**Danish
Sound
Cluster**

Summary: "Future Sound Tech Solutions" – Meeting #19

Meeting # 19 in the working group "Future Sound Tech Solutions" took place on September 5, 2024.

Agenda

1. Webinars & Physical events during 2024/25:
   a. Follow-up on proposals and ideas from meeting # 18 including additional comments and proposals.
   b. Proposals for possible speakers
   c. New themes?
2. Collaborative projects, update of proposals, indication of possible project consortia.
3. News from DSC secretariate
4. A.O.B.

Danish Sound Cluster

Ad 2: Proposals for Webinars

#	Subject	Background
15	Speech Prediction	**Background:** Speech Prediction is a topic in its own right - and interests seem high. The aim is to find an approach to overcome the middle frequency range challenge, where existing solutions (see below) appear to fail. Active noise cancellation, ANC, can remove low frequency noise and passive noise cancellation can remove high frequency elements. Some research on speech Prediction exists, but in general it is today still a tiny R&D domain. **Potential speakers:** • Johannes Sars ? (check with Niels Pontoppidan) • Yurii Iotov, Ph.D. Student, AAU in collaboration with Jabra, (contact also Jesper Rindom Jensen, AAU) Yuri is currently very busy completing his Ph.D., and some of his work addresses sensitive patent applications, so he is now not able to take active part in a. webinar. He appears willing at a later point in time, most likely at the end of 2024, to assist in a webinar. Jesper will try to obtain information when a possible event could take place in relation to Yuriis schedule. Henrik Fønns, IDA (involved in speech recognition) has offered his assistance as moderator for the session. Jeppe has approached Jesper Jensen, AAU (the other Jesper Jensen at the same department), if he could be interested in contributing to a webinar on the topic. Jeppe and Henrik Fønns have in addition pursued opportunities related to "Deep Fake" that could form another part of the event. They have contacted 11 labs on that topic but have not yet received any response. "Deep fake" will be part of the event. *There has been no development on the subject since the last meeting. The contact with Henrik Fønns must be dusted off. The subject will be taken up again at the next meeting.*
21a	Augmented sound in future society Focus on Auracast **(Webinar 2024)** **Follow-up to the SoundDay panel discussion**	**Timing:** • September 25, 2024 **Title:** • **"Auracast is the Future of Audio!"** **Speakers:** • Damian Murphy, Professor Audiolab University of York • Nick Hunn, CTO at Wifore • Thomas Olsgaard, Principal Engineer at GN Hearing There will be a focus on which sound is thought to be used in Auracast and experience with developing products for Auracast. In addition, there will be a good debate on the topic between the speakers and with questions and comments from the audience. The webinar will be followed up in the "Audio hardware" networking group under Danish Sound Cluster.

#	Subject	Background
21b	Augmented sound in a Metaverse society	The aim of this topic is also to look for general trends in augmented sound that could pivot the Danish sound Industry into a future leading technologically position in sound – rather than just wait for trends to come to us from the outside.
		Directions to investigate could be:
		• **System devices**
		• **Metaverse, virtual/augmented audio** (*Metaverse: Improved digital environment where it is possible to move seamlessly between work, play, shopping, socializing and creativity in one digital landscape*).
		Professor Damian Murphy, University of York and results from his Lab seems to be quite interesting
		WG members envision that a real breakthrough will happen, if, and most likely, when large companies, e.g. Apple, bring applications to the market. Then other industries will follow.
		Still remains the situation. For now, it is a bit difficult to set up a webinar on the theme, but we expect that in the foreseeable future things will change. For that reason, we keep the theme, and once we can get more substance, we reactivate the planning of an event.
23	Better tools for ensuring good audio quality in e.g. field recordings, hence reducing the need for dubbing	The theme is interesting, but we need to scope it better.
		If we continue this theme, we should focus on the middle segment, not the highly professional market and not the market for amateurs, but more on the middle segment.
		Focus is on producing good quality audio everywhere
		A Finnish company, Genelec, making monitors have e.g. stated that it is not so much the picking up of sound, rather the reproduction of it when used in home studios. Here automatic equalization, calibration, room control, etc. are at stake. It applies to both making music and professional audio.
		It was mentioned that 3D audio is gradually entering use in headsets and other sound applications. Here room calibration becomes even more of an issue.
		To reach out for more info on 3D recording Industry, Torben Ch. proposed to contact Sennheiser that already in 2017 had a first solution released. One person to contact could be Veronique Larcher. Ph.D., Sennheiser.
		She in turn has recommended us to contact Henrik Oppermann from Schallgeber, who apparently is an expert in the field and has done several activities with Sennheiser. (Birger has contacted Henrik Oppermann after the meeting. We need to define better, what we want)
		We expect that there will be a breakthrough in the area emerging from leading hi-tech companies in the foreseeable future.
		Miika will also try to identify people that could assist in setting up an event on the theme.
		Further discussion to be continued at the next meeting

#	Subject	Background
23b	3D sound recording for use in e.g. test applications **New Theme**	Recording of 3D-sound, e.g. in connection with being able to carry out product tests in a 3D environment, has increasing interests. FORCE has together with B&O, GN-Hearing, Oticon and others been in the process of creating a library of video and 3D sound recording data sets captured in real life allows for feature testing of hearing assistive devices (OTC), hearing aids, telecom headsets, TWS earbuds and even AI model training. See https://forcetechnology.com/en/services/acoustics-noise-sound-quality/senselab-download-hoa-ssr-dataset The purpose is to be able to use the data sets in connection with laboratory test tasks. Similarly, AAU in collaboration with B&O has been working on the reproduction side. How can you use spacious recordings to recreate a "sound space", and how the user can select between various data sets? The aim of a webinar about the technical recordings could be to aim at the more technical aspects of this kind of sound recording and how they can be used in different contexts. Persons who could contribute are: • Tore Stegenborg or Søren Vase Legarth, Force Technologies about 3D sound recordings and data sets for use when testing products • Jan Østergaard, AAU about spacious sound recordings and their use to recreate a "sound" space • A user form one of the participating companies. The topic could also suggest how we can bring partners together who can take advantage of the opportunities presented in the webinar, e.g. through an EU-funded project. The webinar will thereby contribute to our strategy of bringing partners together. There is also a desire that, in the context of the webinar, we contribute to conveying project results that have already been collected. The subject can be elaborated more in the next meeting.
25	**Immersive Audio & Quality Development in Digital Meetings**	Webinar completed • 30 April, 2024, 15:00 – 16:30 **Speakers and topics:** • Markus Multrus, Fraunhofer Institute for Integrated Circuits IIS • Stefan Bruhn, Dolby Laboratories This event was created in collaboration with IDA – The Danish Association of Engineers.

#	Subject	Background
26	Autonomous Response to Audio	Some companies, e.g. hearing aid companies, are highly interested in how sound influences human bodies, i.e. human nerve systems. In the past, these companies frequently sent students to Roskilde Festival with equipment to measure and indicate the effects that sound had on the human body.
		Today, some companies instead send students to New York, so that students can experience on their own body how the surrounding sound and noise are influencing them.
		Some companies also work closely with schools on the topic. However, there are ethical aspects related to this as well, when techniques are transformed into use in other contexts, e.g. the office, at political events, etc.
		Potential speaker:
		• Jeppe Høy Konvalinka Christensen, Eriksholm Research Lab - How daily-life noise impacts stress levels in hearing-aid users, and how this might be linked to listening effort. - How having a good SNR is crucial not only for improving speech intelligibility but also for lowering stress levels. - How big-city noises (New York) can induce stress in young people, and how we can measure this. - How synchrony in heart rate between people might relate to (auditory) engagement in real life.
		• A possible candidate from SDU (through Jeppe Høy)
		• Mette Sørensen, RUC
		• Jens Hjortkær, DTU (group of Jeremy)
		The topic is about physiological response to different stimuli. Noise is well known to create a lot of issues in that context.
		The WG agrees that the topic is highly interesting.
		Torben Ch. has been in contact with Jeppe Høy K.C., see above.
		Miika will contact a former Ph.D. student at B&O, who now has a job at a British University to try to obtain some references to the theme.
		The theme will also be addressed at SoundDay 2024
		Jeppe will follow up with Jeppe Høy K.C. og Mette Sørensen.

#	Subject	Background
28	Cultural, ethical, and social consequences of new use of sound	How will the way we consume music/sound in the future affect the way we interact?
		What are the social consequences?
		As audio producers how do we take this into account?
		For example, future use of Auracast may also have an undesired effect of isolation people socially, since the sound transmitted directly into earbud may counteract social contact to people around. Similar effect when people use artificial vision solutions. When developing an augmented world, it is important that we make it distinct able, so that people can realize the differences.
		Important that we also understand how to handle the negative effects of new sound solutions. It is probably difficult to get people to give formal presentations on the topic, so a panel debate may prove a more efficient way to structure the theme.
		A new book "Kig op" (Danish) by Jakob Sorgenfri Kjær has been published. He addresses how people cannot find rest, cannot focus, because they are overloaded by massive information streams. Although his focus is on video content rather than audio, a similar effect is likely to influence humans due to massive audio info. May be Jakob Sorgenfri Kjær could contribute to a webinar, offering an "audio angle"?.
		In general, it may be important not just to fill our lives up with audio but ensure quality and relevant purpose of surrounding audio. Augmenting audio should be as natural as possible.
		Many new technological developments add cognitive load to our brains, but our brains are the results of thousands of years of development, so there is limit to how much cognitive load, we can handle on top of what we already handle.
		In addition, how do we convey emotions through e.g. video/audio connections? Hi-Tech companies are currently identifying a problem with people working remotely and hence only participate through video meetings that creativity is dropping, because employees do not meet informally e.g. in front of a coffee machine to exchange ideas.
		So, can some of the nice developments we see in new smart audio solutions also be seen as counterproductive in the sense that we at the same time loose out on significant and proven ways of interacting, and if so, what can we do to circumvent the negative effects?
		Torben Ch. is in the process of reading Jakob Sorgenfri Kjær's book on the subject. Based on Torben's assessment, we will discuss at the next meeting whether we think that Jakob Sorgenfri's book can be used as input on a webinar.
		In addition, a dialogue on the social consequences of the use of modern sound solutions is also planned in the upcoming webinar on Auracast.
		In general, many of the modern uses of audio products have an impact on people's social behavior.

#	Subject	Background
29	Competition for students at universities	Competition among Students at Universities to come up with advanced solutions, novel ideas, for Future Sound Tech Solutions. Best idea/concept/solution wins a prize of e.g. 25.000 DKK. Event for Prize Award, where e.g. DR1 and TV2 are invited to broadcast winners and ideas in the news. The WG endorsed the idea. In our next meeting, we will try to frame how such an event can be activated and how we can find sponsorships for the price. *Discussion postponed to next meeting.*
30	**Audio in use with drones and robots** **New Theme**	The use of audio in drone and robotic applications is a rapidly evolving field, combining aspects of acoustics, artificial intelligence, and robotics to solve diverse challenges. From detecting and identifying drones through their unique acoustic signatures to enabling robots to perform acoustic monitoring in natural environments, the potential applications are vast. These technologies can be used for tasks such as surveillance, environmental monitoring, and human-robot interaction. Below in #30a-#30d are given examples of use of sounds in relation to robots and drones. A webinar could focus on one of the themes of combining more themes.
30a	**Drones and robots:** Biomimicry/-acoustics	A promising area of development is biomimicry, where systems such as artificial echolocation are designed to mimic natural sonar used by animals like bats and dolphins navigating in low light conditions. **Potential speakers/companies:** • Frederike Dümbgen • Jan Steckel, • Robin Kerstens In another type of applications echolocation, a company like Teledyne-RESON, Slangerup, market leader in underwater acoustic sensors, state-of-the-art echosounders, multibeam sonar systems, transducers, hydrophones, may be a potential company to include. TH company has been involved in e.g. use of sonar in torpedoes. Several other companies in Denmark have deep roots in sonar applications. .
30b	**Drones and robots:** Drone detection	Humanoid robots equipped with advanced audio perception capabilities are also gaining interest, providing opportunities for improving assistive technologies and enhancing human-robot interaction. The field also touches on sound-based navigation, and auditory scene analysis, which could be beneficial in complex, dynamic environments The use of acoustic solutions in connection with defense-related research and development has obtained focus in these years. Some solutions focus on the use of acoustics, e.g. acoustic arrays with fixed microphones and microphones placed on soldiers in the field to detect drones in the area. Solutions are used in addition to other detection solutions. Companies with such solutions include e.g. MyDefense in Aalborg, Squarehead Technology in Norway and others. **Potential speakers/companies:** • Ines Hafizovic, • Robin Kerstens • MyDefense, Aalborg

#	Subject	Background
30c	**Drones and robots:** Localization/Tracking of humans	Sound control is seen as an opportunity to supplement other sense technologies in connection with e.g. mobile robots on industrial floors, in hospitals and elsewhere. Interesting users could be companies such as: • Mobile Industrial Robots (MIR) • Nilfisk And others **Potential speakers/companies:** • Benjamin Yen,
30d	**Drones and robots:** Robot audition	The area focuses on how to optimize applications where inherent noise is a problem and the signal/noise ratio must be optimized to achieve useful applications. Is e.g. a challenge in connection with drones, not least if you want to use drones for sound observation. **Potential speakers/companies** • Benjamin Yen, • Elisa Tengan
31	"VLP" (Virtual Listener Panel) **New Theme**	SenseLab has developed a machine learning model, 'Virtual Listener Panel', VLP, for use when listening to recordings of e.g. headphones, and evaluate various attributes in the recorded sound. The model is trained on data from listening tests with expert listeners. It is currently trained on Bass strength, Treble strength, Midtone strength, timbre (dark-light), Brilliance and Bass depth. The next step is to train it on e.g. canned sound, metallic etc. attributes that describe more resonant phenomena. Later come dynamic attributes, such as 'Punch'. VLP cannot replace listening tests 100%, but it can help companies in their development of e.g. headphones/earbuds etc. in the development phase, where you typically need to test several times to see which way you are moving. Later in the development process, however, you must use listening tests to confirm your results. VLP is a breakthrough in the use of models, and it could be interesting to include the solution in a webinar, perhaps together with other machine learning techniques in connection with the development of audio products.
32	OTC hearing aids **Resumed Theme (previous #13)**	On September 9, 2024, Apple announced that the latest model of the company's mobile phone will also be able to be used as an OTC hearing aid. The functions are intended for people over 18 years of age with mild to moderate hearing loss, and are expected to be available in more than 100 countries during autumn 2024. The subject of OTC hearing aids has previously been proposed as a topic for a webinar (**see Appendix 3**), but had to be abandoned because, among other things, the hearing aid manufacturers were not interested in participating. It was assessed that the OTC market, after some initial hype, quickly turned out to be very limited. With Apple's entry into the OTC market, interest in OTC may have been created again. In Denmark at least the 'Høreforeningen' has shown interest, not least because the new hype can support acceptance of the use of professional hearing aids. But even though the Apple product offers the option of self-testing, the 'Høreforeningen' advises that you get a professional hearing test done. At the next meeting we will discuss whether we should try to revive OTC as a topic for a webinar.

Next meeting

The next meeting in the working group on "Future Sound Tech Solutions" will take place:

- **Tuesday, November 12, 2024, 14:00 – 15:00**

Appendix 1: Participants in the meeting

Jesper Rindom Jensen	AAU, Inst. f. Electronic Systems	Associate Professor
Tore Stegenborg Andersen	FORCE Technology	Senior Researcher
Birger Schneider	CHAMAJ Consult ApS	Director
Jeppe Lindegaard	Danish Sound Cluster	Program Manager

Appendix 2: Events proposed and promoted by the working group

#	Title	Comments	Event type	Date
1.a	AI/Machine Learning	Workshop (Edge)	On-line	5 April, 2022
1.c	AI in signal processing		Webinar	
2	"Demant Discovery"	Start-up in dialogue with Demant	Networking event	17 March, 2022
4	Audio & privacy	Part of physical conference	Panel discussion	4 May, 2022
5	Sound Quality in Digital Meetings	• Position paper • Conference session	Conference	4 May, 2022
6	Multisensory Processing		Webinar	7 December 2021
7	Sustainable transformation in Audio Companies	Green footprint in sound	Webinar	25 January, 2022
9	Personalization of User Needs		Webinar	1 June, 2022
10	Data Simulation for AI		Webinar	7 June, 2002
11	Perceptual Audio Evaluation		Webinar	13 October, 2021
12	Key Note, Sound Day 2021 "The Sound of Metal"	Oscar Winning Mikkel E.G: Nielsen, Film editor & Nicolas Becker, Sound Designer	Conference, Sound Day 2021	17 November, 2021
	AI in Audio Applications	Conference event at Digital Hi-Tech Summit, Bella Center	Conference	26 October, 2022
19	AI in Audio Applications		Webinar	13 December, 2022
8	Emerging Acoustic Sensor Technologies and Applications		Webinar	14 March, 2023
14	Feedback and noise cancellation		Webinar	9 May, 2023
17	Use of sound with robotics		Webinar	23 May, 2023
27	AI in Music & Sound		Webinar	26 October 2023
25	Immersive Audio & Quality Development in Digital Meetings		Webinar	30 April 2024

Appendix 3: List of potential Themes

Addressed or proposed in previous meetings but for the time being put on the list of potential topics until the topics are better matured - or the need better identified.

#	Subject	Background	Proposers
13	Hearables, OTC	Theme is rather interesting. However, it is difficult to find speakers. Hearing aid companies are reluctant to contribute since the topic is too close to current business interests. It is not the products themselves but where and how such products are placed in the competitive landscape. University contribution is also not so likely since it is a topic mostly in the business domain. A discussion on what type of products is included under the term "hearables". The product term "hearables" was originally coined for a hybrid of the terms: wearable and headphone. • OTC ("over the counter" products) belongs to the category of medical products, i.e. hearing aids. The WG feels that this is a separate domain and does not fit into the general term "hearables". • Instead, most of the "hearables" seen to date are Bluetooth devices that use phones or PCs as the central computing unit. Focus seems to be on mobile communication, real time information services, activity tracking including biometric data, e.g. temperature, heart rate or oxygen saturation. Although "hearables" is a business domain for many consumer technology manufacturers, several SME's and start-ups also have managed to obtain crowdfunding and soft funding from e.g. EU R&D funding and are active in the area.	Niels Pontoppidan Jonas Raun Hansen Morten Kroman Clément Laroche Tobias Neher Peder Costa