on Spatial Localization in Normal-Hearing and Hearing-Impaired Listeners".

From December 2021, Thirsa started as a postdoc researcher at the Johannes Gutenberg-Universität in Mainz, Germany.

Principal supervisor: Professor Torsten Dau,

Co-supervisor: Associate Professor Ewen MacDonald,

Co-supervisor: Dr. Tobias Piechowiak

Examiners: Associate Professor Jeremy Marozeau, DTU Health Tech, Professor Steven van de Par, University in Oldenburg, Director G. Christopher Stecker, Boys Town National Research Hospital.

Chairperson at defence: Senior Researcher Jens Bo Nielsen

More info about the defence [here](#).

New PhD projects



Characterizing listener behaviour in complex acoustic scenes

Valeska Slomianka

The aim of Valeska's project is to explore and analyze listener behavior in environments with varying degrees of complexity and dynamics. Specifically, listeners will be monitored continuously using various sensors, such as motion and eye trackers, to record body and head-movement trajectories, as well as eye-gaze throughout the experimental tasks. The underlying hypothesis is that difficulties in processing and analyzing a scene will be reflected in the tracked measures and that comparing behavior across different scenes will help pinpoint which aspects of the scenes pose challenges for the listener. This, in turn, will help to differentiate listener behavior and performance depending on the auditory profile that characterize the individual listeners' hearing loss and as a function of the scene complexity. Furthermore, this grouping and characterization will support the selection of appropriate compensation strategies tailored to the individual listener. This project is supported by the Center for Applied Hearing Research (CAHR).

New PhD projects



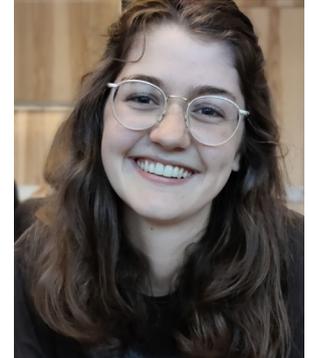
Investigating conversational dynamics using objective behavioral metrics and multi-modal, egocentric sensing

Ingvi Örnolfsson

It is known that the brain behaves very differently when engaging in a dynamic conversation than when it is only listening. This PhD project focuses on developing a new research paradigm based on naturalistic group conversations with multiple simultaneous participants. The first step will be to develop objectively quantifiable metrics for conceptualizing important concepts related to conversation success and failure. Egocentric sensing devices will then be used to measure relevant audio-visual and physiological signals, and these signals will then be used to gain insight into whether specific behavioral patterns are correlated with conversation success. This project is supported by Facebook Reality Group/DTU.

Computational modelling of the perceptual consequences of individual hearing loss

Lily Paulick



In her study, Lily investigates the perceptual consequences of hearing loss using a computational modelling framework. The hypothesis of the study is that, based on recent insights from data-driven 'auditory profiling' studies, computational modelling enables the prediction of perceptual outcome measures in different sub populations such that their distinct patterns in the data can be accounted for quantitatively and related to different impairment factors. More realistic simulations of the signal processing in the inner ear, the cochlea, will be integrated in the modelling. Most hearing losses are 'sensorineural' and have their origin in the cochlea and sensorineural hearing loss has recently been demonstrated to also induce deficits at later stages of auditory processing in the brainstem and central brain. This project is supported by the Center for Applied Hearing Research (CAHR).

New MSc project

Evaluation of signal processing methods to determine the reliability of functional near-infrared spectroscopy (fNIRS) for measuring hearing. Andreas Hafstrøm. Supervisors: Abigail Anne Kressner (DTU), Hamish Innes-Brown (Eriksholm Research Centre), Erik Kjærbøl (Bispebjerg Hospital).

Other Research projects



Elisabeth Koert

Research Internship

Elisabeth is currently doing a research internship at Hearing Systems supervised by Bastian Epp with the goal to develop a PhD project proposal. The general idea is to investigate if a change in the stimulus shape can improve the performance of the electrical auditory nerve stimulation used in cochlear implants. The first step will be to find feasible alternative pulse shapes using computer simulations by taking the biophysical properties and dynamics of the auditory nerve into account. The neuronal responses to these shapes could later be investigated in mice via electrophysiological experiments and psychoacoustic tests with human subjects could be used to determine changes in perception.



Kirsten Maria Jensen Rico

Research Assistant

Kirsten is a research assistant within Hearing Systems and contributes to both the PUPILS and DAST projects. Within the PUPILS project, she will be investigating the reliability of pupillometry within hearing-impaired listeners, which is an important step in evaluating pupillometry as a diagnostic tool for hearing-aid fitting. Within the Danish Sentence Test (DAST) project, she will be contributing to the creation and evaluation of the new, larger sentence corpus and associated sentence test.



Borgný Súsonnudóttir Hansen

Student Assistant

During the last year, Borgný has worked as a student assistant at Hearing Systems, collecting data on young normal-hearing, older normal-hearing and hearing-impaired participants. Borgný has been working on Jonathan Regev's PhD project 'Measures and computational models of amplitude modulation processing and perception in hearing-impaired listeners'. From March, Borgný will start an industrial PhD at The University of Southern Denmark (SDU) in collaboration with WS Audiology.



Andrea Clara Dich Jensen

Student Assistant

Andrea is currently hired at the HEA section as a student assistant to help with lab measurements, like audiometry, speech intelligibility and in the future also psychoacoustic measurements. She's currently studying a bachelor in audiology at the University of Copenhagen (KU).

Publications (Since September 2021)

Journal papers

Saleh HK, Folkeard P, Van Eeckhoutte M, Scollie S (2022) [Premium versus entry-level hearing aids: using group concept mapping to investigate the drivers of preference](#). International Journal of Audiology.

Märcher-Rørsted J, Encina-Llamas G, Dau T, Liberman MC, Wu PZ, Hjortkjær J (2022) [Age-related reduction in frequency-following responses as a potential marker of cochlear neural degeneration](#). Hearing Research 414, 108411

Cañete OM, Nielsen SG, Fuentes-López E (2022) [Self-reported listening effort in adults with and without hearing loss: the Danish version of the Effort Assessment Scale \(D-EAS\)](#). Disability and Rehabilitation, 1-8

Simoes JP, Daoud E, Shabbir M, Amanat S, Assouly K, Biswas R., Casolani C, Dode A, Enzler F, Jacquemin L, Joergensen M, Kok T, Liyanage N, Lourenco M, Makani P, Mehdi M, Ramadhani AL, Riha C, Santacruz JL, Schiller A, Schoisswohl S, Trpchevska N, Genitsaridi E (2021) [Corrigendum: Multidisciplinary tinnitus research: Challenges and future directions from the perspective of early-stage researchers](#). Frontiers in Aging Neuroscience 13, P 647285 730758

Navntoft CA, Landsberger DM, Barkat TR, Marozeau J (2021) [The perception of ramped pulse shapes in cochlear implant users](#). Trends in Hearing 25

Bachmann F, MacDonald E, Hjortkjær, J (2021) [Neural Measures of Pitch Processing in EEG Responses to Running Speech](#). Frontiers in Neuroscience 15 P 738408

Fuglsang S, Madsen KH, Puonti O, Hjortkjær J, Siebner H (2021) (Accepted/In press) [Mapping cortico-subcortical sensitivity to 4 Hz amplitude modulation depth in human auditory system with functional MRI](#). NeuroImage, 12 P 118745

Mansour N, Westermann A, Marschall M, May, T, Dau, T, Buchholz J (2021) [Guided ecological momentary assessment in real and virtual sound environments](#). Journal of the Acoustical Society of America. 150 (4) P 2695-2704

Sørensen AJM, Fereczkowski M, MacDonald E (2021) [Effects of noise and second language on conversational dynamics in task dialogue](#). Trends in Hearing 25

Fereczkowski M, Dau T, MacDonald E (2021) [Comparison of Behavioral and Physiological Measures of the Status of the Cochlear Non-linearity](#). Trends in Hearing 25

De Cheveigné A, Slaney M, Fuglsang S, Hjortkjær J (2021) [Auditory stimulus-response modeling with a match-mismatch task](#). Journal of Neural Engineering. 18 (4) 046040

Folkeard P, Eeckhoutte M, Levy S, Dundas D, Abbasalipour P, Glista D, Agrawal S, Scollie S (2021) [Detection, speech recognition, loudness, and preference outcomes with a direct drive hearing aid: Effects of bandwidth](#). Trends in Hearing, 25, 33874803

Alickovic E, Ng EHN, Fiedler L, Santurette S, Innes-Brown, Graversen C (2021) [Effects of Hearing Aid Noise Reduction on Early and Late Cortical Representations of Competing Talkers in Noise](#). Frontiers in Neuroscience 15, 2636060

Sidiras C, Sanchez-Lopez R, Pedersen ER, Sørensen CB, Nielsen J, Schmidt, JH (2021) [User-operated Audiometry project \(UAud\) – Introducing an automated user-operated system for audiometric testing into everyday clinic practice](#). Frontiers in Digital Health 3, 724748

Sanchez-Lopez R, Grini Nielsen S, El-Haj-Ali M, Bianchi F, Fereczkowski M, Cañete O, Wu M, Neher T, Dau T, Santurette S (2021) [Auditory tests for characterizing hearing deficits in listeners with various hearing abilities: The BEAR Test Battery](#). *Frontiers in Neuroscience* 15, 724007

Bruzzone SEP, Haumann NT, Kliuchko M, Vuust P, Brattico E (2021) [Applying Spike-density component analysis for high-accuracy auditory event-related potentials in children](#). *Clinical Neurophysiology* 132 (8) P 1887-1896

Conference papers

Sierra MC, Brunskog J, Marozeau J (2021) [An audio-tactile art installation for hearing impaired people](#). 2nd Nordic Sound and Music Conference (online)

Casolani C, Epp B, Norena A, Wang J, Hinze P,ENZLER F (2021) [Exploring MEMR and natural sounds with a connection with hyperacusis](#). Annual Conference on Acoustics DAGA 2021 (online)

PhD thesis

Tirsa Huisman (2021) [The Influence of Vision on Spatial Localization in Normal-Hearing and Hearing-Impaired Listeners](#).

Book Chapters

Meunier S, Van Eeckhoutte M, Moore B (2021) Editorial: [Loudness: From Neuroscience to Perception](#) *Frontiers in Psychology* 12 (3) P 785093.

Szibor A, Hyvärinen P, Mäkitie A, Aarnisalo AA (2021) Chapter 4. [Low inter-rater consistency in semantic profiles of tinnitus-like sounds rated by tinnitus patients](#). *Progress in Brain Research*, 262 P93-113



The Museum of Art and History in Geneva where the chairs from Augmented Music project are exposed now.
Photo: Raphael Ortis



Group Photo November 2021. Photo Jesper Scheel