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News from the Auditory Valley

AUDITORY VALLEY
FUTURE HEARING

Hearing for all. All people, all situations, all sectors.

DFG funds new Oldenburg research project

VIBHear gets to work

World-wide unique treatment at the Hanover Medical School

mEEGaHStim - a mobile EEG-based brain stimulation for improving hearing

Foto: Universität Oldenburg

Spring 2017

Hearing 4all

Cluster of Excellence in the
AUDITORY VALLEY
FUTURE HEARING

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The Future of Hearing: The research and development network 'Auditory Valley' focuses on bundling a variety of expertises on the topic of hearing. This magazine will give you a regular insight into the fascinating and varied world of auditory research.
In the category SONIC BOOM, this edition focuses on the changes of the guidelines for hearing aid supplies and the the 6th Lower Saxony Health Prize for Remote Care. In DIRECTIONAL FILTER, we introduce the VIBHear project, funded by the European Regional Development Fund (ERDF) A broad mix of research news and event reports is offered in our PINK NOISE segment.

Also in this issue we're putting a special focus on the developments and results of Hearing4all, the Cluster of Excellence in the Auditory Valley.

We hope you'll enjoy reading this issue of CLICK!

Your CLICK Editorial Team

P.S. Would you prefer to receive CLICK as a pdf by email? Just write us at info@auditory-valley.com

Content

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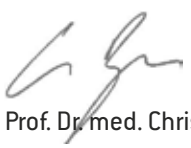
Editorial staff and layout: Swantje Suchland, Dr. Corinna Pelz, Daniela Beyer. English: www.stels-ol.de
CLICK is published for free twice per year

Prof. Dr. med. Christopher Baum,
President of the Hanover Medical School

Over 15% of the population is affected by hearing loss, and for more than one million people in Germany artificial substitutes are the only solution. However, less than 10% of those affected receive adequate provisions and not every provision has the desired level of success. The medical requirement for top-quality hearing research combined with groundbreaking innovations and improvements to diagnoses, prevention and therapy is without doubt imminent. The Hanover Medical School (MHH) has been working side by side with the Carl-von-Ossietzky University of Oldenburg and the Leibniz University of Hanover ever since the foundation of the Cluster of Excellence Hearing4all with the aim of incorporating its outstanding expertise in the field of hearing medicine and research into streamlined scientific work. The MHH is by far a leading institute on the national scale, as well as on the international scale when it comes to cochlear implant care, along with intensive patient preliminary and aftercare and ongoing dialogue with associations of interest. With Hearing4all and in cooperation with all partner associations, a unique, interdisciplinary and cross-professional knowledge cluster was formed to overcome existing technological and biological boundaries. Close interaction between fundamental research, traditional developments, practical medicine and the experience of national and international partners is combined to form a common approach.

The German Research Foundation (DFG) extended the current funding phase of the Cluster of Excellence to the end of 2018, meaning that planning security for all participating research groups is only guaranteed for one more year. When it comes to the next research phase of the Cluster of Excellence, success in the current competition is crucial for the further development and sustainability of solutions and personal perspectives of scientific parties. A successful result will mean support for a minimum of seven years including new resources to strengthen the link between the Cluster of Excellence and the normal scientific activities taking place at the respective universities. Hearing4all has presented a convincing concept which is currently competing against more than 190 other concepts in a written procedure by the expert panel of the DFG's Excellent Strategy - a mammoth task for the panel and all future proposals. Our applicants' consortium has done its best to make the decision easier. Hearing4all has developed a smart, coherent concept which draws upon the strengths of previous work and the cooperative added value of the cluster, whilst proposing a new direction of research that will be extremely significant for the further development of hearing research. The hearing cluster of the future has committed itself to developing both quantitative and personalised knowledge based on optimised models and high-resolution clinical data. This should ultimately result in modern, accurate medical science across all levels in terms of genetic and functional causes of hearing loss and development of the respective biological and technical solutions in cooperation with all required disciplines. In short: Hearing for everyone - everyone for hearing. The goals and demands are huge, the structure is unique and the minds involved are great. We are crossing our fingers in the hope that this concept will soon become a reality.



Prof. Dr. med. Christopher Baum

Missed opportunity: The Federal Joint Committee amends the guideline tools for hearing aid care in Germany

With the amended guidelines, which entered into effect on 17 February 2017, a campaign for the renaissance and expansion of the more than 50-year-old Freiburg monosyllabic speech test to the use in noise reached its temporary climax. The initiative is driven by the good intentions to offer an alternative for practice to the Göttingen and Oldenburg sentence tests, which until then were exclusively approved for usage in noise. This has the disadvantage of investing much time and money in a less suitable and inaccurate measuring methods for this purpose. But what is this highly stylised 'Freiburg versus Oldenburg' argument regarding the best measurement procedures and their respective members about?

The Göttingen sentence test, presented in 1997 by Kollmeier and Wesselkamp, with its short, meaningful sentences for the detemination of speech reception threshold (SRT) in noise, and the Oldenburg sentence test introduced in 1999 by Wagener et al. with short, meaningless sentences with a fixed sentence structure (e.g. 'Kerstin buys seven wet chairs') are internationally established tests in hearing aid and cochlear implant research (see special issue of the International Journal of Audiology 52 S2, 2015). With the Oldenburg sentence test, compatible, international 'matrix' speech recognition tests are conducted with a listener in his or her native language, without the investigators needing to understand this language themselves, since the words understood do not have to be repeated and auditorily assessed - they can be selected by the patient themselves from a closed 'matrix' of 5x10 words. These procedures form the reference for the international standard for speech audiometry ISO 8253-3 and the International Collegium of Rehabilitative Audiology (ICRA) made them the standard for comparing speech tests in more than 16 languages. With the guidelines valid as of 2012, these tests have been used for prooving the gain through hearing aid provision in noise because, using an adaptive procedure, the threshold for 50% of speech recognition can be determined with a list with an accuracy of 1 dB, so that in practice, a modern audiometer can accurately and efficiently determine the difference between two different hearing aids and different hearing aid settings. By definition, these procedures also have disadvantages (e.g. the well-documented training effect of the Oldenburg sentence test and the listening effort required to determine threshold of speech recognition which lies at a low signal-to-noise ratio). In contrast, however, the huge efficiency of the measurement procedure remains with a sentence test, because multiple words can be tested at the same time in one sentence per unit of time, all sentences are equally difficult and the required threshold can be accurately determined within a short period of time. Small but for hearing in noise important differences between hearing aids can be measured this way.

The Freiburg monosyllabic test developed by Hahlbrock in 1954 was designed for use in quiet situations with fixed levels and achieves its most accurate results upon determination of discrimination loss, i.e. the maximum measurable speech recognition at high levels. The long-standing tradition, widespread prevalence and experience in ENT medical practices and audiology speak for it. However, it has been subject to criticism for more than 30 years because the lists for determining a 50% threshold are not equivalent and the use of only one list is too inaccurate to reliably measure the differences between different hearing aids. The main problem of this test is that only the accuracy of an individual word is tested per word presented and repeated by the patient. On the other hand, in the case of a sentence that is presented (consisting of five words for example), five words are determined one after the other. Accordingly, the Freiburg monosyllabic test lasts longer until a sufficient number of words have been tested to a certain statistical reliability, meaning the efficiency of the test is significantly worse than the Göttingen or Oldenburg sentence test. A list of the Freiburg monosyllabic test tests 20 words and lasts about 1.7 min in execution. A test list of the Göttingen or Oldenburger Test tests 100 words in approx. 4min.

For example, to achieve the same accuracy of a 50% threshold obtained with one list of the adaptive Göttingen sentence test, up to 13 lists of the Freiburg monosyllabic test would have to be carried out, each at a different fixed level. This is impractical. This has its justification in the shallower slope of the psychometric function, the smaller number of words per test list and the non-adaptive measurement. The amendments to the guidelines suggest to use at least two test lists for the Freiburg test. Its measurement uncertainty for 50% speech comprehension (expressed by 95% confidence interval) therefore remains at +/- 15% or at +/- 3 dB.

With the legalised implementation of the Freiburg test in background noise (which is not covered by a standard or audiologically funded publication), many important measurement conditions remain unclear: generally a signal-to-noise ratio of 5dB is used which does not limit speech intelligibility by the noise. Hence, the test condition is not testing on the practice-oriented limitation of speech comprehension in background noise. Furthermore, the reduced measurement accuracy and existence of 'easy' and 'difficult' lists are not taken into consideration, so the door is open to wrongful decisions or manipulation by a suitable test list selection. It was for exactly these reasons that v. Wedel demanded a replacement for the Freiburg test in 1984 for hearing aid indication and testing and paved the way for the development of modern, reliable and efficient procedures such as the Göttingen and Oldenburg sentence tests. Their development - together with the introduction of software by the non-profit HörTech gGmbH onto the market for the majority of modern computer-controlled audiometers – took place with the aim of applying practice-oriented solutions for the well-being of patients which would replace the Freiburg test that had been under scrutiny for 30 years.

Unfortunately it was neglected by the GBA to accurately determine which conditions must be measured so that the benefits of a hearing aid or the advantage of hearing aid A over hearing aid B could be proven. Now there are concerns that the very inprecise measurement instrument of the Freiburg test means that the patient will get a hearing aid supply rejected because no significant difference to the unserved situation can be measured. The difference to a significantly worse hearing aid also cannot be measured which would be possible when using a more accurate measurement procedure. Since the amendment by the GBA takes a step in the opposite direction, this is a missed opportunity at the cost of the patients, who require reliable, meaningful and internationally recognised determination of the success of their hearing aid fitting.

(from left to right) Lower Saxony Minister for Social Affairs, Cornelia Rundt handed over the prize to ENT clinic directot Prof. Prof. h.c. Dr. Thomas Lenarz, Prof. Andreas Büchner and Ingo Klokemann (both Deutsches HörZentrum Hannover (DHZ)). The laudation was held by former State Secretary Daniela Behrens from the Ministry of Economic Affairs.

ENT clinic and the DHZ win the 6th Lower Saxony Health Prize for Remote Care

Outstanding: The ENT clinic and the Deutsches HörZentrum (DHZ) of the Hanover Medical School have won the 6th Lower Saxony Health Prize for Remote Care for their remote adaptation of cochlear implants.

The award ceremony took place at the end of November in Hanover's 'Altes Rathaus', with the Lower Saxony Minister for Social Affairs, Cornelia Rundt. It is the sixth time the Lower Saxony Health Prize has been awarded by the Ministry for Social Affairs, Health and Equality, the Ministry of Economic Affairs, Labour and Transport, the Association of Statutory Health Insurance Physicians in Lower Saxony, the AOK Lower Saxony (Health Insurance Fund) and the Lower Saxony Chamber of Pharmacists.

The award was presented in three categories and the ENT clinic came top in the eHealth area against twelve other projects. 'We are very pleased to receive this recognition. That's because with Remote Care, which has become part and parcel of our clinical routine, we are able to achieve high quality of care close to home by recognising the early signs of risks and complications without the patient needing to travel to the MHH in Hanover for this therapeutic unit', explains Prof. h.c. Dr. med. Thomas Lenarz,

Foto: Kaiser/MHH

Director of the ENT clinic at the MHH, the world's largest reference centre for cochlear implants and implantable hearing aids.

Cochlear implants are hearing aids which bridge the function of the damaged hair cells in the inner ear and transform sound into electrical pulses which the auditory nerve then passes on to the brain to decode. This allows sounds, music and particularly speech to be (re)produced. These highly complex devices have to be regularly tested and adjusted, however. Patients therefore like to be treated at home without having to rely on the handling clinic. Remote Care allows patients to receive remote treatment from specialists at the Deutsches HörZentrum ENT clinic of the MHH. MHH aftercare is therefore within easy reach nationwide. 'Remote care is an important factor in service-oriented therapy for our patients. We are therefore very pleased to have received the award for the remote tailoring of cochlear implants', reports Prof. Andreas Büchner, Scientific Director of the Deutsches HörZentrum Hannover (DHZ)

How Remote Care works: With regards to remote cochlear implant care, the Rhine-based company auric Hörsysteme is working with the MHH on a newly developed system for real-time remote care featuring a high-resolution video whereby thanks to the fast reaction time and high image and sound quality, care is provide for the patient as though they were sitting opposite the audiologist at the Deutsches HörZentrum Hannover. The highest standards of data security and patient confidentiality are applied.

Patients have access to technically trained staff who oversee connection of the speech processor to the remote care system and make adjustments. Once setup is complete the normal hearing tests can take place. The test environment corresponds to the requirements of the Deutsches HörZentrum Hannover so that test results are easily achieved that are comparable with previous results and quality control is guaranteed by resolving potential complications in good time. Full documentation then takes place at the DHZ. A medical follow-up also takes place closer to home.
The initial care phase is excluded from remote care: This remains for all implant patients in the MHH at the Deutsches HörZentrum Hannover. The necessary closely integrated processes between daily care, therapy and medical follow-up over a period of five days can only be realised by an interdisciplinary team of experienced, trained staff who take into account all available patient data, and cannot be outsourced.
Remote Care allows patients to be seen and receive follow-up care close to home with a certified hearing care professional and medical practitioner who is in direct contact with the MHH. There are currently 18 Remote Care sites, three of which are in Lower Saxony (Osnabrück, Osterholz-Scharmbeck and Emden).

A short film about the winning project 'Remote Care' is available to view on YouTube: https://www.youtube.com/watch?v=vxZR_HQDQsI

More information about local follow-up remote care can be found online at www.hoerzentrum-hannover.de

Extra-aural noise effects: When noise affects cognition and psyche

Dr. Meis, what is meant by extra-aural noise?
Extra-aural noise effects are the psycho-physiological, cognitive and subjective effects of unwanted sound. They do not affect the hearing directly and occur below the noise relevant level of <80 dB.

That means noise also has a negative effect when it is not so loud?
Yes. Several studies show that the noise, especially in open space offices, is an important ergonomic issue and affects employee health and well-being. This is also reflected in employee surveys.

What noise do we have in the office? Phones, printers and the like?
In the past, there were actually still printers, which contributed to the considerable disturbance in the office. Studies of the last 20 years show, however, that particularly undesirable, irrelevant human speech sounds have a negative effect. So the phone call of the colleague or the quick discussion at the next table for example.

How exactly does that affect?
That is different. Impacts on cognitive performance, such as attention, memory, and execution of instructions, are demonstrated. However, physiological reactions, e.g. the increased release of stress hormones are triggered.

Do not employers have to react?
Since the end of 2013, the Occupational Health and Safety Act explicitly requires consideration of the psychological stress in the risk assessment according to DIN EN ISO 10075-1. This means that all companies and organizations must also identify those hazards for their employees, which result from the psychological stress at work.

What measures can employers take to reduce the psychological impact of noise in the ‚open space office'?
On the one hand, acoustical aspects should, of course, already be taken into account in the case of construction planning and initial installation. Whether acoustically effective carpets, wall and ceiling coverings, fabrics, furniture or partition walls - there are various possibilities (even later) to reduce and compensate for acoustic sources of noise in the working environment.

You are an expert in noise at the Forum Office Acoustic. What is the aim of the Forum?
Our motto is 'Together for better acoustics in offices'. Our first goal, is to aware employers, facility managers, security specialists, builders and architects of the importance of room acoustics, the effects of noise in the office, and the related policies and standards. For example, my colleague Dr. Christian Nocke (Akustikbüro Oldenburg) and me explained on the occasion of the 'International Noise Awareness Day' on 26.04.2017, experts and architects the scientific connections, the relevant standards and the cross-connections of the actors involved in the room acoustics. Together with the partners in the Forum Office Acoustics (BARRISOL -NORMALU SAS, CarpetConcept Objekt-Teppichboden GmbH, CRÉATION BAUMANN AG, REHAU AG + Co, Strähle Raum-Systeme GmbH and USM Möbelbausysteme GmbH), we were able to show comprehensive approaches with a practical orientation for the planning of acoustically optimised offices.

www.forum-office-acoustics.com

FORUM OFFICE ACOUSTICS
IM AUDITORY VALLEY

Dr. Markus Meis is Head of Market and Efficiency Research at the Hörzentrum Oldenburg and, together with Dr. Christan Nocke (Akustikbüro Oldenburg), heads the Forum Office Acoustics in the Auditory Valley.

Dr. Karsten Plotz (on the right), professor for otolaryngology at the Jade University of Applied Science hands over the USB sticks including the Oldenburg Cochlear Implant Trainer to Dr. med Andreas Radeloff, chief doctor of the ENT clinic at the Evangelic Hospital in Oldenburg.

How deaf patients can learn to understand speech

If hearing loss becomes so severe that a hearing aid no longer suffices, a cochlear implant (CI) is an electronic inner ear prosthesis which can help. The Institute of Hearing Technology and Audiology (IHA) at the Jade University of Applied Sciences has developed a software together with the university ENT clinic at the Evangelical Hospital which supports deaf patients in relearning to hear.

Learn at home

'Our main focus is on the patients' wish to practice understanding individual words and sentences in peace and with additional sounds each day from the comfort of their home, at their leisure', explains audiotherapist Katrin Bomke, graduate of the Hearing Technology and Audiology course, who was heavily involved in the development of the programme. 'And to be sure that everyday errands become easier and conversations can be better understood. The 'Oldenburg Cochlear Implant Trainer' ('OL CIT') training programme can be installed by patients onto their PC at home using a USB stick. 'Patients can choose from a male or female voice which clearly pronounces individual words and sentences', says Martin Schiffkowski, speech therapist at the AWO speech therapy centre. 'Signals are played through the computer or laptop speakers at a comfortable volume.' 'The advantage of this programme is that it is simple and free for patients to use at home', summarises Katrin Bomke. It is an extremely logical addition to speech therapy.

Software is available free of charge

The software is financed as part of the Jade University research project and programmed by a student at the Institute for Hearing Technology and Audiology, Michael Thiermann. It is available to download free of charge from the Institute's homepage and a USB stick containing the software is given to patients at the Evangelical Hospital. 'The next step might be an app that makes the training programme even more flexible to use', says Dr. Karsten Plotz, professor of ENT medicine, phoniatrics and paediatric audiology at the Jade University, who is responsible for the project.

150 patients with cochlear implants treated each year

Each year, around 150 patients with cochlear implants are treated at the Evangelical Hospital. The Institute for Hearing Technology and Audiology has worked continuously with the Hörzentrum since 2003 to achieve improved hearing-based quality of life. Together with the department for cognitive neurophysiology, changes to the area of the brain responsible for hearing were studied. 'Learning or relearning acoustically perceived speech is an intensive process which takes just a few weeks or months for some patients', explains Plotz. Others require a longer rehabilitation period. 'It seems that various adjustment processes in the so-called auditory cortex of the human brain are responsible for this.'

The programme has now been officially handed over to the senior consultant of the university ENT clinic at the Evangelic Hospital, Dr. Andreas Radeloff, who supports the use of this software solution: 'I am very pleased with the successful partnership between Jade University and the university ENT clinic which directly benefits our patients.

PINK NOISE

Foto: Universität Oldenburg

Dr Anna Warzybok is a researcher in the Department of Medical Physics and the Cluster of Excellence Hearing4all at the University of Oldenburg.

International standards for hearing aid provision - The DFG funds new Oldenburg research project

Hearing-impaired people from different countries are tested and clinical standards streamlined, thereby promoting optimum international provision of hearing aids - that is the objective of Oldenburg physicist and hearing researcher, Dr. Anna Warzybok. The postdoctoral fellow who is a researcher in the Department of Medical Physics at Faculty VI Medicine and Health Sciences, and the Cluster of Excellence Hearing4all at the University of Oldenburg, receives around 500,000 euros from the Deutsche Forschungsgemeinschaft (German research funding organisation - DFG).

'This grant highlights the excellent work of our up-and-coming scientists. We congratulate Anna Warzybok on this success', says University President, Prof. Hans Michael Piper. 'With her project, Anna Warzybok is making an important contribution to establish an internationally compatible speech audiology, hearing diagnostics and provision of hearing aids - for the benefit of many patients', adds Prof. Birger Kollmeier, spokesperson for the Hearing4all Cluster of Excellence.

'Multilingual, model-based rehabilitative audiology' - this is the title of the project of which Warzybok is both the applicant and coordinator. Over the next three years, the young scientist will measure speech comprehension of hearing impaired people in different countries and develop internationally applicable test procedures. To measure speech comprehension, Warzybok uses standardised audiology tests - so-called matrix tests - in different languages which allow an international comparison of results. The hearing researcher will use the tests to model speech understanding using automatic speech recognition. The results should provide the best-possible hearing aid settings for patients.

The project takes an interdisciplinary approach and will be realised in close cooperation with worldwide-leading clinics and research centres. Participating institutes are based in countries such as Italy, Poland, Russia and the USA.

Source: Universität Oldenburg

Open for global exchange: Master Hearing Aid to become open source

For over 10 years, researchers in Oldenburg have been working on their 'Master Hearing Aid', a software platform that simulates a hearing aid and can test new hearing aid algorithms developed by the university. The Master Hearing Aid will now be developed to an open source platform, the 'openMHA' in order to make it available to a large research community. This open source approach means that researchers around the world can research and develop using a standardised platform. Vice versa, corresponding licences ensures that developments made by other work groups on the Oldenburg Master Hearing Aid are made in the same spirit: avilable for free, allowing the entire community and, ultimately, hearing aid users to benefit.

This development is currently funded by the National Institutes of Health (NIH) in the USA as part of a five-year research project, in which the University of Oldenburg, the HörTech gGmbH in Oldenburg and the BatAndCat Corporation, a small research-focused company from Silicon Valley, are all participants. Regular releases of the software are part of the project, i.e. new software versions uploaded to a public platform (link: https://github.com/HoerTech-gGmbH/openMHA). After a pre-release was published in February this year in the form of a basic software package featuring a simple hearing aid, the first official release will be online in mid-June 2017. Other regular updates serve to develop and release new programme features. Three example applications are already available which are of fundamental importance for hearing aids. Signal compression (depending on hearing loss), reduction of background noise for a better speech intelligibility and elimination of feedback, an ever-present problem in modern hearing aids. These elements can be combined to create a fully functioning hearing aid and interconnected with additional, self-developed algorithms which can be tested under extremely realistic conditions.

Access to the platform will be possible via three channels in future. First, the platform is adressed to programmers who want to develop their own algorithms on the platform. Second, to application engineers who want to incorporate the programme into measuring equipment and benefit from the modular structure. Third, to end users such as hearing care professionals and audiologists, who want to use the plug-and-play system and simply change certain signal parameters for use on test subjects and hearing aid users.

www.openmha.org

Project manager Prof. Volker Hohmann with a mini-computer on which the open-source platform could run in future, as on a laptop or desktop computer.

Foto: Universität Oldenburg

Hearing4all on tour

In addition to the annual conference of the German Society of Audiology, the German Biotechnology Days and Biotechnica, the Cluster of Excellence Hearing4all was presented at CeBIT in Hanover in spring 2017. Scientists and the team at the Translational Research Center gave interested specialist and general public audience exciting insight into the future of hearing. One vision is hearing aids which are controlled by thought. Hearing researchers are developing a so-called brain-computer interface (BCI) with which the user steers his attention towards the desired speaker or can consciously alternate between settings for music and speech processing. The Cluster of Excellence also presents the auditory midbrain implant (AMI) which allows people with damaged hearing nerves to hear again.

As part of the trade fair tour, Prof. Dr. Dr. Birger Kollmeier, spokesperson for the Cluster of Excellence Hearing4all, and Gabriele Heinen-Kljajić, Lower Saxony Minister for Science and Culture, were able to promote the impressive research results.

20th Annual Conference of the German Society of Audiology

From the 22nd to 25th February 2017, the 20th Annual Conference of the German Society of Audiology (DGA) was held at the Aalen University of Technology and Economics. Under the leadership of conference chairwoman, Prof. Annette Limberger, the conference's theme of 'Hearing meets Brain' highlighted the fact that central auditive and cognitive processes play just as important a role as peripheral hearing organs. The appealing programme took into account the diversity of professions, whose cooperation is crucial for state-of-the-art recognition, diagnostics, treatment and long-term rehabilitation of hearing impairments. With short lectures and structured conferences, renowned scientists presented the latest results of their research and developments and uses of new audiology methods. Four tutorials provided further professional training on a range of current topics. Conferences on education of the hearing impaired and 'big data' also showed the interdisciplinarity of the field.

At its booth, HörTech gGmbH presented the latest developments in the area of international matrix tests and translation of the Hearing4all Cluster of Excellence.

The German Society of Audiology (DGA) awarded the annual Meyer-zum-Gottesberge Prize to Prof. Torsten Rahne for outstanding work in the field of hearing research.

from left to right: Prof. Dr. Annette Limberger (Conference Chairwoman) with Prof. Dr. Ulrich Hoppe (President of the DGA) and Thilo Rentschler (mayor of the city of Aalen)

Hearing research meets art: Data streams can be acoustically and visually experienced.

With the interactive 'Pulsating Globe' sound and light installation, Thomas Bisitz, sound artist, musician, sound engineer and Physicist at the Cluster of Excellence Hearing4all, has impressively bridged the gap between art and science exclusively for the 'I AM DATA' exhibition at the Oldenburg bau_werk Halle.

The installation addresses topics which are currently of importance in today's research. The Hearing4all Cluster of Excellence is working on understanding the process of human hearing in more detail, developing new diagnostic methods and improving hearing for the hearing impaired through the use of technical hearing aids. Data plays a varied role in scientific work. Measurement data from studies with and without test subjects is taken, analysed, exchanged, presented and published. Using four possible points of interaction, the installation plays with the theme of how humans connect through different communication channels, making various making various data streams visible and audible.

Sound waves such as speech (or music) are converted into digital data and processed using digital signal processing in such a way so as to improve or even re-initiate understanding of speech between people, for instance. Signals processed in hearing aids are transported to the ear drum via a miniature loudspeaker. Cochlea implants transfer signals from the cochlea to the hearing nerves using electrodes. Sounds are then able to be heard.
In mobile platforms for research hearing aids, small single-board computers and microcontrollers are used for

Thomas Bisitz, sound artist, musician, sound engineer and physicist at the Cluster of Excellence Hearing4all

this signal processing, similar to those in the installation. This simplified analysis and representation of speech signals from the microphone to the LED strips in the installation is motivated by a frequency analysis which takes place in the hearing aid's signal processing and in the vibrations of the basilar membrane in the cochlea in the human inner ear.

Interfaces for controlling hearing aids play an important role. Biometric data is also captured and used as feedback. It will be researched on hearing systems which can process brain waves (EEG) as well as the pulse. Systems such as cEEGrid (http://ceegrid.com) make capturing EEG data significantly easier and can be used in everyday situations.

PINK NOISE

Hearing Day - Hearing research made in Oldenburg

On the occasion of World Hearing Day on 3rd March 2017, Prof. Birger Kollmeier, spokesperson for the Hearing4all Cluster of Excellence, gave exciting insight into hearing research at the Schlaues Haus Oldenburg.

Whether improvements in hearing diagnostics, development of new algorithms for further development of hearing aids or research into future-oriented technology - Prof. Birger Kollmeier presented the exciting phenomenon of complex human hearing to visitors and introduced the latest research questions and results from the Hearing4all Cluster of Excellence.

Anyone wishing to find out how well their own hearing worked had the option of undertaking a hearing screening test. The so-called digit triplets test provides a simple, anonymous and non-binding opportunity to check hearing ability. The triple digits test determines how well an individual can comprehend speech in noisy environments. During the test, the individual hears multiple combinations of three digits which are spoken against background noise. Depending on the answers, this process is repeated up to 30 times. During each test, three digits are randomly repeated. The more often the digits are correctly repeated, the softer the voice becomes and the more difficult the test. After the test, the individual receives an assessment of how well they can understand speech against background noise and is given suggestions for further steps. The process does not replace a medical diagnosis, but simply tests hearing ability in everyday situations and gives insight into how hearing works.

The test can also be carried out online at www.hoerzentrum-oldenburg.de.

Important visitor: The Parliamentary State Secretary for the Federal Ministry for Labour and Social Affairs visits the HCIG and Deutsche HörZentrum Hannover

At the invitation of the Hanover Cochlear Implant Society (Hannoverschen Cochlea-Implantat-Gesellschaft) the Parliamentary Secretary of State for the Federal Ministry for Labour and Social Affairs, Gabriele Lösekrug-Möller, visited the Deutsche HörZentrum Hannover (DHZ) in December to find out about the work of the HCIG self-help organisation and the clinic. Lösekrug-Möller is an SPD representative for the Lower Saxony constituencies of Hameln-Pyrmont, Holzminden, Uslar and Bodenfelde and is responsible within the Ministry for social security, pensions, welfare and integration.

The graduate social worker was welcomed by the HCIG chairwoman, Roswitha Rother and the ENT clinic director, Prof. Thomas Lenarz. As an introduction to the topic of hearing, hearing impairment, therapy and social participation, Prof. Lenarz showed the State Secretary around the DHZ. The first stop was a visit to the engineers and therapists at the DHZ who demonstrated the fitting of a cochlear implant as well as the therapeutic work with the patient during hearing training. At the microscope, Prof. Lenarz then showed the delicate work that surgeons have to perform to insert a cochlear implant electrode into the inner ear. The State Secretary was given a vivid picture in the so-called CI real-time simulator, which Prof. Andreas Büchner showed as Scientific Director of the DHZ: The CI simulation replicates the current speech processing strategies of the cochlear implant, giving an idea of how hearing sounds to a CI wearer.

During the following round table, the clinicians around Prof. Lenarz and CI wearers of the HCIG discussed with Lösekrug-Möller about accessibility and inclusion, social acceptance of hearing impaired people, the importance of self help and the care situation for the hearing impaired. Since Lösekrug-Möller became President of the State Association of Lower Saxony Music Schools in June 2014, great importance was attached to the subject of hearing music with a CI.

Research for the International Hearing Aid Industry

The research team around Prof. Inga Holube and Prof. Jörg Bitzer at Jade University and Dr. Markus Meis from the Hörzentrum Oldenburg received the award for tender with the Hearing Industry Research Consortium.

The project proposal was up against a number of international university research establishments.

Over the course of two years and with a grant of 300,000 dollars, measuring processes will be developed with which communication in everyday situations and the associated quality of life can be individually assessed. Using a smartphone-based system and individual observations, difficult hearing situations will be identified and improvements for communication using hearing aids researched. The project uses existing developments of the main research points of the Jade University 'Everyday Hearing (HALLO)' which receive state-funded support from 'Lower Saxony in Advance Funds from the Lower Saxony Ministry of Science and Culture. 'We are very pleased to be able to continue with the developments of 'HALLO' in this project. This approval shows the relevance of previous research to the hearing aid industry,' emphasises Prof. Inga Holube.

The six largest hearing aid manufacturers merged to the Hearing Industry Research Consortium, which covers more than 80% of the global hearing aid market. The Consortium funds one or two research projects each year from all the competition which serve of mutual interest to the manufacturers. The objectives are to increase the benefit for the hearing aid wearer, support for the hearing care professionals and pre-competitive developments for the hearing aid industry. The project is domiciled in the 'Technology and Health for People' department, the most research-focussed unit at Jade University.

Foto: Piet Meyer

Prof. Inga Holube manages the audiology department at Jade University

Comprehension of speech in complex situations such as cocktail parties is particularly problematic for the hearing impaired.

mEEGaHStim - a mobile EEG-based brain stimulation for improving hearing

The 'cocktail party effect' describes the ability of normal-hearing people to focus on a particular speaker and suppress other sounds. Many people with hearing impairments lack this ability, or it is no longer working adequately. Modern hearing aids are good at separating useful sounds from background noise. However, in cocktail party situations they don't know which is the useful sound because information is missing about which speaker the hearing aid should follow. A project funded by the Federal Ministry of Education and Research (BMBF), 'mEEGaHStim - a mobile EEG-based brain stimulation for improving hearing', is working on a remedy.

Objectives and method

The aim of the project, which started on 1st April, is to develop a system which improves speech comprehension in complex situations for hearing impaired individuals and automatically picks out the signal of the source which the user is attending to. This will be achieved using a combination of electroencephalography (EEG), audio signal processing and electrical stimulation of the hearing centre in the brain. The entire system is a hearing aid that feeds back information from the EEG signal to the system using a brain computer interface, enabling modifications to the hearing process. In doing so, there is direct interaction with the user. Hearing is significantly improved for the hearing aid wearer or cochlear implant patient and enables better social participation and rehabilitation.

Innovation and perspectives

By measuring neurophysiological signals and stimulating the auditory cortex simultaneously, in real time, an interactive brain-computer interface with neurofeedback loop is developed, providing an innovative solution for the 'cocktail party effect', a long-time issue in hearing research.

Key activities

Under the leadership of project coordinator neuroConn GmbH, participating partners (Advanced Bionics GmbH, University of Oldenburg, HörTech gGmbH, University of Siegen, Fraunhofer IDMT) will undertake various different tasks.

In addition to project coordination, neuroConn will undertake tasks for the development and transfer of methods for software and hardware development of the TES module. Advanced Bionics will apply its knowledge in the definition and implementation of sensory algorithms (measurement of EEG signals with implanted electrodes, preparation of measurement signals) and actuator Technology (control of hearing aid). The University of Olden-

Test set-up with TASCARpro in the communication-acoustic simulator

burg will perform TES experiments on test subjects and further develop the targeted transcranial stimulation of the auditory cortex. HörTech focuses primarily on the development of algorithms for audio signal processing with the possibility of simulating a complete hearing aid. The University of Siegen plays a leading role in conducting and analysing user studies and a user-centered technological design. Fraunhofer provides expertise in the area of designing and implementation of the EEG experiments as well as in audio signal processing.

Project coordinator
neuroConn GmbH, Ilmenau

Partners
Advanced Bionics GmbH, Hanover
University of Oldenburg
HörTech gGmbH, Oldenburg
University of Siegen
Fraunhofer IDMT, Oldenburg

TASCARpro : virtual acoustic environments

TASCARpro (toolbox for acoustic scene creation and rendering) is a software solution for creating virtual acoustic environments: Moving sound sources are physically modelled; Air absorption and Doppler shift are taken into account in the simulation. An image source model with simple reflection properties, which allows for static or moving reflectors, can be applied. The signals are rendered in real-time in the time domain, to allow for interactive positioning of the objects, e.g., controlling the receiver based on body motion tracker data. The output signal can be rendered in higher order ambisonics (HOA), vector base amplitude panning (VBAP) or binaurally. Generic or individual HRTFs can be used for binaural output signals.
For synchronisation purposes, an interface to video sources or interactive computer graphics is available via the open sound control (OSC) protocol. Solutions for an interface to the blender game engine exist.

New centre of excellence for translational medical technology

In conjunction with representatives from industry, politics and science Dr. Gabriele Heinen-Kljajić, minister for science and culture in Lower Saxony, and Prof. Reimund Neugebauer, President of the Fraunhofer society, opened the centre of excellence 'Translational medical technology' in Hanover on 25th April.

The aim of the new centre is to bring medical products from research into the first phase of clinical testing. The focus is on active implants – i.e. electrical stimulating systems such as cochlear and retinal implants – and inhalation technological solutions for administration of medication. The latter are developed systematically in the direction of smart-drug-device combination products, a combination of intelligent medical products and pharmaceuticals. The centre of excellence is funded by the state of Lower Saxony and the Fraunhofer society. 'We want to bring the research results for innovative medical products at the Hannover base to the next stage and implement them, whether from implant research and development or regenerative or personalised medicine, so patients can benefit from the new products and procedures. The new centre of excellence 'Translational medical technology' is a valuable link between the researching institutions and the economy. It strengthens the close network in its life science research in Hannover', claims Heinen-Kljajić.

'In the centre of excellence we support researchers, interested parties and companies, starting at the development phase. For example special processes in the manufacture of medical products represent a significant economic hurdle for small and middle-sized companies. Medical products also have to undergo quality assurance and risk assessments before they can be clinically tested. We accompany you through the complex transfer processes from basic research to the hospital - we help you, as it were, through a bottleneck of translation', stated Prof. Theodor Doll, director of the centre of excellence. Doll holds a professorship, which the Hanover Medical School established in conjunction with the Fraunhofer ITEM. It links the research from the cluster of excellence 'REBIRTH' and 'Hearing4all' at the Hannover base as well as the state initiative 'Biofabrication for NIFE' directly with the translation competence of the Fraunhofer institute.

'Within a short period of time the centres of excellence from the Fraunhofer society have proven themselves as excellent cooperation partners with universities and industry. They unite science and economy, bridged by applied research in a 'One-Stop-Shop'. The aim is to promote research and teaching, training and development, career and youth development and transfer these to a broader base and to establish the centres of competence as transfer infrastructures', explained Neugebauer. With the new centre of excellence 'Translational medical technology' an ideal opportunity is opening up to attain a leading position in innovative product development in the medical sector. Together with our partners we can give decisive impulses for future innovations for industry, medium-sized companies and start-ups in the medical sector.'

At the moment the currently valid medical product directives are being replaced by the much more stringent medical product decree that extends throughout Europe. 'With these heightened standards the centre for excellence is in an ideal position to support the companies and the researchers', says Doll.

Representatives from science, politics and the economy opened the centre of excellence 'Translational medical technology': (from left to right). Dr. Gabriele Heinen-Kljajić, Minister for science and culture in Lower Saxony, Prof. Theodor Doll, director of the centre of excellence, Prof. Norbert Krug, Institute director for the Fraunhofer ITEM, Prof. Reimund Neugebauer, president of the Fraunhofer society, Prof. Christopher Baum, president of the Hannover Medical School and Prof. Thomas Lenarz, hospital director ear-nose-throat hospital of the Hannover Medical School (seated at the front).

Petra Gaede during a test with hearing aid acoustician Kevin Pollak at the Hörzentrum Oldenburg

Test person at the Hörzentrum Oldenburg: Interview with Petra Gaede

You are a test person at the Hörzentrum Oldenburg. How did you get here?
As a result of a newspaper article in the Nordwestzeitung - it was very small but very interesting to me. I spent a long time as a special auditor at the university and as part of these studies always looked for searches where test persons were wanted. I then did two or three studies. And in that sense – yes – it appealed to me.

Did you already have hearing aids when you came to us? Have you become a hearing aid-wearer through us?
No. My family noticed that my hearing wasn't very good - particularly my daughters. One of them mumbles terribly and I always had to ask her to repeat what she said but the other also told me that I had to do something because I didn't hear very well. So then I came here and the study conductor told me I should get in touch with a hearing aid acoustician. The earlier I start, the better it will be. Yes, and that's what I did.

How often do you come here for studies?
I haven't looked this up but I think it's six times a year.

Is that much? Or would you say this is actually good to cope with?
Well, it isn't too much for me and I think given that you can simply say – I have time or I don't have time – the whole thing is regulated. I am interested in being involved and when I have time I am here.

What do you find most exciting about your work as a test subject?
I believe it is the different studies that I have already participated – this diversity – this I find exciting.

Are you aware that you are supporting hearing research with you participation and contributing to the further development of new measurement procedures and hearing technology?
Of course – it wouldn't work without test subjects.

Do you have any requests for the Hörzentrum Oldenburg?
I have thought about it for a while and nothing has occurred to me. So I hope that the Hörzentrum will continue here for a long time. The research is also very renowned here and has been proven - or is recognised in the meantime. And I can only hope that it continues that way. But I don't have any requests myself. I come here, I feel fine – everything that you want from your test persons.

Become a test person

Testing hearing systems in laboratories or real-life situations, surveys and measurements with various different people is crucial to the work of the scientists. To acquire this valuable data, the Hörzentrum Oldenburg is always looking for people (with impaired or healthy hearing) who would like to support hearing research, scientific studies and product tests with their participation. All project participants receive compensation for expenses.

We would be very pleased to have your assistance! Please call us on 0441 2172-100.

PINK NOISE

Automatic speech recognition with surrounding noises and room sounds

'In the Starship Enterprise we are shown possibilities for speech control. But these do not have to remain within the realm of science fiction, because today solutions are being developed, which come very close to the film. Personally I find it extremely important that new technologies are used for applications, which dictate contact-free control or upgrading of user comfort, such as e.g. in the case of hearing aids or support systems for people with restrictions.' This credo was behind Dr. Niko Moritz's doctoral thesis with the title Amplitude Modulation Analysis for Automatic Speech Recognition, which was extremely highly acclaimed at the end of 2016.

Dr. Niko Moritz works as a research associate in the project group hearing, speech and audio technology in the Fraunhofer IDMT in Oldenburg. Moritz completed a B.Sc. in Imaging Physics from Bremen university and subsequently an M.Sc. in Engineering Physics from the university of Oldenburg. Prof. Dr.Birger Kollmeier and Dr. Jörn Anemüller participated in the doctorate in a supervisory capacity.

The aim was the improvement of automatic speech recognition with surrounding noises and room sounds. This was achieved through improved analysis of amplitude fluctuation of a speech signal. The applied method is motivated by findings on the human processing of temporal modulation characteristics. The development is particularly suitable for applications with remote microphones, as background sounds and room noises could significantly disrupt the speech signal and consequently automatic speech recognition. Comparable applications are Amazon Alexa or Google Home. These influences should be considered when using automatic speech recognition for home automation, as the user typically uses remote room microphones.

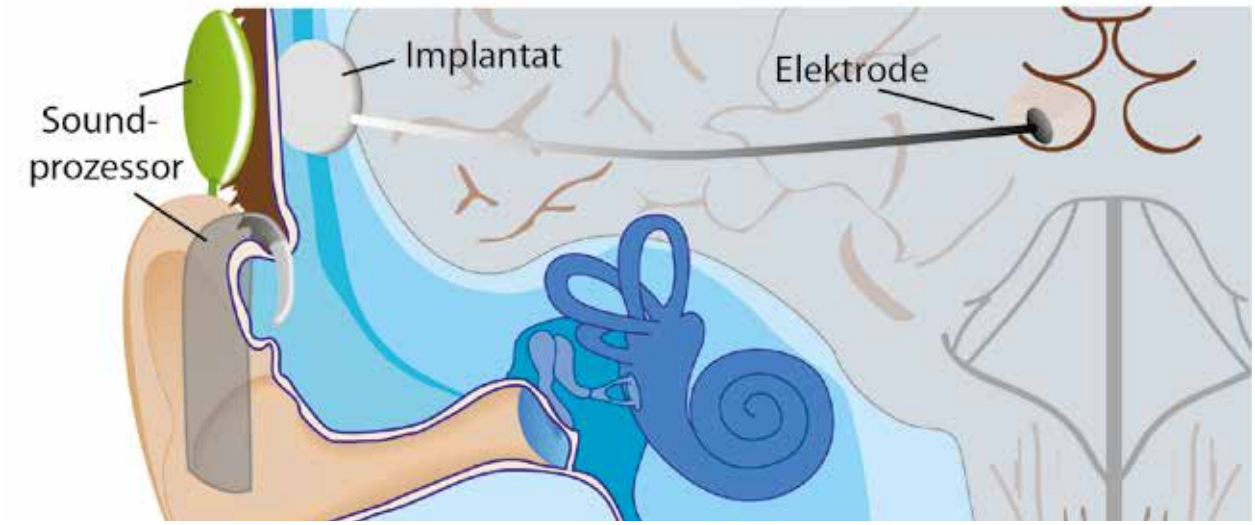
Enriched communication across the lifespan

Language is an extremely efficient means of communication. Whether old or young – restrictions in hearing or speech are a considerable hindrance for social integration in all areas of life. Hearing aids and speech synthesis can contribute to compensating for these restrictions, however even with these aids acoustic communication requires greater cognitive effort than for people without communication restrictions. The basic objective of the research network ENRICH, which is funded by the EU, is to modify or supplement language with additional information, to reduce this cognitive stress. ENRICH will train 14 doctoral candidates and not only give them the necessary interdisciplinary knowledge and research skills, but also offer the opportunity to gain experience in the technological transfer and business development sectors. Consequently the young scientists can put research results in products and services in the acoustic communication sector into practice.

Gerard Llorach, one of the doctoral candidates at the Hörzentrum in Oldenburg and at the university of Oldenburg, will research the use of visual information for improved signal processing in hearing aids and for realistic hearing aid tests.

Communication in environments where it proves difficult to hear such as cocktail parties does not only require that the individual speaker is understood against the background noise. It also requires a switch of attention between two or more conversation partners, and the adaptation to rapidly changing acoustic foregrounds and backgrounds. Current hearing aids only allow for the correct analysis and perception of the entire acoustic scene in a limited manner.

The aim of Llorach's research work is to overcome this restriction and to optimise communication for hearing aid wearers in challenging acoustic conditions through multi-modal analysis both with regard to the acoustic environment as well as the head and eye movements. The signal processing in the hearing aid should be 'enhanced' with additional visual information and consequently reduce the cognitive stress when switching attention between two or more conversation partners.



New hope for the hearing impaired: Hanover Medical School offers a world-wide unique central-auditory implant for NF2 patients

The researchers at the HNO hospital of Hanover Medical School have set another further milestone in offering patients, who have lost their hearing, the chance to hear again: After a number of years of research work they are now presenting the central-auditory mesencephalon implant (AMI), which can help in the case of neural hearing loss due to a missing or destroyed auditory nerve. Patients, who suffer from neurofibromatosis type 2 (NF2) are often affected. They develop acoustic neuromas on both sides. These are benign tumours, which destroy the auditory nerve during their growth, or the auditory nerve has to be removed when the tumours are removed. This results in the transfer of acoustic signals captured by the ear to the brain being irretrievably obstructed. To date the only way to restore this patient's hearing was to perform an auditory brain stem implant (ABI), a central-auditory implant –, which electrically stimulates structures of the auditory path at the brain stem and consequently bypasses the defective auditory nerve. Stimulation in this area is however difficult and imprecise, for this reason the so-called mesencephalon implant (AMI) was developed, which does not dock onto the brain stem but onto the colliculus inferior (lower hill) of the mesencephalon. This section of the auditory pathway is responsible for sound analysis and is particularly suitable for frequency selective stimulation using the implant electrode, because it is organised very regularly and can therefore be activated accurately.

Cochlear implants, which are used for inner ear deafness and make speech comprehension possible again for hearing impaired or deaf patients and have been tried and tested for over 30 years, provide perfect preliminary work for this innovative implant. Both the electrode technology used at AMI as well as the speech processor are identical with that of the cochlear implant. The patient wears a speech processor behind his ear, which directs the preprocessed signals through the skin to the implant situated below via a transmitter coil.

Roughly 1 percent of the hearing impaired can benefit from this new central-auditory implant, because either the auditory nerve was not docked from birth onward or was destroyed in the course of neurofibromatosis. 'We estimate that with the AMI we can help approximately 800 affected people to restore communication capabilities for the first time or again', reports ENT hospital director Prof. Prof. h.c. Thomas Lenarz, who built up the world's largest centre for cochlear implants and implantable hearing aids at the Hannover Medical School.

Affected NF2 patients can contact Hanover Medical School at any time, to establish whether an AMI would come into question for them.

Innovation consortium for integrated, binaural hearing system technology – VIBHear gets to work

February marked the start of the VIBHear project, funded by the European Regional Development Fund (ERDF) and state funds with a total of 1.2 million Euros: an innovation consortium for integrated, binaural hearing system technology.

In the next three years the collaborative project coordinated by the University of Oldenburg will adress the objective of implementing newly acquired knowledge as quickly as possible into technological solutions - and as such will promote the innovations that make hearing, particularly in difficult acoustic conditions, possible for people with hearing impairments and hence improve their social participation.

Apart from the University of Oldenburg, other good, old acquaintances from the cluster of excellence Hearing-4all are participating in the consortium – the Hanover Medical School, the HörTech competence centre, the Hörzentrum Oldenburg and the Jade University. Another example of successful collaboration between the two hearing research hubs in Lower Saxony. The collaboration project consists of five sub-projects, each managed by a different collaboration partner. Main objective: to create the technological conditions to combine the technologies from hearing aids and cochlear implants, which have to date largely been developed separately, independent of manufacturer. The infrastructural requirements shall also be created to test innovations faster and in a more standardised manner - while remaining realistic - on both software and patients. The researchers are also striving to introduce objective standards,

Kick-off meeting of the ERDF-funded project VIBHear, during the plenary meeting of the Cluster of Excellence Hearing4all in Soltau

which would enable the doctors to decide which hearing system technology to prescribe for a patient.

'The project VIBHear serves to make the area between Oldenburg and Hanover the first address world-wide where manufacturers of hearing aids or cochlear implants can source their technology' , according to Prof. Dr. Dr. Birger Kollmeier, spokesperson for the cluster of excellence Hearing4all and director of the collaboration project VIBHear. With regard to the project he wishes 'that these developments from our region become visible on a world-wide scale and also lead to new solutions, which ultimately lead to products, which are for the good of the patients.'

Background: The European Regional Development Fund (ERDF) is an important structural fund within the EU, which is coordinated in Germany by the Federal Ministry for Economic Affairs and Energy. Primarily the main focus is on projects to heighten competitiveness and create jobs as well as investments in energy efficiency, research and technological development as well as environmental protection.
The clinics and institutions in Lower Saxony involved in VIBHear have already merged in the 'Auditory Valley' with the corresponding Cluster of Excellence Hearing-4all and are world leaders in the provision of hearing systems of all kinds and in the respective research. As a result major impetus for the development of new technologies, testing methods and new forms of treatment are emerging from the continuous research and clinical application. In turn significant incentives arise for science centres Hanover and Oldenburg and consequently for the state of Lower Saxony.

More information available at: Vibhear.de
Film from the Lower Saxony state chancellery on VIB-Hear

Binaural noise reduction for hearing aids and multi-microphone dereverberation

In many speech communication applications, such as hearing devices, voice-controlled systems and hands-free telephony, the microphones are typically located at a large distance from the speaker. Therefore, the recorded microphone signals do not only contain the desired speech, but also ambient noise, interfering speakers and reverberation. Noise and reverberation result in degraded speech quality and speech intelligibility, not only for hearing-impaired persons but also for normal-hearing persons, as well as in a reduced performance of automatic speech recognition systems.

To tackle these problems, in the Signal Processing Group of the Dept. of Medical Physics and Acoustics at the University of Oldenburg Prof. Doclo and his team are developing various speech enhancement algorithms. More in particular, in the last years breakthroughs in the area of binaural noise reduction for hearing aids and multi-microphone dereverberation have been achieved.

Binaural noise reduction

Using hearing aids on both ears can generate an important advantage, both from a signal processing perspective since all microphone signals from both hearing aids can be used, as well as from a perceptual perspective since it enables the auditory system to exploit binaural cues. In addition to monaural cues, binaural cues are known to play a major role for speech intelligibility and for spatial awareness. 'Although many existing binaural speech enhancement algorithms are able to suppress noise and reverberation quite well, they are often not able to preserve the binaural cues of all sound sources in the acoustic scene,' Doclo explains. 'Clearly, this is undesired since the auditory impression of the acoustic scene is distorted, which in some situations (e.g., traffic) can even be dangerous. Recently, we have been able to design binaural noise reduction algorithms that preserve the binaural cues of both the target speaker as well as the binaural cues of the residual noise. The parameters in these algorithms have been optimized based on psycho-acoustic criteria, and perceptual experiments have shown that our algorithms are able to both improve speech intelligibility as well as preserve the spatial impression. Current research aims at integrating com-

Prof. Dr. Simon Doclo, Head of the Signal Processing Group of the Dept. of Medical Physics and Acoustics at the University of Oldenburg

putational acoustic scene analysis into these binaural noise reduction algorithms, which will further improve the performance for complex and highly time-varying acoustic scenes. In addition, we are currently investigating the usage of one or more external microphones, e.g., lying on a table or worn by a speaker, in combination with the hearing aid microphones. The first results in terms of noise reduction and binaural cue preservation are very promising.'

Multi-microphone dereverberation

Besides noise, another important factor influencing speech quality in distant-talking speech communication applications is reverberation, which is caused by acoustic reflections, e.g., against room walls. The aim of dereverberation algorithms is to blindly estimate the dry speech signal from the reverberant microphone recordings. 'Since obviously neither the dry speech signal nor the reverberation are known in practice, dereverberation was considered a very challenging signal processing problem up to a couple of years ago,' according to Doclo. 'In the last years, many advances have been made, not only by our research group but also by other research groups in the world. For speech dereverberation using a single microphone, we developed a spectro-temporal filtering algorithm together with the Fraunhofer project group for Hearing, Speech and Audio Technology. This algorithm obtained the best scores in terms of overall speech quality in the international REVERB challenge, which was a very satisfying result. In addition, for speech dereverberation using multiple microphones, we developed a framework based on multi-channel linear prediction which exploits sparsity of the speech signal in the time-frequency domain. Using this framework we are able to estimate the reverberation components and subtract them from the reverberant microphone signals, leading to impressive results. '

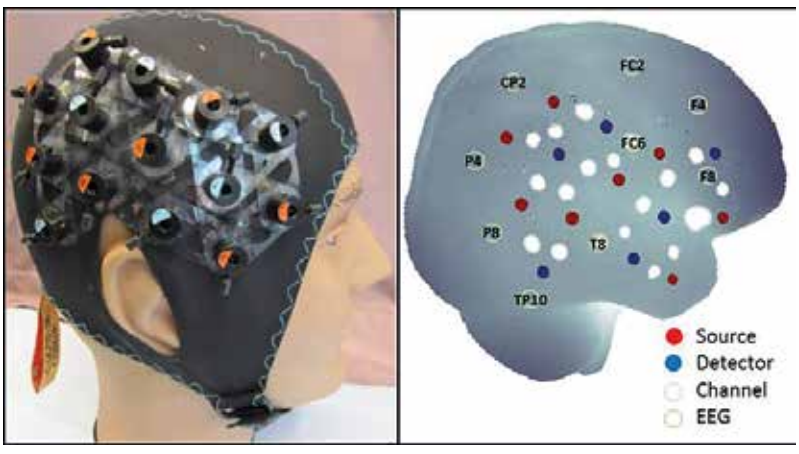
Since last year, these algorithms can be tested in a new acoustic lab with variable reverberation time in the NESSY building in Oldenburg. Using rotatable panels with absorptive material on one side and reflective material on the other side, the reverberation time can be changed from 0,2 s to 1,2 s in a matter of minutes. 'There are only few labs in the world where the acoustic properties can be changed so quickly in such a large range,' Doclo says. 'Therefore this lab is very important for the further development and validation of our speech enhancement algorithms.'

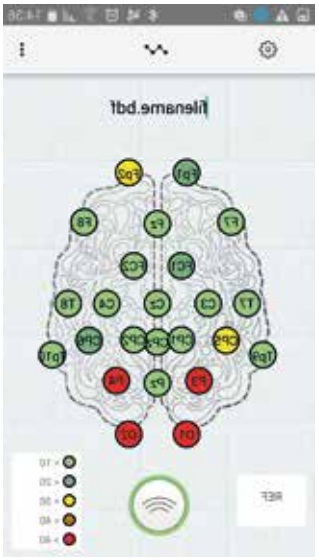
Functional near-infrared spectroscopy and cochlear implants – The possibility to represent hearing through light

The activation of the auditory cortex in the cerebral cortex is highly relevant for the development of speech and communicative skills. Generally in the case of CI wearers, however, in particular in the case of children, the objective evaluation of whether the electric current stimulation of the auditory nerve also reaches the cerebral cortex and activates the desired hearing sensations, is difficult. Because the use of common neuroimaging modalities such as e.g. the electroencephalograph (EEG), the magneto-encephalograph (MEG), or the functional magnetic resonance tomography (fMRT) is restricted in this case. Therefore a reliable testing procedure is necessary. The functional near-infrared spectroscopy (fNIRS) seems to be an extremely promising approach here. The fNIRS is a non-invasive optical method for the recognition of changes in blood flow, so-called haemodynamic patterns, which are created by cortical activity. Recently the fNIRS application has been examined as a promising approach, alone or in conjunction with other measurement methods (multi-modal measurement), in the central auditory diagnostics sector. Particular attention was paid to the possible use by CI wearers.

The physiological basis for the use of fNIRS to measure cortical activity is the interaction between the neuronal activity and the resulting changes to the haemodynamic properties of the brain, which is referred to so-called neurovascular coupling. In principal the method is based on the interaction between light and tissue. Light is radiated onto one point of the head in the near infrared range (wavelength range from approx. 700 to 1300nm) and detected again several centimetres away. A change in the detected light makes it possible to form conclusions on changes in the tissue area that is permeated by light (e.g. increase or decrease of the blood flow in the tissue). This change in the blood flow or rather the change in the oxygen concentration in the haemoglobin - the protein complex in the red blood cells, which binds oxygen-, can now subsequently be perceived as a measurement of neuronal activity. If we do not only measure at one single point on the head but at a number of different positions, it is possible to create a relatively exact mapping of the cortical activations. fNIRS therefore offers an extremely promising, non-evasive, readily available method that can be applied as often as required. Other advantages of the fNIRS are the simple combination with other measurement methods (e.g. the EEG), relative insensitivity to the measurement subject's possible disturbing muscle tremors and eye movements, as well as electric artefacts or ferromagnetic components in the CI.
However, to date only a few research groups have examined first concepts in studies on alternative or combined use of fNIRS methods for hearing representation. Therefore further basic research on auditive perception is required, to examine the future use of fNIRS by CI wearers and use in the area of auditive diagnostics as well as examining the maximum potential of the fNIRS in these areas.

Initial significant steps and studies in this direction are currently being made at the Hanover Medical School as part of the 'Hearing4all' cluster of excellence 'Hearing-4all'. There were promising first results from initial tests on hearing adults. We found distinct activation patterns in the cortical areas, which are linked to the auditory processing. Current detailed studies are in progress to examine intensity-related activation patterns based on these results. Planned studies also include the measurement of activity patterns in the hearing impaired as well as CI wearers and the comparison with people, who hear at a normal level. As a final conclusion we expect a decision on the application of fNIRS as an objective, neurophysiological method to assess the hearing sensitivity in the cerebral cortex, in particular in the case of children, and on their use in the hospital routine.





Above: Representation of impedance, i.e. the quality of connection from the electrode and head to the smartphone
Right: The latest prototype allows EEG activity to be recorded in natural hearing situations outside of a laboratory.

A brain in your pocket: Can the focus of your attention be determined using a mobile EEG ear?

We don't just hear using our ears. Hearing is an active process whereby what we hear depends on our respective interest and experience. In complex hearing situations, our brain plays an important role as it allows us to focus our attention on a particular source of sound and phase out other unwanted sounds. The underlying brain processes can be monitored using an electroencephalogram (EEG), which measures electrical activity in the brain using sensors placed on the scalp. Many research groups are working on detecting EEG signatures while focussing attention during hearing and making it useful for different applications.

In laboratory situations, it is already possible to accurately tell which of two simultaneously presented audiobooks a person is listening to by reading the EEG signals. The long-term goal of Prof. Stefan Debener and his work group is to use the relevant EEG signals to control hearing aids so that the devices are better adapted to the user's intentions and not just the current hearing situation. Hearing aids can indeed compensate for partial hearing loss; however, in complex hearing situations, such as when many people are all speaking at once, many hearing aid wearers report of an unsatisfactory hearing experience because the hearing aid cannot determine between necessary and unnecessary sounds. If EEG signals can be used to determine which voices are of interest to the hearing aid wearer, this voice would be selectively enhanced.

For conventional EEG measurements, a number of sensors are attached to the test subject's head. These signals are transferred via a cable to a large signal amplifier and saved to a computer. In order to use brain activity to control a hearing aid, a new method is required to measure EEG in everyday situations without disrupting the hearing aid wearer. Prof. Stefan Debener and his work group have labelled this concept 'transparent EEG' and are developing methods to make EEG recording as pleasant, comfortable and discreet as possible. Using miniaturised EEG technology, we want to capture the hearing ability of a person in real-life situations.

That's why commercially available sensor strips called cEEGrid were developed - similar to a hearing aid - which are positioned around the hear and can be used in public without drawing attention (www.ceegrid.com). The sensor strips are combined with a small, light and wireless signal amplifier which can be discreetly worn. A commercially available smartphone is used to record EEG signals and analyse data. What once recently was the size of a laboratory desk now fits into your pocket.

The latest prototype allows EEG activity to be recorded in natural hearing situations outside of a laboratory. Researchers want to use everyday hearing situations to find out which of multiple sources of sound a person focuses on, in real-time if possible. In future, they will be able to find out whether EEG signals can be used to control a hearing aid in everyday life.

World-wide unique treatment at the Hanover Medical School: Endogenous cells guarantee improved hearing from cochlear implantation

The experts from the ENT clinic at the Hanover Medical School are taking a world-wide unique approach to improving hearing with the cochlear implant (CI). Hospital director Prof. Prof. h.c. Dr. Thomas Lenarz: The surgeons in conjunction with the CI electrode bring the patient's own stem cells, or more precisely the so-called precursor cells from the bone marrow, into the inner ear. The results of this innovative treatment, which has been offered to adults at the Hanover Medical School for roughly one year, are now available and are proving more than promising.

The principle is quite simple: During the cochlear implantation – the provision of a deaf person with an inner ear prostheses - a small amount of blood is taken from the patient's bone marrow in the sternum and prepared in a centrifuge directly in the OP, so that the precursor cells are isolated. These cells have been formed directly from the stem cells and are necessary for blood formation. They simultaneously fulfil two important goals in the inner ear, because on one hand they reduce the formation of scars around the electrode and on the other hand create an environment, in which the fibres of the auditory nerve feel comfortable and are encouraged to gather at the electrode. Both effects provide a significantly better signal transmission from the electrode to the auditory nerve and consequently an improved hearing result for the patients.

'We will continue to expand this treatment and hope that we also receive approval for children in a few years , so that really all CI patients can benefit', according to Prof. Lenarz, director of the world's largest centre for cochlear implants and implantable hearing aids. To date approximately 8000 patients have received a cochlear implant at the Hannover Medical School, every year around 500 more patients receive an implant.

Prof. Lenarz and Dr. Athanasia Warnecke (director of the work group 'Protection and regeneration of the inner ear') from the ENT hospital at the German HörZentrum Hanover (DHZ) in the Hanover Medical School, who also work on this new approach in the cluster of excellence Hearing-4all, have completed around five years of research work. Based on this preliminary work, Dr. Warnecke finally developed an approach in conjunction with Dr. Ariane Römer, which can be used in the hospital.

Dr. Athanasia Warnecke prepares the patient-specific precursor cells for cochlear implantation directly in the operating room.

The background is the aim to increasingly adapt hearing with cochlear implants to match natural hearing. To date the system has proven outstanding for speech comprehension, but in challenging acoustic situations such as the presence of disturbing noises or when listening to music, the sound quality could be upgraded. As the number of electrode contacts cannot be increased significantly, so as not to restrict the flexibility of the electrodes – with the result that during implantation the sensitive structures in the cochlear are damaged -, the researchers take a number of other approaches to increase the transfer quality. In contrast to the inner ear, which has an estimated 30,000 hair cells, which are responsible for signal transfer, the CI only has a maximum of 22 electrode contacts available. This compression has an impact on the tone and should be rectified in another manner. The approach is the treatment with the patient's own precursor cells, which is to be extended to such an extent in Hanover that it ultimately will become a part of the hospital routine.

SPEECH IN NOISE
WORKSHOP
5-6 January 2017
Oldenburg, DE

'Speech in Noise' (SpiN) workshop on 5th and 6th January 2017 in Oldenburg

The speech-in-noise (SpiN) workshop, which deals with the topic of research into speech perception in difficult communication situations has been organised in Germany for the first time. Funded by generous sponsors, the University of Oldenburg and the cluster of excellence Hearing4all hosted the ninth run of the workshop.

The two-day workshop presented an exciting programme of twelve invited lectures and 52 excellent scientific poster presentations in total. The programme covered a series of subjects: from speech perception with cochlear implants and hearing aids, cognitive and linguistic aspects of speech in a disturbing noise environment, speech comprehension models, new speech comprehension tests, physiological and psychological studies on the influences on speech comprehension and its neuronal correlates, through to speech(signal)processing and automatic speech recognition. There was plenty of time and the right setting for exciting discussions on the posters at a joint evening event.

The main speaker among the participants was Astrid van Wieringen (KU Leuven), who provided a comprhensive overview of findings on the influences of aging on the processing of acoustic signals and speech perception. There was also a guest from the USA – René Gifford from the Vanderbilt University in Nashville, who gave a lecture on the subject speech comprehension improvements in spatial hearing for bi-modal and bilateral cochlear implant wearers. Two representatives of the cluster from Oldenburg opened and concluded the event. Marc René Schädler held a keynote speech on his modelling approaches including an individual speech comprehension prediction from hearing impaired people with hearing aids. Inga Schepers spoke on the influences of visual and auditory speech context on cortical and sub-cortical speech processing. The lecture from Tanja Schultz (University of Bremen) proved a particular highlight. The speaker captivated the audience towards the end of the event the with her work on the acquisition, recognition and interpretation of 'silent speech' using muscles and brain activity.

A prize was awarded for the best poster at the workshop - the Colin-Cherry Award, named after the person, who coined the term 'Cocktail-Party-Effect'. This year it went to Lea-Maria Schmitt, Jonas Obleser and Malte Wöstmann

(Lübeck) and gave the recipients reason to celebrate. The winning poster, and the abstracts from the other poster and lectures can be downloaded from the workshop homepage (http://spin2017.de).

The SpiN workshop is organised every year by an European researcher group from the community of speech and hearing researchers. 'We are proud that we could organise the workshop this year and were able to boost the awareness level of Oldenburg in this research focus sector' said a delighted Prof. Dr. Tim Jürgens, junior professor in the excellence cluster and key figure in the seven-strong organisation team, speaking later about the honour. The workshop always takes place over two days and includes invited lectures and poster contributions from the participants. The aim of the meeting is to unite young researchers and teachers from the different European hearing research groups and to stimulate networking, discussions on research issues and scientific collaboration. The focus of the workshop on speech related subjects is justified by the fact that speech is the most commonly used method of communication. It is fast, robust and open for interactions and also still functions well in unfavourable conditions. Influences, which disrupt the transfer of the speech information content, can be reduced using the latest technological developments - provided one understands the diverse underlying processes, which can only be examined on an interdisciplinary level. The workshop offers a unique opportunity to exchange views on this specific subject on an interdisciplinary level. As a result a number of new project ideas and collaborations can be developed.

Graduates of the JRA in Oldenburg: Interview with Bojana Mirkovic

You are one of the first graduates of the JRA in Oldenburg. Have you been familiar with the offers of the JRA PhD programme and did you use them?

Since the beginning of my PhD position I was well aware that JRA has a well organized program for PhD students. At first, I was mostly informed about the program by my supervisors, Stefan Debener and Maarten De Vos. Additionally, Hearing4all meetings and notification emails have always played a very important role in familiarizing students with additional offers and that is exactly how I was informed about the upcoming events. Over the period of my PhD studies I have on one hand taken part in the wide spectrum of courses and workshops that JRA had to offer, and on the other hand also participated in meetings and social events organized by JRA and Hearing4all. I believe this combination of providing specialization as well as networking is extremely important for advancing one's scientific career.

Which offers were most useful for your future career development?

Since I come from engineering background, once I joined JRA I was glad to have an opportunity to learn more about other research areas and methods that are represented and applied in 'Hearing4all' Cluster of Excellence. In such an interdisciplinary cluster understanding the focus of other researchers and task groups is more than desirable. This is why taking part in courses and workshops that are not tightly related to the specific area of the PhD project was rather important to me. In retrospective, this experience probably helped me shape a bigger picture and will prove crucial in conceptualizing potential larger interdisciplinary projects.

Which other offers would be of use for future PhD students in your opinion/view?

Attending JRA specialization courses and summer schools is a very good way to broaden the knowledge and expend social network. Apart from that, I believe that JRA offers great support and career guidance for young scientists; a very welcome option in the beginning of research career that I would wholeheartedly recommend not only to PhD students, but other young researchers as well. Additionally, although I have not had personal experience with it, I do know that JRA offers various options for young scientists with families. Young parents that are considering starting PhD studies would definitely benefit from this program and it might ease their way to the PhD title. Considering all available options, in my opinion, JRA covers the most important issues that might come up during the PhD.

You are currently working as postdoctoral fellow. Do you know that JRA has also offers for postdoctoral researchers?

I definitely do and intend to make the best of it in future. More specifically, I intend to participate in the relatively new workshop series that are a part of the Career coaching program. Also, I am planning to do a project in the foreign lab and JRA offers a great funding opportunity intended for lab visits that could financially support it. While this is not only an option available for postdoctoral researchers but PhD students also it is nevertheless very helpful.

Bojana Mirkovic is one of the first graduates of the JRA in Oldenburg.

Events and Advanced Training Sessions in Auditory Valley

20 June 2017

Patient University 'Eyes and ears - our connection to the world'

Presentation by Prof. Lenarz and learning stations about the topic of hearing, starting at 6 pm in Auditorium F, contact: mueller.regina@mh-hannover.de

30 July 2017

Hearing festival at Kaliberg Empelde

As a partner to the Hanover hearing region, we will be attending the highlight of this year's programme: the hearing festival at the Kaliberg in Empelde. Remarkable concerts, experiments and activities will take place, all based around the ear. The idea: to present the diversity of the hearing region at different stations and provide lots of people with an impressive hearing-related day. mueller.regina@mh-hannover.de

18 August 2017

Human-machine interaction and user-centered design

Workshop by Oldenburg Chamber of Industry and Commerce, KIZMO GmbH and Hörzentrum Oldenburg GmbH

01 - 02 September 2017

19th Hanover CI Congress

Interdisciplinary congress for patients, doctors, speech therapists, teachers, specialists, self-help groups, interested individuals and friends

20 - 22 September 2017

Intensive course in audiological technology for beginners

The goal of this intensive course is to provide an overview of the methods and procedures of this specialist field and convey an understanding of the most important problems and framework conditions.
The knowledge acquired will, for instance, give new employees of hearing aid, CI and measuring instrument manufacturers a comprehensive and competent introduction to the material.
For more information: www.hoertech.de

06 - 08 October 2017

Hearing4all at the 4th International Congress on Hearing Aids and Overcoming Barriers in Berlin

The German Association for the Hard of Hearing (DSB) invites you to Berlin from 6 to 8 October 2017 - 4 years after the last congress on hearing aid technology in Eastbourne, England - on the initiative of the International Federation of Hard of Hearing People (IFHOH).

The Hearing4all Cluster of Excellence provides insight into current research trends and the future of hearing

17 - 20 October 2017

Forum Office Acoustics at the A+A in Düsseldorf

Together with HörTech, the partners of the Forum Office Acoustics present comprehensive solutions for acoustic optimisation of office spaces.
www.forum-office-acoustics.de

18 - 20 October 2017

HörTech at EUHA 2017 in Nuremberg

The main focus of HörTech gGmbH's exhibition are Oldenburg speech tests and modern approaches to speed audiometry in quiet and noisy environments. The TRC of the Hearing4all Cluster of Excellence presented latest results from translation

24 October 2017

KinderUni Hanover

The KinderUniHanover (KUH) is a free course of lectures for children aged between eight and twelve. On 24 October, the focus will be on 'Hearing, Smelling and Tasting - The Three Senses of Enjoyment'
More information at: www.kinderuni-hannover.de

27 October 2017

Inclusion - barrier-free hearing

During the course, the HörTech pool of experts provides information about transmission equipment for schools and other public facilities as well as acoustic options.
For more information: www.hoertech.de

02 - 03 November 2017

International symposium of the Hearing4all cluster of excellence

Researchers of the Cluster of Excellence present the latest findings from science and industry to an invited audience of specialists.

Hearing 4all

Cluster of Excellence in the Auditory Valley Future Hearing

AUDITORY VALLEY
FUTURE HEARING

Auditory Valley offices

The offices act as the contacts and coordinators for all Auditory Valley work. The offices have a broad range of tasks as active coordinators and points of contact for Auditory Valley. The team of staff from HörTech gGmbH and the Hanover Medical School research topics and trends, bring innovative minds together, determine Auditory Valley's strategic orientation, make sure the activities have a focus and work to give the region's expertise a clear profile.

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