Services and technologies for hearing devices and hearing support

offered by HörTech, Hörzentrurn Oldenburg, Hearing, Speech and Audio Technology at Fraunhofer IDMT and the Cluster of Excellence Hearing4all

June 12th 2019
Dear project partners, colleagues and friends

you are kindly invited to join us for our 3rd Company Showcase & Barbecue in Oldenburg on Wednesday, June 12th, from 15.00 pm to 18.30 pm. This event provides an overview of the current hot topics at HörTech gGmbH, Hörzentrum Oldenburg GmbH, Hearing, Speech and Audio Technology at Fraunhofer IDMT and the Cluster of Excellence Hearing4all.

Program
15.00 Welcome & Overview
   Prof. Dr. Dr. Birger Kollmeier, Cluster of Excellence Hearing4all
15.15 New topics in Research & Development
   Dr. Jörg-Hendrik Bach, HörTech
15.30 Open demonstration session: See, feel and discuss with us!
16.30 From Hearables to Cochlea Implants - Tools for innovative Health Care Research
   Dr. Markus Meis, Hörzentrum Oldenburg
16.45 Hearing support beyond medical use
   Dr. Jan Rennies-Hochmuth, Hearing, Speech and Audio Technology at Fraunhofer IDMT
17:00 Open demonstration session: See, feel and discuss with us!
18.30 Barbecue in the Auditory Garden

Please register by May 24th via mail to company-showcase@hoertech.de or on www.company-showcase.de.
If you have any further questions please do not hesitate to contact us!
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Self-fitting with hearing aids
Adjust your individual sound preferences

This demonstration is for everybody to try out live during the Company Showcase and Barbecue. You will be equipped with a research hearing aid with ear pieces and can connect your smartphone to the hearing aid to adjust the sound to your individual sound preferences. The intuitive user-interface allows for volume, sound and compression individualization. The fitting is based on a binaural loudness equalisation (trueLOUDNESS). The available parameter range is based on hundreds of trueLOUDNESS measurements, so that as much of the hearing loss as possible is covered by the self-fitting procedure. Take a device, try it out and report back to us from your experience with the self-fitting hearing aid!

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The acoustically transparent hearing device

A mobile real-time research device with acoustic transparent sound presentation

The acoustically transparent hearing device is a mobile, real-time research device that integrates a chain of innovative real-time signal processing algorithms with a custom earpiece hardware. The main objective of the device is to provide sound perception with the device switch on comparable with the open ear.

We combine a hardware setup that includes a custom-made multi-microphone electro-acoustic earpiece with signal processing algorithm for acoustic feedback suppression and sound pressure equalization implemented in the Master Hearing Aid. The acoustic feedback suppression algorithm optimally exploits the specialized multi-microphone layout and consists of a robust fixed spatial filter that steers a spatial null towards the hearing device receiver, thus achieving excellent suppression of the acoustic feedback component. The sound pressure equalization algorithm modifies the signals such that in superposition with the leaking sound the acoustic perception of an open ear canal is achieved. This combination can be used as a basis for additional sound processing to achieve high audio quality comparable to the open ear while at the same time benefiting from, e.g., spatial noise reduction algorithms.

For the visitor of this demonstrator it will be possible to experience the prototype acoustically transparent hearing device by listening to the dummy head’s ears through headphones, while the device is processing the sound in real-time.

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Oldenburg Measurement Applications 2.0

New features

The software “Oldenburg Measurement Applications” has been developed in order to offer audiologists an instrument which allows to conveniently conduct new methods in hearing diagnostics using a flexible and modular system, no matter if their workplace is a clinic, a research facility or in the hearing acoustics branch. This includes classical speech tests as well, for instance, loudness scaling and modern, adaptive speech tests in quiet and in noise. In our demonstration we would like to introduce you the new features of OMA 2.0.

• New user interfaces
• 19 Matrix Tests, 5 Simplified Matrix Tests Speech tests now support different interfering noises included in the distribution (e.g. ICRA)
• Speech tests with headphones with virtual spatial acoustics with HRTF’s included in the distribution or own impulse responses
• Multiple interfering noise signals included, installation of own noise signals
• Realtime DSP interfaces (MATLAB and VST)
• Support of database servers „Firebird“ and „Microsoft © SQL Server“
• Extended data export (XML format)
• Optional automatic PDF creation
• Supports Windows 7 to Windows 10

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Shortened digit triplets test
Swift self-screening speech tests in noise

The digit triplets test can be used for rapid screening or self-screening of communication abilities, e.g. in scientific studies, for customer performance monitoring or even marketing purposes. It is a speech-recognition-in-noise test using spoken combinations of three digits, presented in a noise background. It is available on different platforms, and in various languages. For years now, it has proven to be a reliable screening tool.

Two new versions of the digit triplets test are available now. They are optimized in respect of speed and accuracy. One produces threshold estimates in about two minutes. The other compares the customer performance to a threshold value and produces a pass or fail result in about one minute. The latter is especially suited for screening purposes. Both shortened tests yield the same accuracy as the well-established test procedure.

The test may be performed on a website, with stand-alone measurement software using special devices like audiometers, as an app, by telephone or with a software solution that is customized to your individual needs. The tests combine the additional advantages of uncalibrated operation with consumer devices and large subject numbers with a standardized procedure via web servers. Due to the simple instructions, the digit triplet tests are also very suitable for automatic and self-screening operation.

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ACALES
Listening effort scaling

Try out our adaptive method for subjective listening effort rating, “ACALES”. It is quite common that hearing-impaired people report good speech reception, but a high effort is required to really get all the words. A better hearing aid may not improve the absolute speech intelligibility (number of words correct), but would reduce the effort required to follow the conversation. With ACALES you can measure the required listening effort and evaluate the difference between different hearing aids, different algorithms, different fittings, etc.

In noisy environments hearing impaired listeners often describe communication as tiring and effortful although they understand nearly everything. A major benefit of hearing systems is not only to improve the intelligibility but also to reduce the effort to understand, i.e. the listening effort. Since more than 10 years we develop tools to measure listening effort in the lab.

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These two demonstrators show real-time audio processing coupled with mobile EEG recordings. Both audio processing and EEG recording can be controlled through smartphones.

The first demonstrator closes the auditory loop in real-time. From an EEG signal recorded with cEEGrids and mobile amplifiers, the alpha-level is extracted and directly translated into a control parameter for the hearing device (here: gain).

The second demonstrator shows the feasibility to process inputs online from different external devices, in this case simultaneous inputs of EEG data and audio envelope through Bluetooth. An Android app computes the cross-correlation of the two signals and visualizes the cross-correlation coefficients and the two extracted signal envelopes, indicating attention of the user.

Hörzentrum Oldenburg provides medical and audiological care, research and development, and contractual hearing device studies serving all major international Hearing Device manufacturers. Within the contractual studies, Hörzentrum Oldenburg designs and performs the specific studies in close collaboration to the industry in order to individually evaluate and benchmark hearing related products in detail. In order to implement this expertise, physicists, psychologists, audiology, computer scientists, ENT-doctors and hearing aid acousticians are working together in the Hörzentrum as a single unit. Standard audiological test methods as well as advanced methods like e.g. speech intelligibility tests in dynamic acoustic TASCARpro scenes with moving target signals, virtual hearing aid for direct (double-) blind paired comparisons of hearing aids, localization measurements with headtracking, or listening effort scaling are included in the audiological toolbox of Hörzentrum Oldenburg. With the help of our 2000 test persons, we investigate hearing products within laboratory tests, ‘intermediate’, and daily life tests; covering the whole range of high reliability to high ecological validity.

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As an audiologist, imagine your client is complaining about the hearing aid when they last visited a church. Wouldn’t it be great to put your clients virtually into a church and adjust the hearing aid parameters in the virtual scene to satisfy your client’s needs?

This demonstrator creates an acoustic environment for the fitting session which is representative of real-life situations. This is achieved by creating tailor-made virtual acoustic scenes which are presented in the free field using a loudspeaker array in the audiologist’s fitting room. The audiologist is equipped with a simple user interface based on HörTech’s binaural broadband loudness compensation strategy, trueLOUDNESS, to adjust processing parameters in this situation.

SITA project, Speech Intelligibility Transformation & Autocorrection: Research and development of novel solutions to instrumentally measure and enhance speech intelligibility of complex television and multimedia content - without the need of a reference signal.

earls, the product: Ready-to-connect TV hearing system set with transmitter and pocket receiver.

TOADO, the new audio development platform: So that call centre agents can set the sound configurations for telephone conversations to meet their individual needs, experts at Fraunhofer IDMT have developed a convenient application based on the interaction of a wide variety of algorithms. The device is easily installed between the telephone system and the agent’s headset. Individual presets make it possible to adjust the device to personal hearing preferences and habits.

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The Cocktailparty-effect describes the ability of normal hearing individuals to focus on a particular speaker and suppress surrounding noise. This ability is often lacking or insufficient in many individuals with hearing impairments. Modern hearing aids are able to separate signal from noise quite well, but in cocktail party scenarios, they are not capable of detecting the signal of interest. In order to do that an interaction with the hearing aid user is necessary, but is not yet available. In the mEEGaHStim project electroencephalography, audio-signal processing and transcranial electrical stimulation will be combined to establish this aforementioned missing interface. The planned system is a hearing device, worn by a user, which contains a built-in feedback loop delivering information regarding the individual’s attentive state by means of a brain-computer-interface.

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Intelligent voice input and dialogue systems (chat bots) are an important development for man-machine interaction. The use of computer-assisted telephone dialogue in customer contact is a good example of how this technology can deliver genuine added value in the working world. In this context, Fraunhofer IDMT is aiming to create an interlocutor who appears as natural as possible with a very low misrecognition rate.

**Robust even under difficult acoustic conditions**
Intelligent speech input systems are increasingly being used as a user interface in human-technology interaction. The Branch Hearing, Speech and Audio Technology is working on speech detection systems that function robustly even under conditions with background noise and a large distance bet-

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Speech audiometry is an important and reliable tool for the diagnosis of hearing deficits. However, it can be time-consuming and often requires considerable resources: The standard measurement procedure is to invite listeners to visit an audiometrist; during testing, the audiometrist logs the words that were correctly identified by the listener after the presentation of noisy sentences. We investigate the potential of automatic speech recognition (ASR) to automatically conduct listening tests with human-machine speech interfaces, with a special focus on the effect of ASR errors on the measurement outcome—in this case, the speech reception threshold (SRT). For the Oldenburg matrix sentence test, a test accuracy of 0.5 dB is achieved when compared to standard tests conducted by human supervisors. This is identical to the test-retest accuracy of the Oldenburg matrix sentence test, which is used by our system and which is available in over 18 languages. Our approach should provide access to listening tests for a large group of people and is applicable in a clinical environment (allowing for listening tests even if the supervisor does not speak the tested language) and also in home environments through a smartphone-based virtual hearing clinic or smart speakers. Its reliability in a relatively noisy environment can be tested by you during the Company Showcase.

The HörTech Hearing Loss and Hearing Aid simulator allows for demonstrating hearing impressions of people with hearing deficiencies. Using multi-channel dynamic compression or expansion respectively and spectral blur, any incoming audio signal can be processed in real time in such a way that the outgoing signal provides normal hearing people with the impression of a hearing loss. The Hearing Impairment Simulator accepts any audiogram with pure tone thresholds as input parameters. In addition to simulating a hearing loss, it is possible to simulate a hearing aid which individually compensates for the selected hearing loss. This additional processing simulates a generic digital hearing aid with multi-channel dynamic compression which is prescribed using the LoudFit procedure developed by HörTech. The simulator is especially designed to demonstration purposes to audiences, relatives of hearing impaired people to get an impression of problems that hearing impaired people might encounter to raise awareness about hearing deficits.

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Towards a virtual hearing clinic
Self-controlled hearing tests and big data

The development of a “virtual hearing clinic” is one of the main topics of the Cluster of Excellence Hearing4all 2.0 starting in November 2019. The aim is to develop a comprehensive system of multilingual diagnostic methods, functional auditory models, and hearing aid fitting tools for smartphone-based devices in combination with data-driven, machine learning-supported inference techniques. Self-controlled hearing tests and fitting of hearing devices will be included for listeners with a beginning, mild, or moderate hearing impairment. The smartphone app should provide the transition to clinical audiology by indicating if a visit at a real clinic is necessary based on the data collected for a patient. We aim at generating and exploiting a suitable “big” audiological data pool to quantify any possible relationships between audiological, diagnostic and hearing aid benefit parameters and hence to verify or falsify the auditory model predictions in Hearing4all. For each individual listener, not only a potential diagnosis, but also the optimum treatment option and a related prediction of the benefit with the lowest possible uncertainty should be deduced from an incomplete, error-prone individual diagnostic data set.

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Training
Intensive course in Audiological Equipment for Beginners

This intensive course aims to provide an overview of the methods and procedures of the field as well as give insight into its key issues and parameters. The acquired knowledge is intended to assist new staff, for example at manufacturers of hearing aids, cochlear implants or measuring devices, in gaining a comprehensive and competent foothold in the subject matter, and to enable them to hold constructive discussions with colleagues from other departments during project meetings. This continuing education consists of theory and practical steps in which basic theory is applied to practical examples.

The first day focuses on medical basics and audiological testing methods. The second day deals with hearing aids and how to adjust them to a person’s individual hearing impairment. Testing to determine if an adjustment was successful takes place on day three. This intensive course is addressed primarily to engineers, natural scientists, computer scientists, doctors and other clinical and technical staff who work in audiology or with hearing aids.

Next date: 11. - 13. September 2019

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About HörTech gGmbH
HörTech gGmbH is an internationally active research institute for audiological and acoustic innovations in the field of hearing systems and associated products. In numerous national and international research projects, HörTech and its 50 employees develop new technologies and IT-based solutions - always with a focus on people. Founded in 2001, HörTech has headquarters in Oldenburg, Germany and cooperates with a worldwide network of partners from science and industry.

www.hoertech.de

About Hearing4all
In the first funding period of Hearing4all, we have successfully connect three classically separated fields diagnosis, hearing devices and assistive technology in hearing support within one highly interdisciplinary, goal-oriented research unit. However, the problems that hearing impairment causes to our ageing society are not yet solved. There are four persistent challenges which Hearing4all 2.0 aims to solve drawing upon extensive expertise and scientific collaboration across disciplines, university sites, research sectors, and research areas in basic, applied and clinical sciences. So we enhance our research „From models, technologies and solutions for diagnosing, restoring and supporting hearing (Hearing4all 1.0)“ to „Medicine, basic research and technical solutions for personalised hearing care (Hearing4all 2.0)“!

These challenges will be addressed in four Research Threads:

- Research Thread I: Auditory processing deficits throughout the lifespan
- Research Thread II: IT-based diagnostics and rehabilitation
- Research Thread III: Auditory precision medicine: research-based novel intervention methods
- Research Thread IV: The H4A hearing devices of the future

www.hearing4all.eu

About Fraunhofer Institute for Digital media Technology IDMT - Hearing, Speech and Audio Technology in Oldenburg
The goal of the Branch Hearing, Speech and Audio Technology of the Fraunhofer Institute for Digital Media Technology IDMT is to implement scientific findings on auditory perception of normal and impaired hearing in technological applications. Main research is improving speech intelligibility, personalized audio reproduction in as well as computer-based recognition of speech and acoustic events. Our fields of application include Consumer Electronics, Transportation, Automotive, Manufacturing, Security, Telecommunications and Health. The branch was established in Oldenburg in 2008 as a field office of the Fraunhofer Institute for Digital Media Technology IDMT. Through scientific cooperations, it has close links with the Carl von Ossietzky University of Oldenburg, the Jade University of Applied Sciences Wilhelmshaven/Oldenburg/Elsfleth and other hearing research facilities in Oldenburg and is also a partner in the cluster of excellence »Hearing4all«

www.idmt.fraunhofer.de/en/hsa.html

About Hörzentrum Oldenburg GmbH
The Hörzentrum Oldenburg GmbH is a unique institution combining university, clinical and practical expertise regarding hearing impairments and their apparatus-based compensation. Specialists in physics, audiology, hearing aid acoustics, ENT medicine and information technology work at the Hörzentrum. Together they evaluate and optimize hearing aid technology on behalf of their industrial partners. The Department for Market and Effects Research is composed with applied research on the marketability of audiological and acoustic products and basic research on fundamental acoustical effects. In addition working with patients is another core aspect of the work. As the initiator and constructor of the House of Hearing, which joins diverse Oldenburg institutions for hearing research, the Hörzentrum coordinates key activities. The House of Hearing made a vision become reality: A European center for hearing research combining basic research with the development and adjustment of hearing aids. It is a place where institutions are united to benefit the hearing impaired.

www.hoerzentrum-oldenburg.de