International Symposium on Hearing 2018

On June 10-15, researchers from all over the world travelled to Snækkærsten, Denmark, in order to participate in the 18th International Symposium on Hearing (ISH). This year’s theme was “Hearing: Psychophysics, Physiology, and Models”. ISH has been held approximately every three years in Europe since 1969. The hallmark of this truly interdisciplinary meeting is to bring together well-known researchers, as well as young talents, specializing in psychophysics, physiology and models of hearing. The program consisted of a podium of 51 presentations, each of about 20 min. in length. Each presenter also prepared a paper, which will be published in a special open access issue of Acta Acustica united with Acustica in the autumn of 2018.

The total number of participants, including the podium speakers, was 90 people. There was great support for the meeting from industry, both in the form of financial support and in the form of attendance at the meeting. Read more about ISH and see the program at www.ish2018.dk and at our webpage www.hea.elektro.dtu.dk

The next ISH Conference Symposium will be held in 2021 in Lyon, France.
Cognitive Control of a Hearing Aid (COCOHA)

The news of a thought-controlled hearing aid reached Danish media and was covered extensively in the last few months. The Hearing Systems group participates in the international Cognitive Control of a Hearing Aid project (COCOHA). COCOHA researchers have created a feedback system that uses real-time EEG brain signals to control the sound levels of simultaneous talkers in a simulated multi-talker ‘cocktail party’ scenario. The aim is going forward to create a hearing instrument technology that aids speaker separation by using attention-related brain signals. The Hearing Systems group participates in this project with partners from École Normale Supérieure in Paris, University College London, ETH in Zürich, and Eriksholm Research Centre.

Uncovering Hidden Hearing Loss (UHEAL)

The Novo Nordisk Foundation has awarded DKK 15 million for the collaborative synergy project UHeal with the goal to understand, describe, and diagnose hidden hearing loss. The term ‘hidden hearing loss’ refers to noise-induced damage to synapses in the auditory nerve that can exist without shifts in audiometric thresholds. Although standard audometric tests may not reveal a hearing loss, such neuropathic damage is suspected to cause problems with listening in noisy environments. Yet, the nature and the extent of hidden hearing loss in human patients are unknown. In the UHeal project, three international partners combine expertise in auditory physiology, clinical audiology and MR imaging, with the aim to reveal biomarkers in human patients. The partners are the Hearing Systems group at DTU, The Massachusetts Eye and Ear at Harvard Medical School, and the Danish Research Centre for Magnetic Resonance at Copenhagen University Hospital Hvidovre.

Tinnitus Assessment, Causes and Treatments (TIN-ACT)

Two new PhD projects are starting in the autumn, which focus on tinnitus diagnostics and management. Both projects will combine extensive auditory profiling, subjective measures of tinnitus, and objective electrophysiological indicators of tinnitus-related changes in the nervous system. The aim is to provide new diagnostic tools for tinnitus and to use these tools for designing individualized tinnitus management approaches. The projects will be run in collaboration with Interacoustics Research Unit (IRU) and Widex A/S, and are part of the EU Marie Skłodowska-Curie Innovative Training Network TIN-ACT (Tinnitus Assessment, Causes and Treatments, http://tinact.eu).

Spherical microphone for 3D sound capture

As part of the recent PhD project started by Naim Mansour in the Hearing Systems group, an Eigenmike spherical microphone array was purchased by DTU with sponsorship from Widex A/S. This state-of-the-art technology enables the capture of realistic sound scenarios which can be used to better evaluate hearing aid algorithms.
Visiting Professor from Aalto University

Ville Pulkki, Associate Professor from the Department of Signal Processing and Acoustics at Aalto University, Helsinki, was Visiting Professor at Hearing Systems from January until the end of June. Ville Pulkki’s main focus is on spatial sound generation and perception by amplitude panning techniques. This is particularly interesting and relevant also for the Hearing Systems group, where alternative techniques have been used to recreate sound scenes in the laboratory. The idea of Ville Pulkki’s visit has been to discuss and develop novel methods of sound field reproduction in order to study sound processing and perception in controlled complex acoustic environments.

“Hearing Systems is one of the biggest groups that are active in this research area, and I have also discussions with the Acoustic Technology group. We did acoustical measurements with laser-induced pressure pulses three years ago,” Ville Pulkki explained. “In Denmark there is so much acoustics going on. The Hearing Systems Group has a lot of expertise in auditory perception, technical audiology and applied hearing research. But there is a mutual interest in collaboration between our research groups because some of the studies in the Hearing Systems Group are within the area of spatial audio,” he said.

Those interested in finding out how spatial recordings can actually sound depending on the recordings, had the opportunities to listen to samples from Ville Pulkki’s work in the audio visual immersion lab (AVIL). Torsten Dau, Head of Hearing systems was very pleased to have Ville Pulkki as a guest in the group: “Ville Pulkki is known worldwide for his achievements within spatial audio reproduction techniques and his research on the perception of spatial sound in complex audiovisual environments. Furthermore, he has also worked on functional modelling of auditory brain mechanisms. So we have various areas where we can interact and learn from each other.”
Baltic-Nordic Acoustic Meeting in Reykjavik

About 150 acousticians from the Nordic and Baltic countries met in April in Reykjavik, Iceland for the biennial Baltic-Nordic Acoustics Meeting (BNAM). Our Hearing Systems and Acoustic Technology groups contributed to the event with several scientific presentations. Cheol-Ho Jeong, Finnur Pind, and Sébastien Santurette co-chaired sessions on “Hospital acoustics”, “Computational acoustics”, and “Musical acoustics, hearing, and acoustic communication”, respectively. DTU was also represented at a round table on “Dealing with the increasing demand for acoustics graduates in industry and academia” organized by the Young Acousticians Network.

From Hearing Systems, the results of Bertrand Smits’ MSc project on the effects of concert noise on supra-threshold hearing, which built upon the work of PhD student Pernille Holtegaard, were presented. Sébastien Santurette also presented a review of the group’s recent findings on the effects of musical experience and hearing loss on pitch perception.

From Acoustic Technology, Cheol-Ho Jeong and Ida Ørduk presented the noise and room acoustic conditions in a Korean tertiary hospital and several Danish hospitals. PhD student Finnur Pind also presented his work on acoustic virtual reality. The next BNAM meeting will take place in Norway in two years’ time, and it will be Denmark’s turn to be the host country in 2022.

Hearing Aid Study group

The Hearing Aid Study Group is a new initiative at DTU Hearing Systems from our PhD students to stimulate research collaboration, expand knowledge and skills, and to establish best practices. All of this aims to make our hearing-aid research more solid and grounded in the “real world”. The meetings usually take place every second week. The time is spent on presentations and discussions. Everyone is welcome to participate and to present, including people from other research groups, universities and companies. For more information contact Borys Kowalewski: bokowal@elektro.dtu.dk

Staff news

Katrine Louise Bang Thersmansen, Project Administrator, has left the Hearing Systems group from August 1.

From September 1, Sébastien Santurette starts a position as Senior Researcher at Oticon.
Staff News
PhD Defences

On February 20, Alan Winberg successfully defended his PhD thesis “Perceptual effects of non-linear hearing aid amplification strategies”. Alan Winberg now works as Technical Audiology Specialist at Widex A/S.

On January 18, Christoph Scheidiger successfully defended his PhD thesis “Assessing speech intelligibility in hearing-impaired listeners”. Christoph Scheidiger now holds a position as Advanced Analytics Manager at Amazon, Seattle.

On February 5, PhD student Thomas Bentsen successfully defended his thesis “Computational speech segregation inspired principles of auditory processing”. Thomas Bentsen now works as Development Engineer at Oticon.

On June 26, Francois Guérit successfully defended his PhD thesis “Spectral and temporal processing in electric hearing”. Francois Guérit now works at the University of Cambridge as a Postdoc.

New PhD projects

Audio-visual deep learning
Nicolai Pedersen

This project explores the use of multi-modal deep neural networks (DNNs) to extract and investigate audio-visual speech features. The DNNs are to exploit correlations between higher-level visual and auditory features in speech to obtain and enhance the sounds of individual speakers in cocktail-party scenarios. In the first part of the project, DNN algorithms are used to associate real-time audio streams with facial features in multi-talker audio-visual scenarios. The second part of the project focuses on using a video input and eye-tracking to assist audio source separation with DNNs.

The influence of vision on spatial hearing of hearing-impaired and aided hearing-impaired listeners
Thirsa Huisman

As a side effect of improving speech intelligibility, many hearing-aid processing algorithms degrade the acoustic spatial cues, thereby reducing the ability of aided hearing-impaired people to localize sound sources. Ironically, this ability to locate sound sources allows normal-hearing listeners to separate a target of interest within a complex acoustic environment, thus aiding speech intelligibility. However, localizing sound sources does not rely solely on acoustic spatial cues; it relies on both acoustic and visual cues. Thus, hearing-impaired listeners may rely more on visual cues to compensate for their degraded acoustic spatial cues. This PhD project aims to investigate the influence of vision on sound localization, especially for hearing-impaired and aided hearing-impaired listeners, potentially allowing manufacturers and clinicians to better balance the trade-offs of different algorithms.

Lanchen Fan is a fifth-year PhD student in Biomedical Engineering at the University of Rochester, working with Dr. Laurel Carney. During July and August, she has been a visiting student in the group working on the area of computational models.
Characterizing con-
sequences of hearing
impairment and hearing-
aid processing on speech
perception in competing-
talker scenarios
Paolo Mesiano

Speech comprehension is a crucial component of all social in-
teractions. Normal-hearing (NH) listeners exhibit exceptional
abilities in understanding a target talker when additional com-
peting talkers are speaking simultaneously. In contrast, hear-
ing-impaired (HI) listeners experience great difficulties in such
situations. Currently, the perceptual mechanisms that facilitate
these abilities in NH listeners and limit the performance in HI
listeners are not entirely understood. This project aims to extend the current knowledge about the
processing mechanisms responsible for successful speech re-
ception in competing-talker scenarios, which will be of value in
the development of hearing-aid solutions that aim to improve
the users’ listening experience.

Improving cochlear
implant performances
with new pulse shapes:
a multidisciplinary ap-
proach
Charlotte Amalie Navntoft

A cochlear implant (CI) can provide a sense of hearing to deaf
people. A major factor limiting the performance in CI users is,
however, the spread of electric current when an electrode is
stimulated. In this project, the current spread with new electri-
cal pulse shapes will be investigated. It is hypothesised that nov-
el non-rectangular pulse shapes produce a more efficient and
focused stimulation in a CI animal model and a better speech
perception in CI users compared to the rectangular pulse
shapes used in current CI devices. If successful, this project may
be a significant step towards improving sound perception in
many people with severe hearing impairment.

New Post Doc project

Validation of new strat-
egies (Better Hearing
Rehabilitation Project,
BEAR)
Oscar Cañete

One of the BEAR project’s goals is the development of a new
diagnostic test battery that can form a solid base for a clinician
to make decisions regarding the choice of the device and the
initial fitting as the development of new outcome measures to
effectively measure the benefit for the individual hearing-aid
user. The validation of the new strategy vs the existing strat-
ey by objective assessment of aided performance in clinical
populations plays a key role within BEAR. In this project, Oscar Cañete will contribute with the clinical implementation of the
BEAR test batteries and with the design of the clinical hearing-
aid fitting trials in collaboration with the BEAR project in Aal-
borg and Odense.

Speech processing
in hearing impaired
Chinese
Florine Bachmann

All over the world, older adults suffer from speech comprehen-
sion difficulties. Yet, most speech intelligibility research is being
conducted in non-tonal language contexts. In tonal languages,
pitch modulations not only determine prosody, but also convey
lexical meaning. These pitch modulations covary with changes
in the temporal envelope, and neural entrainment to the tem-
poral envelope facilitates speech understanding. Hence, tonal-
ity likely impacts the importance of selected auditory cues on
speech understanding. This project aims to identify crucial cues
for speech intelligibility in Mandarin speakers. Based on the re-
sults, hearing solutions might offer improved speech intelligi-
bility in tonal languages.
Publications (since January 2018)

Journal papers


Conference Papers


Datasets

Sørensen AJ, Fereczkowski M MacDonald E (2018) Task dialog by native-Danish talkers in Danish and English in both quiet and noise


Book production

Software


PhD theses

Christoph Scheidiger (2018) “Assessing speech intelligibility in hearing-impaired listeners”

Thomas Bentsen (2018) “Computational speech segregation inspired principles of auditory processing”


Francois Guérit (2018) “Spectral and temporal processing in electric hearing”

Master projects


Andreas Eckey. Conversational Dynamics: Manipulation of acoustic cues and the effect on turn-end prediction performance. Supervisor: Ewen MacDonald (DTU)

Rasmus Bendsen. Spatial perception in reverberant environments with cochlear implant recipients
Supervisors: Abigail Anne Kressner, Torsten Dau (DTU)

Evan Ho Wei Li. Modeling of speech quality in telecommunication devices.
Supervisors: Marton Marschall, Torsten Dau (DTU) Wookeun Song (B&K)