

# NEWSLETTER

HEARING SYSTEMS IN PROFILE

January

2019



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Photo: Niclas Alexander Janßen

## New DTU Health Technology Department

From January 2019, the Hearing Systems group is a part of DTU Health Technology. DTU Health Technology will consist of research groups from DTU Electrical Engineering, DTU Nanotech, DTU Bioinformatics, DTU Compute, and DTU Bioengineering. "With a strong, joint department, we can attract the best researchers and students—both nationally and internationally—create new networks, new study programs, new start-ups, and a framework for collaboration between DTU's researchers, clinicians, and the industry. DTU Health Technology will become an international-class research platform capable of fostering new technology and new solutions that can improve the quality of patient care and public health and well-being in light of the

fact that we all live longer and longer," explains Rasmus Larsen, Executive Vice President and Provost at DTU.

"DTU has for many years worked with the life science industry on the development of new products and solutions for the health sector. DTU Health Technology will be a strong platform and will forge even closer ties with the industry, the Department of Health and Medical Sciences at the University of Copenhagen, the hospitals in the Capital Region of Denmark and Region Zealand, and generally businesses and knowledge institutions in Denmark and abroad," stretches Rasmus Larsen. Read more about the new institute at [www.dtu.dk/english/news/2018/06/dtu-sets-up-new-health-technology-department](http://www.dtu.dk/english/news/2018/06/dtu-sets-up-new-health-technology-department)

**DTU Health Tech**  
Department of Health Technology

## International news



Postdoc Sergi Rotger Griful (Eriksholm), Jonatan Märcher-Rørsted (DTU), Thomas Lunner, Eva Kaili (Member GR) and Alain de Cheveigné at the EU Parliament are demonstrating the EU funded COCOHA project which took place at the exposition "Tech and Innovation for Social Good" in November. Photo Jens Hjortkjær

In November, researchers from the Hearing Systems group and the Eriksholm Research Centre presented demos in the European Parliament. The demos were part of the EU funded COCOHA project ('Cognitive Control of a Hearing Aid') which aims at controlling hearing aids with the brain. Senior Researcher Jens Hjortkjær and the PhD students Jonatan Märcher-Rørsted and Nicolai Pedersen from Hearing Systems and Researcher Sergi Rotger Griful and Senior Scientist and Professor Thomas Lunner from Eriksholm showed various demos related to the COCOHA project. Visitors stopped by the stand which was part of the exposition "Tech and Innovation for Social Good" together with 15 other projects. Among the visitors were members of the European Parliament and EU commissioners. Moreover, teenagers from all over Europe visited the event, since the 'Youth Parliament' also met that week. The demos generated enthusiastic feedback from the politicians and the young European citizens.



On November 22-30, Torsten Dau was invited to an "Invest in Denmark" event in Palo Alto, California, in the heart of Silicon Valley, together with Dorte Hammershøi, AAU, and the Danish Sound Network. "Invest in Denmark" as part of Denmark's Ministry of Foreign Affairs followed the initiative of the Danish Sound Network to connect to companies in the San Francisco Bay Area and create common activities. Representatives from Apple, Facebook, Google, Amazon, Sonos, Meyer Sound, Roku, Polycom, EmbodimentVR, Starkey, Turtle Beach and LogiTech also attended the meeting. Torsten Dau also had the opportunity to give a scientific talk at Stanford University.





Photo Eva Helena Andersen

## 15 Years Anniversary of the Centre for Applied Hearing Research (CAHR)

On October 12, many guests, collaboration partners and former students attended the special "Presentation Day" of this year in order to celebrate CAHR's 15th birthday. Torsten Dau, Head of Hearing Systems, gave an overview of how the research group has grown from three employees in CAHR in 2003 as part of the Acoustic Technology group to another group (Hearing Systems) at the department of Electrical Engineering. Presently, the group consists of nearly 50 members, including six teachers, 21 PhD students, 9 postdocs and senior researchers, several guest researchers and research assistants, an audiologist, a coordinator, a project controller, a journalist, two technicians and a lab manager. Torsten mentioned 2013 as an essential year when the Oticon Centre of Excellence for Hearing and Speech Sciences (CHeSS) was established with focus on fundamental research. In the same year, another CAHR Consortium, with focus on hearing technology, continued in close collaboration with colleagues from the Danish hearing-aid industry. The group furthermore became a partner in several European networks. Later, the group joined the COCOHA project ("Cognitive Control of a Hearing Aid") and the large scale project BEAR ("Better Hearing Rehabilitation Project") in which the researchers deal with challenges in clinical audiology. A collaboration

between DTU Elektro and Region Hovedstaden was formed. Research on cochlear implants (CI) has become another area of focus. Interacoustics established their research unit (IRU) in the same building and contributes to the supervision of various student projects and other activities. With the new audio-visual immersion lab, the Hearing Systems group studies auditory signal processing and perception in simulated adverse acoustic conditions. Establishing virtual, yet realistic, acoustic environments allows the researchers to better probe and understand the mechanisms in the brain, which may help design and evaluate advanced hearing aid algorithms. "We received very positive feedback at the international research evaluation last year which was nice," Torsten Dau said and continued:

"New opportunities and challenges will come forward as we become part of the new department of "Health Technology".

Read more about the event at [www.hear.elektro.dtu.dk/news](http://www.hear.elektro.dtu.dk/news)



### Volunteers' Day

Photo Borys Kowalewski

The Hearing Systems' researchers invited all test subjects who participated in their experiments. The event, which took place on August 24, gave the researchers the opportunity to thank the test subjects and to tell them more about the experiments they took part in. About fifty guests, volunteers, relatives and friends participated in the event in the Hearing Systems' lab. Associate Professor Jeremy Marozeau and Audiologist Rikke Sørensen welcomed all and thanked them for their contribution to the research. All volunteers had the opportunity to see demonstrations in the lab and learn about some of the projects where the researchers explained their scientific posters. They used also the opportunity to connect to the other test subjects and to exchange experiences.



### Arches in Nottingham

Photo Borys Kowalewski

On November 12-13, four researchers from the Hearing Systems group participated in the ARCHES meeting ('Audiological Research Cores in Europe'), which took place in Nottingham. ARCHES is a European network focusing on hearing science and collaboration within the field. The network consists of several partners from the United Kingdom, the Netherlands, Belgium, France, Switzerland, Spain, Germany and Denmark. The annual meetings focus on the exchange of ideas and the newest research results, with the emphasis on the work of young researchers. This year, 20 posters and 12 contributed talks were presented on a broad range of topics within speech and hearing sciences and audiology.

Professor Torsten Dau gave a panorama talk about the different research activities in the Hearing Systems group. Andreu Paredes-Gallardo gave an oral presentation on "Auditory stream segregation and selective attention for cochlear implant listeners". Posters were presented by Paolo Mesiano (about "Characterizing the role of hearing loss in comodulation masking release: Behavioral measurements and computational model predictions" and by Borys Kowalewski (about a "Perceptual evaluation of signal-to-noise-ratio aware wide-dynamic range compression"). The next ARCHES meeting will take place in Paris in November 2019.



## Staff news



### New Support Team

In September, the Hearing Systems and Acoustic Technology groups employed two new support team members:

Lab Manager Andrew King and Academic Technician Dana Gilbert. Andrew King, born in the UK, did his BSc in Psychology at the University of Hull. He then moved to Manchester where he completed his MSc education in the Acoustic Research Centre at the University of Salford. Andrew did a Ph.D. in Audiology at the University of Manchester. During his time as a PhD student, he spent some time in Denmark. From 2015 to 2018, he was a postdoc at the 'Ecole Normale Supérieure in Paris. Andrew now works as a Lab Manager in the Acoustic Technology group and our Hearing Systems group to support the experimental research carried out in the two groups. In the future, Andrew will also take care of the IT support in the two groups.

Dana Gilbert is specialized in electronics. She just finished her MSc in Physics with Particle Physics & Cosmology, although her main projects evolved around electronics and lasers in a quantum technology research group. Born in Essex (UK), but raised in Lyngby (DK), she decided to move back to England for her undergrad and therefore did her four-year masters at the University of Birmingham (UoB). During her education at UoB, she learned that her passion lies in electronics and general hands-

The new support team. Leftmost: Assistant Engineer Henrik Hvidberg, Lab Manager Andrew King and Academic Technician Dana Gilbert.  
Photo Eva Helena Andersen

on work in research. This, combined with her desire to return to Denmark, made this position at DTU a perfect fit. Together with Assistant Engineer Henrik Hvidberg who has already supported the groups over the last two years, and with Tom Arent Petersen, who has been our IT-expert for many years, Andrew and Dana represent our current technical support team.



In November, a new article was featured at the Carlsberg Foundation's webpage about Sara Miyay Kim Madsen's postdoctoral project awarded by the Carlsberg Foundation. In the article, Sara Miyay Kim Madsen explains her project "The role of perceptual salience in sound segregation." Read more about Postdoctoral Fellowships at [www.carlsbergfondet.dk](http://www.carlsbergfondet.dk)



Jens Hjortkjær  
Senior Researcher

Jens Hjortkjær has been employed as Senior Researcher at Hearing Systems in the field of Cognitive Auditory Neuroscience. His work focuses on using functional neuroimaging and computational models to understand basic aspects of sound processing in the human auditory system. Jens Hjortkjær is also affiliated with the Danish Research Centre for Magnetic Resonance at Hvidovre Hospital.

## PhD defence

On August 31, Andreu Paredes Gallardo successfully defended his PhD thesis "Behavioral and objective measures of auditory stream segregation in cochlear implant users". He now works as a Postdoc in the group.



## New Post Doc project

Computational models of auditory scene analysis for cochlear implant listeners

Andreu Paredes Gallardo

Cochlear implants (CIs) allow severely hearing-impaired listeners to regain some auditory capacities. However, noisy scenarios are challenging for most CI listeners. In such scenarios, the auditory system needs to perceptually group sounds into auditory objects (e.g. a speaker), a process known as auditory scene analysis (ASA). The present project aims to develop and validate a computational model of ASA for CI listeners. Such model might be used in future studies to investigate the effect of factors such as the degree of neural survival, current spread or the impact of new stimulation strategies on ASA.

## New PhD projects



Objective correlates of tinnitus and cochlear synaptopathy

Chiara Casolani

This PhD project focuses on the specific case of tinnitus sufferers with audiological normal hearing. In these listeners, the tinnitus was often initiated by a noise trauma. It has recently been shown that excessive noise exposure can lead to permanent changes in the inner ear without affecting sensitivity to sound, commonly referred to as "cochlear synaptopathy". Making use of recent insights within cochlear synaptopathy, behavioural outcome measures will be combined with novel approaches based on non-invasive electrophysiology, imaging and computational modeling to quantify the presence of tinnitus in these listeners. Finding a connection between tinnitus and cochlear synaptopathy will provide important insights toward the development of better diagnosis and treatment methods.

Exploring innovative hearing aid techniques for tinnitus treatment

Mie Lærkegaard  
Jørgensen



Currently no routine treatment exists for tinnitus patients, despite the fact that an estimated 10-15 % of the population suffer from the perception of phantom sounds. The aim of the current project is to develop improved methods for the management of tinnitus by means of combination hearing aids that provide both standard hearing aid and sound therapy. The project addresses this issue by first investigating whether more complex hearing aid settings can provide long-term tinnitus improvements to patients, that otherwise don't benefit from hearing aids and then investigating sound therapy induced changes in tinnitus-related distress using psycho- and electrophysiological markers.



### Behavioural and electro-physiological correlates of synaptopathy

Jonatan Märcher-Rørsted

An increasing number of patients seeking audiological help are found to have normal hearing sensitivity in standard clinical tests but still experience problems with speech communication in noisy environments. Our recent issue with speech communication in noisy environments has suggested, that such "hidden" hearing-loss can be attributed to dysfunction of synapses in the inner-ear, also known as synaptopathy. The project is part of the international UHEAL synergy project focused on diagnosis of synaptopathy and understanding its perceptual consequences in auditory behavior. It further focuses on detecting behavioral and electrophysiological correlates of synaptopathy in human listeners that are also examined in other parts of the project.

### Effect of the automatic gain control on spatial perception in cochlear implants using normal-hearing listeners in reverberant rooms

Rasmus Østergaard Bendsen,  
Research Assistant



Amplitude compression is often used as a signal-processing strategy in cochlear implants (CIs) and hearing aids (HAs) in order to compensate for the limited dynamic range of sounds. However, such processing can also disrupt the natural characteristics of sound in reverberant environments, leading to a distorted spatial perception. This project investigates the effects of compressive processing on spatial perception in CIs using a vocoder simulation in experiments with normal-hearing listeners. Several compression schemes will be tested, including novel "spatially aware" compression. The results of the project will potentially provide insights into new CI stimulation strategies.

## Other research projects



### Innovative Hearing Aid Research – Ecological Conditions and Outcome Measures

Sergio Luiz Aguirre,  
Early Stage Researcher in the HEAR-ECO project

This PhD project at Eriksholm Research Centre focuses on the reproduction of realistic sounds scenarios and how to apply them for the measurement of listening effort. The long-term goal is to create new tests for examining the benefit of hearing-aid technology on listening effort in an ecologically valid environment. This project is jointly overseen by the Hearing Sciences – Scottish Section research group of the University in Nottingham (William Whitmer and Graham Naylor) and the Eriksholm Research Centre (Thomas Lunner). Additional collaboration with Hearing Systems, DTU, that will explore new ways to create the adequate sound field will be performed in the Audio Visual Immersion Lab (AVIL).



### New clinical profiling and hearing-aid fitting

Silje Grini Nielsen,  
Research Assistant

The last half a year, Silje Grini Nielsen has been working within the BEAR project focusing on new clinical profiling and hearing-aid fitting. New strategies have been tested at Bispebjerg Hospital (BBH), Technical University of Denmark (DTU), and Odense University Hospital (OUH). The experiments are divided into two sections: the clinical profiling and hearing-aid evaluation. In the second part of the experiment, different combinations of hearing-aid setting have been tested on speech intelligibility, noise annoyance, and overall quality. It is now being investigated which test is the most suitable dividing people into four different profiles, and whether there is a correlation between the profiles and the hearing-aid settings.



## Publications (since August 2018)

### Journal papers

Wong D, Fuglsang S, Hjortkjær J, Ceolini E, de Cheveigne A (2018) A comparison of regularization methods in forward and backward models for auditory attention decoding. *Frontiers in Neuroscience* 12, 531

Moncada-Torres A, Joshi S, Prokopiou A, Wouters J, Epp B, Francart T (2018) A framework for computational modelling of interaural time difference discrimination of normal and hearing-impaired listeners. *Journal of the Acoustical Society of America*, 144 (2) P 940–954

Winn M, Wendt D, Koelewijn T, Kuchinsky S (2018) Best practices and advice for using pupillometry to measure listening effort: An introduction for those who want to get started. *Trends in Hearing* 22, P 1-22

Sanchez Lopez R, Bianchi F, Fereczkowski M, Santurette S, Dau T (2018) Data-driven approach for auditory profiling and characterization of individual hearing loss. *Trends in Hearing* 22, P 12

de Cheveigné A, Di Liberto G, Arzounian D, Wong D, Hjortkjær J, Fuglsang S, Parra L (2018) Multiway canonical correlation analysis of brain data. *NeuroImage*, 186, P 728-740

Kowalewski B, Zaar J, Fereczkowski M, MacDonald E, Strelcyk O, May T (2018) Effects of slow- and fast-acting compression on hearing-impaired listeners' consonant-vowel identification in interrupted noise. *Trends in Hearing*, 22 P 1-12

Guérit F, Marozeau J, Deeks J, Epp B, Carlyon R (2018) Effects of the relative timing of opposite-polarity pulses on loudness for cochlear implant users *Journal of the Acoustical Society of America*. 144 (5) P 2751-2763

Buchholz J, Le Goff N, Dau T (2018) Localization of broadband sounds carrying interaural time differences: Effects of frequency, reference location, and interaural coherence. *Journal of the Acoustical Society of America*. 144(4) P 2225–2237

Jensen J, Callaway S, Lunner T, Wendt D (2018) Measuring the Impact of Tinnitus on Aided Listening Effort Using Pupillary Response. *Trends in Hearing*, 22

Laugesen S, Rieck J, Elberling C, Dau T, Harte J (2018) On the Cost of Introducing Speech-Like Properties to a Stimulus for Auditory Steady-State Response Measurements. *Trends in Hearing*, 22 (ISAAR Special Issue).

Kressner A, Westermann A, Buchholz J (2018) The impact of reverberation on speech intelligibility in cochlear implant recipients. *Journal of the Acoustical Society of America*, 144 (2) P 1113-1122

Cubick J, Buchholz J, Best V, Lavandier M, Dau T (2018) Listening through hearing aids affects spatial perception and speech intelligibility in normal-hearing listeners. *Journal of the Acoustical Society of America*, 144 (5) P 2896-2905

Szibor A, Lehtimäki J, Ylikoski J, Aarnisalo A, Mäkitie A, Hyvärinen P (2018) Attenuation of Positive Valence in Ratings of Affective Sounds by Tinnitus Patients. *Trends in Hearing*, 22, P 1–10

Wang, Yang; Kramer, Sophia E.; Wendt, Dorothea; Naylor, Graham; Lunner, Thomas; Zekveld, Adriana A (2018) The Pupil Dilation Response During Speech Perception in Dark and Light : The Involvement of the Parasympathetic Nervous System in Listening Effort. *Trends in Hearing*, 22, P1–11



Hjortkjær J, Kassuba T, Madsen K, Skov M, Siebner H (2018) Task-Modulated Cortical Representations of Natural Sound Source Categories Cerebral Cortex, 128 (1) P 295-306

Scheidiger C, Carney L, Dau T, Zaar J (2018) Predicting Speech Intelligibility Based on Across-Frequency Contrast in Simulated Auditory-Nerve Fluctuations. Acta Acustica United With Acustica, 104 ( 5) P 914-917

Favre-Félix A, Graversen C, Hietkamp R, Dau T, Lunner T (2018) Improving Speech Intelligibility by Hearing Aid Eye-Gaze Steering: Conditions With Head Fixated in a Multitalker Environment Trends in Hearing, vol: 22, pages: 1-13

## Conference Papers

Gil Carvajal JC, Dau T, Andersen T (2018) Consonant-Order Reversals in the McGurk Combination Illusion  
Presented at: 19th Annual International Multisensory Research Forum

Zaar J, Dau T (2018) Predicting consonant recognition and confusions using a microscopic speech perception model . Journal of the Acoustical Society of America, 141 (5) P 3633-3633. Presented at: The 3rd Joint Meeting of the Acoustical Society of America and the European Acoustics Association

Epp B, Manley G, van Dijk P (2018) The mechanisms underlying multiple lobes in SOAE suppression tuning curves in a transmission line model of the cochlea. Part of: To the Ear and Back Again - Advances in Auditory Biophysics (2018) American Institute of Physics. Presented at: 13th International Mechanics of Hearing Workshop

## PhD thesis

Andreu Paredes Gallardo (2018) "Behavioral and objective measures of auditory stream segregation in cochlear implant users"

## Master and Bachelor projects

(Master) Irene Arrieta: Auditory assessment of children with Cochlear Implant. Supervisor: Jeremy Marozeau (DTU)

(Master) Golam Reza Sadeghnia: Development and Evaluation of an External, Steerable Microphone Array for Improving Spatial Selectivity of Hearing Aids. Supervisor: Torsten Dau DTU, Thomas Lunner (Eriksholm Research Centre)

(Bachelor) Liv Moretto Sørensen: Clustering in an array of nonlinear and active oscillators as a model of spontaneous otoacoustic emissions. Supervisor: Bastian Epp (DTU)



Five future philosophical doctors from the Hearing Systems group in the Ghent University Library at the 11th annual SPIN Workshop

