

# NEWSLETTER

HEARING SYSTEMS IN PROFILE

August 2015



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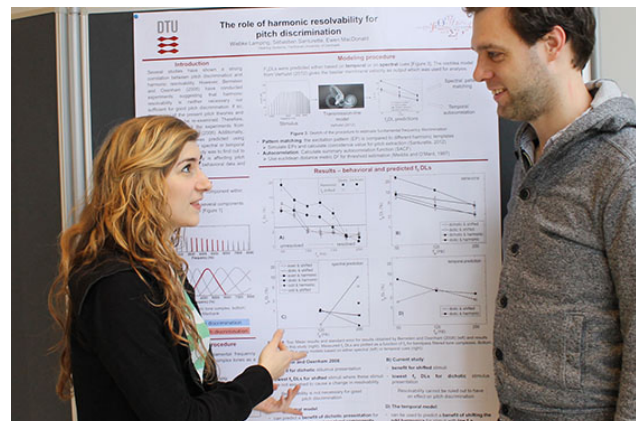
## News, awards and prizes



### The Lothar Cremer Award

Once per year, the "Deutsche Gesellschaft für Akustik" (DEGA) awards the "Lothar Cremer Award" for outstanding achievements of young academics. This year, Dr. Bastian Epp, assistant professor at Hearing Systems, received the award for his contributions within physiological and psychological acoustics. In particular, Bastian Epp strongly contributed to a better understanding of the processing of sound in the human inner ear and consequences both for the generation mechanisms of so-called otoacoustic emissions as well as the perception of complex sounds.

Photo By Joachim Rode



### The DEGA Student Grant

The DEGA grant encouraged ten young acousticians to visit the DAGA conference. This included a free participation at DAGA 2015 in Nürnberg, a travel allowance of 250€ and a one-year DEGA membership. This year, two out of ten young researchers that received the grant were from the Hearing Systems group: PhD students Axel Ahrens and Wiebke Lamping. Both researchers were happy about the acknowledgement: "I'm excited to go to the DAGA conference for the first time accompanied by experienced colleagues from our team," Axel Ahrens says and Wiebke Lamping agrees: "Even though we are 'only students' it's recognition for good work. This is also a great opportunity to represent DTU and the Hearing Systems group at an international level for feedback and experience," she says. Photo by Eva Helena Andersen



HRH Crown Princess Mary was impressed by the facilities demonstrated by Hearing Systems researchers Jens Hjortkjær and Gerard Encina Llamas. Photo by Alexandre Chabot-Leclerc.

## Royal interest in the research at Hearing Systems

HRH Crown Princess Mary was especially impressed by the cognitively-controlled hearing aid when she visited DTU at the Festival of Research, April 23-25. In addition to participating in the official program the Crown Princess also got time to talk to many of DTU's researchers. She was very fascinated by the many projects, but especially Hearing Systems with the eye-tracking facilities, caught the royal guest's attention. The cognitive hearing instrument not only receives audio signals, but also signals from the user's brain and eyes to amplify the sound sources towards which the listener turns his or her attention. In situations where several people are talking at the same time like at a cocktail party, this new technology is able to identify and amplify the sound sources that the user is trying to focus on.

## Journal Club

The newly formed journal club has the goal to communicate research topics from journal papers within our group. It aims at providing insight knowledge on the various topics people work on in our group.

The presented work will mainly be from other research groups all over the world that was published recently in high-profile journals within the presenter's field. The journal club will help all attendees to extend their own radius of knowledge and might influence new research questions, projects and hypotheses. Furthermore, it will help the researchers (mainly the PhD students) to improve our "question asking" and presenting skills that we need at conferences. The journal club takes place every second Tuesday.



Photo by Eva Helena Andersen

## Hearing researchers reaching new audiences

The Hard of Hearing Association, a business academy in Southern Denmark with around 100 students and a rehabilitation centre in Roskilde with audience from hospitals, the hearing industry and CI-users, showed large interest when two of Hearing Systems' researchers volunteered for 'Book a researcher' during the Festival of Research April 23-25.

"We guys work on modelling the human system in a technical way in the hope of improving hearing aids. You guys help hearing impaired people day in and day out and know the practical challenges. I am glad we get to meet," Christoph Scheidiger, PhD student at Hearing Systems, said to the audience of the Rehabilitation Centre who followed his lecture of how the brain may translate speech.

"It was fantastic to be in touch with a researcher in this way," one of the attendants at the Rehabilitation Centre said afterwards. Also at the business school several students approached Christoph Scheidiger afterwards. One of the students said he had decided to apply for a Master at DTU Elektro to learn more about acoustics and auditory perception.

Jeremy Marozeau, Associate Professor at Hearing Systems, had very positive feedback as well with his lecture about restoring the ability to listen to music for people with cochlear implants. Several people asked questions during the talks and came to the researchers afterwards to discuss specific questions.

"Normally, we researchers are in a "scientific bubble". It has been interesting being challenged to talk to another audience," Jeremy Marozeau said..



At the lab opening everybody had a chance to try the new facilities

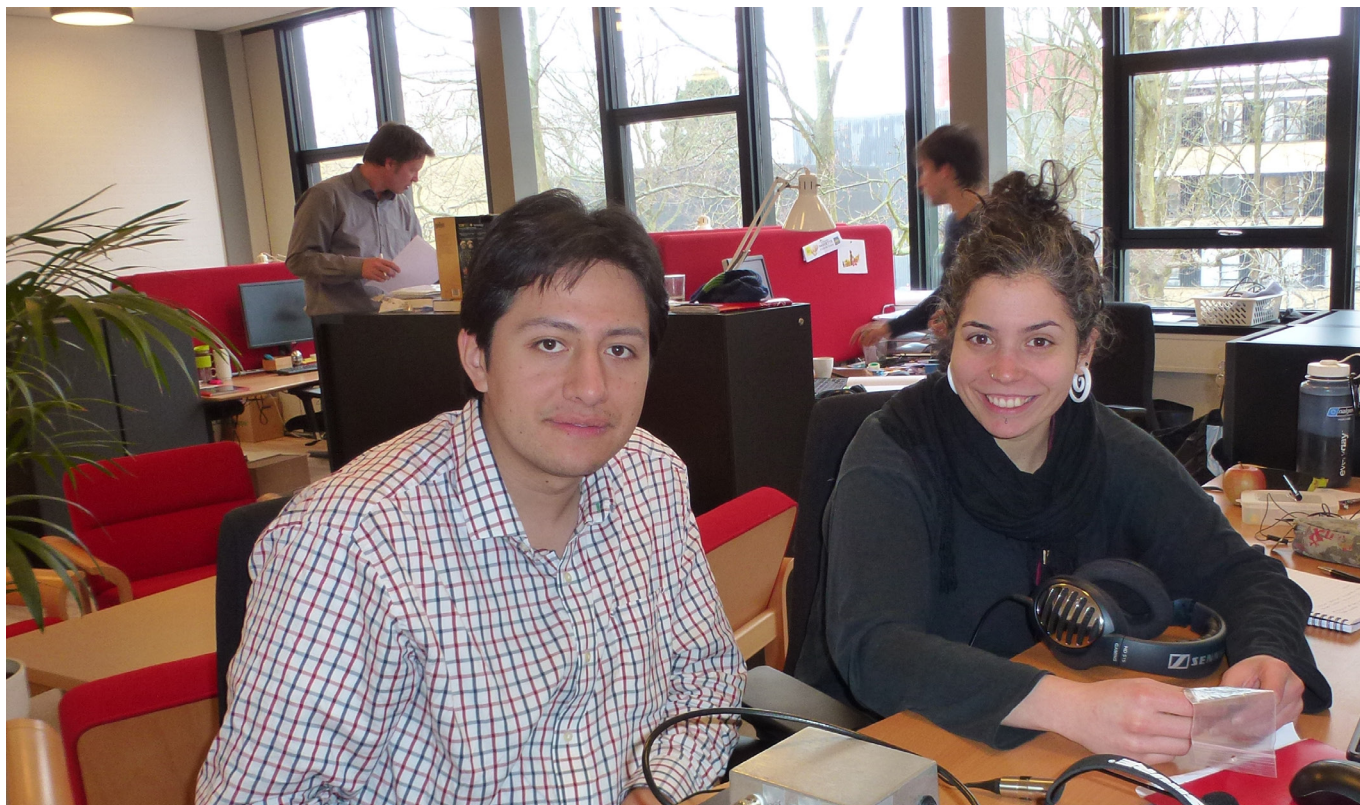
Photo by Eva Helena Andersen

## Lab opening

More than a hundred people filled the new buildings on Friday, June 26, at the opening of the new Hearing Systems laboratories. Søren Nielsen, General Manager of Oticon A/S, was representing the Oticon Foundation:

"A lot of research has to be done to understand the "Cocktail Party Problem". There is a long history of knowledge about hearing related issues in Denmark exemplified by three Danish companies Widex, GN ReSound and Oticon who produce half of all hearing aids in the world. We want Denmark to maintain this position at the very forefront in an international context and for the researchers in this field at DTU to be the very best. The three companies together employ more than a thousand engineers working with the uniqueness of making products that help people with hearing problems. We can only support this with a very strong university environment. Competing for the best talents in the world is also a question about offering the most interesting research fields and facilities," Søren Nielsen concluded.

Torsten Dau, Group Leader showed a video of the construction of the new audio-visual immersion lab, as a giant weaving in several layers with the listening chair hovering in space and mounting speakers at the bottom in the middle of the room and on top. A film crew from the company KEF, who has delivered the 64 loudspeakers in the new Audio Visual Immersion Lab, was also doing an interview with Torsten Dau about the future research. After the speeches, everybody had a chance to try the new facilities.



## Visiting PHD students at Hearing Systems

The Hearing Systems group got two new visiting PhD students this spring: Rachel Bou Serhal from Université de Quebec, Montréal in Canada and Arturo Moncada-Torres from KU Leuven in Belgium.

As part of the Erasmus Mundus Auditory Cognitive Neuroscience (ACN) Network, Rachel Bou Serhal, electrical engineer, wanted to come to Hearing Systems at DTU Elektro.

"DTU is definitely well known in our field, and Ewen Macdonald's [Associate Professor DTU] research aligns very well with what we are trying to do. So it is the perfect exchange. In the ACN network there are several partners we can collaborate with, and I researched each of them. When I got to DTU it seemed like the best fit because of our research. I'm an electrical engineer, and a lot of the auditory cognitive network is mostly psychology," Rachel Bou Serhal says.

Arturo Moncada-Torres from KU Leuven in Belgium visited the group at the same time as a part of his PhD project within the ICanHear framework (Improved Communication through applied Hearing Research).

"Here in this group at DTU, they have a very strong engineering background and also a lot of experience with mathematical

modelling of the hearing system in general. So I think it fits perfectly with the objectives of my project. In Leuven, the lab is a lot of combination between engineering and audiology which is also a very good approach; but particularly for my project, I think it is also good to have this "hard core engineering backbone". Here it's a perfect place, and the faculty has been really helpful and welcoming," he says.

Photo by Eva Helena Andersen

Hearing Systems is a member of two European Marie Curie Initial Training Networks on "Investigating Speech Processing in Realistic Environments" (INSPIRE) and "Improved Communication through Applied Hearing" (ICanHear).

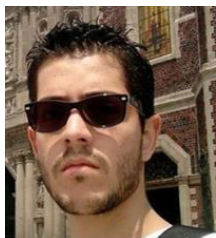
In addition, we received funding for the European Collaborative Project "Reading the world with Two Ears" (Two!Ears), as well as support for external research stays of PhD students at North American Universities through the Erasmus Mundus Program "Auditory Cognitive Neuroscience" (ACN) Program and the Cognitive Control of a Hearing Aid Horizon 2020 (COCOHA). These networks are particularly valuable and we expect that we will be able to continuously attract excellent researchers to our group both at junior and senior levels.

## Staff news

We have to say goodbye to:



Remi Julien Blaise Decorrière has started as Audiology and DSP Developer at Oticon August 17 2015



Juan David Gil Corrales has started as Developer at Odeon A/S since April 2015



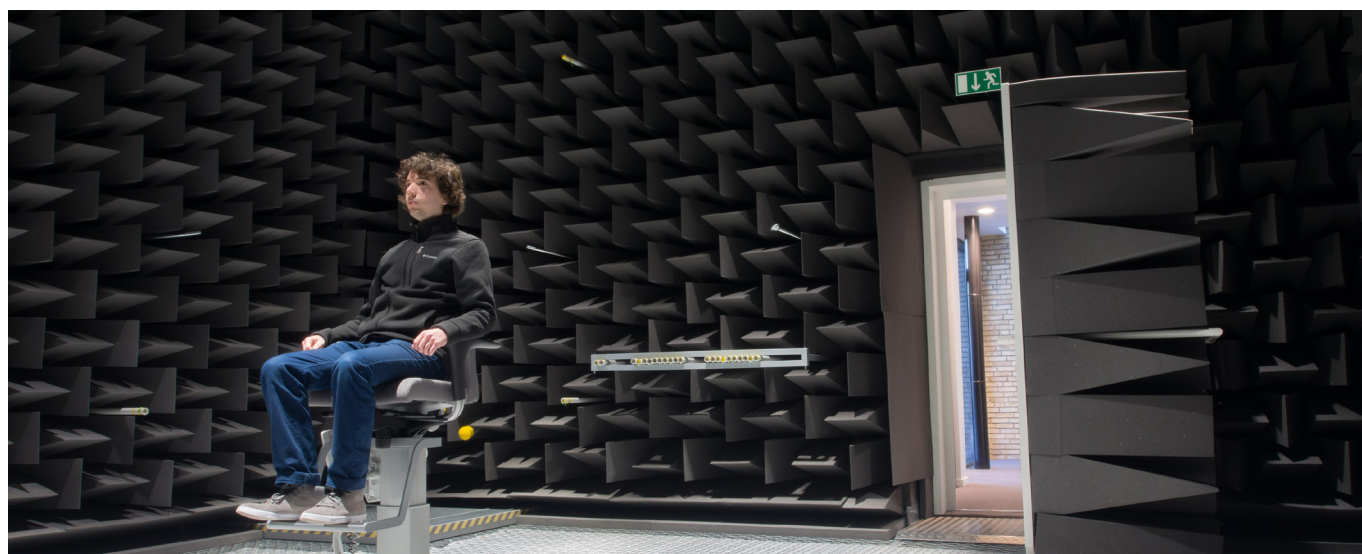
## New Postdoc projects



“Simultaneous-masking based compression estimates for extended clinical diagnosis”

Michal Feręczkowski

Currently, the main method used to diagnose hearing loss and fit hearing aids is based on a measurement of the pure-tone sensitivity at different frequencies (the audiogram). Researchers agree that additional measures are needed. Experiments based on a forward-masking paradigm have been proposed as a possible solution. However, the paradigm’s perceptual complexity limits the approach. In this project, we investigate the clinical applicability of a perceptually easier, simultaneous-masking experiment. The experiment will be run on a clinical population with use of our recently developed, time-efficient, threshold-tracking method - the Grid. The main focus is on estimating peripheral compression and frequency selectivity.



Testing the chair in the Audio Visual Immersion Lab. Photo by Jens Cubick

## New PhD projects



**"Behavioural and objective measures of auditory streaming in cochlear implant users"**

**Andreu Paredes Gallardo**

Hearing devices such as hearing aids or cochlear implants (CI) restore the ability to understand speech in quiet remarkably well. However, listening to music or a single voice in a crowded room is still challenging for most people with impaired hearing. Both music perception and speech-in-noise understanding involve auditory stream segregation, a perceptual process by which the human auditory system organizes sounds from different sources into perceptually meaningful elements. Although hearing impairment reduces the ability to segregate streams, few studies have investigated streaming in CI users. This PhD project investigates auditory streaming in CI listeners through psychophysics and electrophysiology.



**"Characterizing the effects of distortion and audibility loss on speech recognition"**

**Helia Relaño Iborra**

Hearing impairment is heterogeneous and varies strongly among listeners. While some deficits may only lead to audibility loss, compensated for by sound amplification in a hearing instrument, other deficits lead to a "distortion" loss which requires more complex compensation strategies. Currently, despite substantial knowledge on sensorineural hearing loss and the development of computational models of cochlear processing, no model successfully describes the relation between individual impairment and speech recognition. The present project tries to extend current model approaches for speech perception in NH-listeners towards HI-listeners in order to develop a model framework that facilitates the analysis of individual impairment factors on speech recognition.



**"Improving music perception and voice pitch in cochlear implant users"**

**Wiebke Lamping**

Despite the success of the cochlear implant (CI), its users still face multiple difficulties in hearing, possibly connected to a poor pitch perception. In this project the mechanisms of pitch perception will be investigated in CI users through behavioral and objective measurements. The main objectives will be to understand the interaction and the salience of the different pitch dimension caused by changes in place and rate of stimulation, amplitude modulation and synchronicity across the electrodes. Different methods will be tested to improve these pitch dimensions and eventually enhance the perception of pitch by CI users.



**"Characterizing neural mechanisms of attention-driven speech processing"**

**Søren Fuglsang**

A fundamental limitation of today's hearing aids is that the ability to selectively attend to one sound source among many sources rarely can be restored by amplification since it involves an unknown component of top-down attention control. Recently developed in-ear EEG devices are envisioned to form the basis for future "cognitively controlled" hearing aids that use neural input to selectively amplify attended speakers or other sound sources. The current project investigates the cortical mechanisms involved in attention-driven speech processing. The aim is to develop models of attention-driven speech processing that can be implemented in cognitively controlled hearing aids and used to identify attended sound sources from EEG signals. To obtain this, the project combines a stimulus reconstruction approach with detailed computational models of auditory signal processing, with in-ear EEG electrodes.

*This project is supported by the COCOHA Horizon 2020 Project*

## Recent publications

### Recent articles

Innes-Brown H, Marozeau J (2015) Auditory Processing of Temporal Fine Structure: Effects of Age and Hearing Loss  
Journal of the Acoustical Society of America, 137 (1) 525

Decorsière R, Søndergaard P, MacDonald E, Dau T (2015) Inversion of Auditory: Spectrograms, Traditional Spectrograms, and Other Envelope Representations  
IEEE Transactions on Audio, Speech and Language Processing, 23 (1) 46-56

Jørgensen S, Decorsière R, Dau T (2015) Effects of manipulating the Signal-to-Noise Envelope Power Ratio on Speech Intelligibility  
Journal of the Acoustical Society of America 137 ( 3) 1401–1410

Marozeau J, McDermott H, Swanson B, McKay C (2015) Perceptual Interactions Between Electrodes Using Focused and Monopolar Cochlear Stimulation. Journal of the Association for Research in Otolaryngology 16 (3) 401-12

Wendt D, Kollmeier B, Brand T (2015) How Hearing Impairment Affects Sentence Comprehension: Using Eye Fixations to Investigate the Duration of Speech Processing  
Trends in Hearing 19 (1)

### Conference papers

Gil Corrales J, Song W, MacDonald E (2015) Reproduction of Realistic Background Noise for Testing Telecommunications Devices.  
Presented at 138th International Audio Engineering Society (AES) Convention, Warsaw

May T, Ma N, Wierstorf H, Brown G (2015) A Machine-Hearing System Exploiting Head Movements for Binaural Sound Localisation in Reverberant Conditions. Presented at 40th IEEE International Conference on Acoustics, Speech and Signal Processing, Brisbane

May T, Ma N, Brown G (2015) Robust Localisation of Multiple Loudspeakers Exploiting Movements and Multiconditional Training of Binaural Cues. Presented at 40th IEEE International Conference on Acoustics, Speech and Signal Processing, Brisbane

Ioannidou C, Santurette S, Jeong C (2015) Annoyance of Wind-Turbine Noise as a Function of Amplitude-Modulation Parameters  
Presented at 169th Meeting of the Acoustical Society of America, Pittsburgh, PA

Santurette S, de Kérangal M, Joshi S (2015) Effects of Harmonic Roving on Pitch Discrimination  
Journal of the Acoustical Society of America, 137, 2226 Presented at 169th meeting of the Acoustical Society of America Pittsburgh, PA

Zaar J, Dau T (2015) Auditory Correlates of Stimulus-Induced Variability in Consonant Perception. Presented at: DAGA 2015, Nürnberg

Fereczkowski M, Kowalewski B, Dau T, MacDonald E (2015) Time-Efficient Multidimensional Threshold Tracking Method.  
Journal of the Acoustical Society of America, 137 (4) 2228  
Presented at 169th Meeting of the Acoustical Society of America, 2015, Pittsburgh, PA

Lamping W, Santurette S, MacDonald E (2015) The Role of Harmonic Resolvability for Pitch Discrimination  
Presented at DAGA 2015, Nürnberg

Agerkvist F, Torras Rosell A, McWalter R (2015) Improvements in Elimination of Loudspeaker Distortion in Acoustic Measurements.  
Presented at 138th International Audio Engineering Society (AES) Convention, 2015, Warsaw

Ahrens A, Joshi S, Epp B (2015) Spektrale Gewichtung von interauralen Zeit- und Pegelunterschieden zur Lateralisierung von Breitbandsignalen. Presented at DAGA 2015, Nürnberg

Eckey A, MacDonald E (2015) Exploiting Deep Neural Networks and Head Movements for Binaural Localisation of Multiple Speakers in Reverberant Conditions. Presented at DAGA 2015, 2015, Nürnberg

May T, Bentsen T, Dau T (2015) The Role of Temporal Resolution in Modulation-Based Speech Segregation  
Presented at Interspeech 2015, Dresden

## Conference posters

Epp B, Sanchez R (2015) Extraction of OAEs During Multi-Frequency ASSR Recordings With the Goal to Estimate Peripheral Compression  
Presented at 38th Annual MidWinter Meeting of the Association for Research in Otolaryngology, Baltimore, MD

Bianchi F, Santurette S, Wendt D, Dau T (2015) Effects of Musical Training on Pitch Discrimination of Resolved and Unresolved Complex Tones. Presented at 38th Annual MidWinter Meeting of the Association for Research in Otolaryngology, 2015, Baltimore, MD

Müller J, Wendt D, Kollmeier B, Brand T (2015) Using Eye Movements for Analyzing the Influence of Linguistic Complexity, Noise, and Hearing Loss on Sentence Processing Time. Presented at the International H4all Symposium in Oldenburg, 2015

Ahrens A, Joshi S, Epp B (2015) Spectral Weighting of Binaural Cues: Effect of Bandwidth and Stream Segregation  
Presented at: 38th Annual MidWinter Meeting of the Association for Research in Otolaryngology, 2015, Baltimore, MD

Joshi S, Dau T, Epp B (2015) A Model of Auditory Nerve Responses to Electrical Stimulation  
Presented at 38th Annual MidWinter Meeting of the Association for Research in Otolaryngology, 2015, Baltimore, MD

Zaar J, Dau T (2015) Sources of Variability in Consonant Perception and their Auditory Correlates  
Presented at 169th Meeting of the Acoustical Society of America, 2015, Pittsburgh, PA

Bianchi F, Santurette S, Fereczkowski M, Dau T (2015) Relation between Temporal Envelope Coding, Pitch Discrimination, and Compression Estimates in Listeners with Sensorineural Hearing Loss  
Presented at 169th Meeting of the Acoustical Society of America, 2015, Pittsburgh, PA

Valdés-Laribi H, Wendt D, MacDonald E, Cooke M, Mattys S (2015)  
Informational Interference from a Competing Talker: a Thought-Provoking but Elusive Construct  
Presented at: The Third International Conference on Cognitive Hearing Science for Communication, 2015, Linköping, SE

### PhD thesis

Feręczkowski M (2015) Time-efficient behavioural estimates of cochlear compression. Associate Professor Ewen MacDonald (Supervisor), DTU Elektro; Torsten Dau (Co Supervisor) Morten Løve Jepsen, Widex (Co Supervisor) Technical University of Denmark

### MSc projects 2015

Teaching a cochlear implant how to speak Danish. Veit Lukas Goßmann.

Supervisors: Jeremy Marozeau (DTU), Ewen MacDonald (DTU), David Morris (Co-supervisor KU)

The effect of cognitive load on auditory processing. Mhairi Riddet.

Supervisors: Ewen MacDonald (DTU) Torsten Dau (Co-supervisor DTU) Sven Mattys (The University of York)

Subjective and objective assessment of vehicle audio systems. Álvaro Monreal Cantó.

Supervisors: Ewen MacDonald (DTU), Wookeun Song (B&K)

Modeling the intelligibility of time-compressed speech. Søren Fuglsang.

Supervisors: Oded Ghitza (Boston University), Torsten Dau, Johannes Zaar (DTU)

Analysis and synthesis of environmental sounds based on auditory processing principles. Jan David Brümmerstedt.

Supervisors Torsten Dau and Richard McWalter (DTU)

Analysing the effects of auditory processing and the decision metric on speech intelligibility prediction. Helia Relano Iborra.

Supervisors Torsten Dau, Søren Jørgensen (Oticon) and Christoph Scheidiger (DTU)

### BSc and other projects 2015

Evaluation of a clinical auditory profile in hearing-aid candidates. Nikoline Thorup. *Special Project*

Supervisors Morten Friis (RH/KU), Sébastien Santurette (DTU), Erik Kjærbøl (BBH), Søren Jørgensen (ex-DTU)

Implications of articulatory variability for consonant perception modeling. Dmitry Vasilev. *BSc*

Supervisors Johannes Zaar, Sébastien Santurette, Bastian Epp (DTU)



The 'AVIL-TEAM' mounting the Audio Visual Immersion Lab. Photo by Gusztáv Löcsei

