

Summary: "Future Sound Tech Solutions" – Meeting #14

Meeting # 14 in the working group "Future Sound Tech Solutions" took place on August 29, 2023.

Agenda

1. Presentation of Jeppe Lindegaard, new Program Manager at Danish Sound Cluster
2. Webinars & Physical events during 2023:
 - a. Follow-up on proposals and ideas from meeting # 12 including additional comments and proposals.
 - b. Proposals for possible speakers
 - c. New themes?
3. Collaborative projects, update of proposals, indication of possible project consortia.
4. News from DSC secretariate
5. A.O.B.

Ad 1: Presentation of Jeppe Lindegaard

Jeppe obtained a bachelor's degree from the Royal Academy of Music in Aarhus ("Det Jyske Musikkonservatorium"), followed by a master's degree at Aarhus University studying "Audio design" at "Information og Mediekendskab". Jeppe subsequently worked 2 years as a live TV engineer at TV3 Sport".

In 2015 Jeppe established his own company operating as a sound designer and sound consultant providing assistance to companies and others in relation to Sound Signatures, e.g. in conjunction with Podcasts, Apps, company presentation etc. He continued to have a strong interest in R&D in sound.

Now Jeppe has accepted the position as Program Manager at Danish Sound Cluster.

Jeppe lives in the Copenhagen area with his family.

Ad 2: Proposals for Webinars & Physical Events

| # | Subject | Background |
|----|--|--|
| 15 | Speech Prediction | <p>By mistake the right topic for #15 was not discussed at the meeting. It will instead be addressed in the next meeting in October 2023. Sorry for the inconvenience.</p> <p>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 appear to fail.</p> <p>Background:</p> <p>Active noise cancellation, ANC, can remove low frequency noise and passive noise cancellation can remove high frequency elements.</p> <p>However, noise related to speech between the two regions remains an issue. ANC will never be able to suppress noise related to speech in the middle frequency range. Can the challenge be handled to some degree through employment of speech prediction to overcome this downside of in ANC?</p> <p>A difficult research topic, where speech modelling may have solutions. Today classic speech modeling has been overtaken by neural network approaches. Can original classic speech modeling prove a way ahead.</p> <p>Potential speakers:</p> <ul style="list-style-type: none"> • Johannes Sars ? (check with Niels). |
| 17 | Use of sound with robotics | <p>The webinar was successfully broadcasted on May 23, 2023, moderated by Shelley.</p> |
| 18 | 'Sound Quality in Digital Meetings' (and in digital communication in general) | <p>Shelley has been in contact with a Microsoft employee, Sebastian Braun, previously a Fraunhofer employee, that may be able to give a presentation on the subject matter:</p> <ul style="list-style-type: none"> • Sebastian Braun - Microsoft https://www.microsoft.com/en-us/research/people/sebraun/ <p>Tentative title: "DNN-based speech enhancement for real-time communication"</p> <p>Short abstract:</p> <p><i>In the last few years, fast progress has been made in research, adopting deep neural networks (DNNs) for audio signal processing tasks such as noise reduction, echo cancellation, speech detection and separation. In this talk, we will show crucial steps how to design and train small and efficient DNNs under the challenging requirements of real-time communication pipelines as used in online meeting software on PCs and phones. Practical aspects such as balancing computational budget, quality aspects like speech distortion vs. noise reduction, and realistic evaluation methods will be covered.</i></p> <p>It was agreed that we merge the above presentation with topics under item #25. For more details see the comments under #25.</p> |
| 20 | AI and Sound in general | <p>Contacts to Per Bækgaard (DTU COMPUTE, Institute for Mathematics & Computer Science), have not yet been successful.</p> <p>Instead, it was agreed that AI is now popping up in numerous areas related to sound and it may be a more productive approach to split focus to more specific areas of AI-sound related themes.</p> <p>Examples of more focused area can be found under:</p> <ul style="list-style-type: none"> • #25, "Sound Quality in communication systems" • #27, "AI created music (and the threat to artistic generated music)" <p>The present general theme on AI will be dismissed.</p> |

| # | Subject | Background |
|-----|--|---|
| 21 | <p>Augmented sound in future society</p> <p>SoundDay 2023)</p> | <p>Bluetooth Auracast™ (Auracast broadcast audio will let people invite others to share in audio experiences. People can log on to streams that are in the air. Is likely to change our society already short term).</p> <p>Nick Hunn has offered to give a presentation on Bluetooth Auracast™, at SoundDay 2023. In addition, he is willing to also participate in a follow up webinar on Bluetooth Auracast™.</p> |
| 21a | <p>Augmented sound in future society:</p> <p>Follow-up webinar on Bluetooth Auracast™</p> | <p>We aim at a new webinar on Bluetooth Auracast™ (follow-up to the Nick Hunn presentation at Sound Day 2023 and the original “The new Bluetooth LE Audio standard” webinar transmitted on June 22, 2021)</p> <p>Timing:</p> <ul style="list-style-type: none"> February or March 2024 <p>Nick Hunn should serve as moderator and possibly also give an introduction. During SoundDay 2023 we will discuss with Nick Hunn, how he sees a proper layout for the webinar and if he has people to propose included.</p> <p>We would also like to include an industrial perspective. Not least the Hearing Aid industry has been promoting Bluetooth Auracast, and some companies have already invested 7-8 person years in efforts related to Bluetooth Auracast.</p> <p>Potential candidates for industry case presentations:</p> <ul style="list-style-type: none"> Bjarne Klemmensen, Eriksholm (confirmed by Niels, mail 11 May 2023) - Søren Vilsgaard?, WS-Audiology (Morten will check with Søren Vilsgaard) <p>Two other options for presentations were aired in the meeting:</p> <ul style="list-style-type: none"> Damian Murphy, Professor of Sound and Music Computing, York University “Sonic Home Project” Gershon Dublon “How a Sensor-Filled World Will Change Human Consciousness” (Scientific American 2014) https://www.scientificamerican.com/article/how-a-sensor-filled-world-will-change-human-consciousness/ <p>Jeppe and Birger to talk to Nick Hunn during SoundDay 2023. We will address the topic again at our next meeting.</p> |
| 21b | <p>Augmented sound in a Metaverse society</p> | <p>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.</p> <p>Directions to investigate could be:</p> <ul style="list-style-type: none"> 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). <p>Jeremy will look for some potential candidates in the university environment.</p> <ul style="list-style-type: none"> Professor Damian Murphy, University of York (see item #21a) and his Lab also seems to be quite active in this domain and may be able to give a presentation. <p>Theme to be addressed again at our next meeting.</p> |

| # | Subject | Background |
|----|--|---|
| 22 | Text-to-speech | <p>Microsoft is reported to focus on text-to-speech in its Azure offerings. What will that mean for development in the sound sector ?</p> <p>Topic is now merged into theme #27, 'AI created music and the threat to artistic generated music'</p> |
| 23 | Better tools for ensuring good audio quality in e.g. field recordings, hence reducing the need for dubbing | <p>A spin-off from the brainstorming on "Augmented sound in future society" could be the option for devising better tools for audio recordings in the field. We know from discussions in the working group "Creative Sound Solutions" that broadcast organization like DR and TV2 are actively interested in obtaining better tools for recording in the field for their journalists, so that dubbing activities can be reduced or avoided. Progress in areas like headsets and speaker phones involving widespread use of AI, might be a solution to the needs of journalists and broadcasting organizations.</p> <p>Various speech enhancement solutions may fit the needs. Actually, there are rather huge R&D activities in the field throughout the world that may have solutions or are in the process of developing solutions that could fit into this context. It could prove of interest to a broader group of people to hear about such tools and what they could be used for.</p> <p>Augmented audio support indications already at the time of recording may be another way of improving recordings in the field.</p> <p>The working group on "Creative Sound Solutions" will run a webinar on "Podcasting – Technology and Potential" on September 6, 2023:</p> <p>Strategy: We will await the webinar on September 6, 2023, to see, if we see a role for our working group to follow up.</p> |
| 24 | 'Sound Pollution' | <p>As discussed during the brainstorming on 'Augmented sound in future society', sound is added to a lot of products and solutions – sometimes with rather meager or even negative effects. Is that what society needs? One example is noise added to silent electrical cars.</p> <p>In general, at low driving speed, 50 km/hour or below, the noise from cars is basically noise from the tires, not the engines. However, the topic here is the noise from electrical cars that is being added to ensure that electric cars driving at very low speed, e.g. at parking spots, can be observed by people walking with their backs to an approaching car (accidents were reported in Japan).</p> <ul style="list-style-type: none"> • Tore has approached one of the "fathers for noise added to electric cars" Torben Holm Petersen to obtain the background incentive for such added noise (see Appendix 04) <p>The discussion on the topic indicated that in general we see it as a vital theme and that there are several issues related to sound pollution. Approaches like "sound scaping" and "sound shaping" also play into this, where sound is added to make sound impressions perceived by people more pleasant, i.e. sound can help in suppressing the undesirable effects of noise.</p> <p>The working Group on "Environmental Sound Solutions" is currently working on more themes for webinars in relation to this. To mention a few of the themes under development, the following are under development:</p> <ul style="list-style-type: none"> • "Sound Scaping": Physical event addressing issues related to noise in conjunction with infrastructures (roads, railways, Metro, etc.). • "The future city and noise" • "Development and measurement of noise/sound related to products, where sound is a 'bi-product' (cars, household equipment, pumps in heating systems, wind turbines and other types of machinery, etc.) • "Noise from large construction works" (physical event) • "Traffic noise in more densely populated areas" <p>It is proposed to put the present theme on rest for our working group "Future Sound Tech Solutions" and leave the theme to the 'Environmental working group.</p> |

| # | Subject | Background |
|----|--|---|
| 25 | <p>“Sound Quality in communication systems”</p> <p>Reshaped from the original themes: ‘Sound Quality in Digital Meetings (#18) and ‘Quality of sound in cell phone communication’ (#25) (</p> | <p>Background: Transmission of sound quality in communication systems (i.e. digital meetings”) depends on several factors in the individual devices (headsets, speakerphones), echo cancellation, CODECS, compression algorithms, transmission solutions, etc. Even placement of the microphone close to the mouth of the speaker and the acoustic performance of the speaker/listener environments are essential. Add to that that products are getting more complex. Eg. Employing several microphones per unit to ensure better performance. ‘AI’ in various implementations is part of this in parts of the entire chain of transmission. Success in a quality transmission of sound depends on that basically all elements in a cascaded effort are performing in an optimal manner.</p> <p>The current webinar theme tries to address some of these vital elements.</p> <p>Timing:</p> <ul style="list-style-type: none"> • Q1 of 2024 <p>Audience: Researchers and developers of solutions, audio engineers in general, and other people interested in the technical details of communication links in relation to sound quality.</p> <p>Potential speakers and topics:</p> <ul style="list-style-type: none"> • Sebastian Braun - Microsoft “DNN-based speech enhancement for real-time communication” https://www.microsoft.com/en-us/research/people/sebraun/ • Pejman Mowlae, Jabra • Stefan Bruhn (Dolby) or Markus Multus (Fraunhofer) New immersive CODEC, 3GPP SA4 Codec supporting multi channels. Converts between headphones and multichannel systems. https://www.3gpp.org/technologies/ivas-highlights <p>Mads will provide additional names for potential speakers. Tore will assist in establishing contacts to 3GPP CODEC people.</p> <p>Jepe undertakes the final development of the webinar</p> |
| 26 | <p>Autonomous Response to Audio</p> | <p>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.</p> <p>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.</p> <p>Potential speaker:</p> <ul style="list-style-type: none"> • Dorothea Wendt, Eriksholm Research Lab <p>The topic could somehow be related to the ‘sound/noise pollution’ topic discussed earlier on (item #24), since it s about the physiological response to different stimuli. Noise is well known to create a lot of issues in that context.</p> <p>Topic not addressed in the meeting due to absence of key people.</p> |

| # | Subject | Background | | | | | | | | | | | | | | | | | | | | |
|---------|---|---|----------------|-------|------|--------|-------|-----------|-----------|----------|-------|------------------|------------------|----------------|-------|---------|--------|---------|---------|----------|-----------|--|
| 27 | AI created music (and the threat to artistic generated music) | <p>New music tracks can be artificially created using AI based tools like Boomy-AI. Simply use a number of keywords that describe the direction in which the result should go. The new music tracks can be created almost instantly and can then be put online and streamed.</p> <p>Apart from creating a major challenge to traditional artistically generated music, it also distorts the business model for music streaming. When AI generated music is put onto a streaming service, the people that use AI to generate the music, are entitled payments, although they basically have not been artistically creative in the generation.</p> <p>Spotify, the world's largest music streaming service has recently removed more than 7% of all music tracks that were generated by Boomy. More than 14 million tracks are believed to have been created by Boomy, so it is a substantial problem.</p> <p>(See also Berlingske Business, May 10, 2023)</p> <p>One angel to the topic could be symbolic AI generated music: one example is AI generated music can be found from:</p> <ul style="list-style-type: none"> • Bob L.T. Sturm, Associated professor at KTH Stockholm See youTube: https://www.youtube.com/watch?v=2WRQYH8o6B8 <p>Mads can assist to establish contact (former colleague)</p> <p>Bob L.T. Sturm lists many other AI Music generation solutions.</p> <table border="0"> <tr> <td>Humtap</td> <td>Xhail</td> <td>AIVA</td> <td>Popgun</td> </tr> <tr> <td>Boomy</td> <td>Melodrive</td> <td>Algotunes</td> <td>Soundraw</td> </tr> <tr> <td>Amper</td> <td>LifeScienceMusic</td> <td>IBM Watson Music</td> <td>Sony CSL Music</td> </tr> <tr> <td>Endel</td> <td>Magenta</td> <td>Audoir</td> <td>Jukebox</td> </tr> <tr> <td>Wave AI</td> <td>Neutrino</td> <td>DeepMusic</td> <td></td> </tr> </table> <p>Other interesting people that could fit well into this webinar theme:</p> <ul style="list-style-type: none"> • Andreas Bang Hemmeth (DJ Encore), Danish song writer and part of the songwriter association AUTOR. Can be reached through 25942125 (Mbrace Music ApS) POLITIKKEN May4, 2023: "Æder kunstig intelligens musikbranchen til morgenmad?" • Anders Øland, Danish songwriter, music producer & computer scientist Article: https://finans.dk/tech/ECE16379256/dansk-hitmager-vil-loese-et-enormt-problem-med-kunstig-intelligens/ Anders is working on developing an AI based tool to help identify if new music is violating existing copyrighted music. • Google is researching a prototype of a new tool that can generate music from text, 'MusicLM' under their AI Test Kitchen' program. Clément knows the author of a recent article from Google on the topic and will try to establish contact. <p>AI will revolutionize music and certainly is a top priority for us to have a theme on, and there is consensus that this theme should have priority.</p> <p>Our focus should be on the technical issues.</p> <p>Jeppe will coordinate the work of putting a webinar together.</p> | Humtap | Xhail | AIVA | Popgun | Boomy | Melodrive | Algotunes | Soundraw | Amper | LifeScienceMusic | IBM Watson Music | Sony CSL Music | Endel | Magenta | Audoir | Jukebox | Wave AI | Neutrino | DeepMusic | |
| Humtap | Xhail | AIVA | Popgun | | | | | | | | | | | | | | | | | | | |
| Boomy | Melodrive | Algotunes | Soundraw | | | | | | | | | | | | | | | | | | | |
| Amper | LifeScienceMusic | IBM Watson Music | Sony CSL Music | | | | | | | | | | | | | | | | | | | |
| Endel | Magenta | Audoir | Jukebox | | | | | | | | | | | | | | | | | | | |
| Wave AI | Neutrino | DeepMusic | | | | | | | | | | | | | | | | | | | | |

Ad 3 3. Other events of interests

Danish Sound Day, 7th November 2023 at The Center for Hearing & Balance

Still in early stages of development, but the themes we are working with now include:

- Sound & Mental Health
- AI in the Clinical Environment
- Hearing Health

New this year, is that we will have a poster session. The event invite and more info will be coming in our next newsletter.

If someone in the group feels that they already know a fantastic topic/research/demo that should be part of Danish Sound Day 2023, please get in touch with Jeppe Lindgaard.

Next meeting

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

- **Tuesday October 31, 2023** **14:00 to 15:00**

Appendix 1: Participants in the meeting

| | | |
|---------------------------|---------------------------------|---------------------------|
| Clément Laroche | GN Audio, Jabra | Senior Research Scientist |
| Facundo Ramón | GN Hearing | Acoustic Engineer |
| Jeremy Marozeau | DTU, Department of Health Tech. | Associate professor |
| Mads Græsbøll Christensen | AAU | Professor |
| Tore Stegenborg-Andersen | FORCE Technology, SenseLab | Senior Researcher |
| Birger Schneider | CHAMAJ Consult ApS | Director |
| Jeppe Lindegaard | Danish Sound Cluster | Program Manager |
| Torben Vilsgaard | Danish Sound Cluster | CEO |

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 | <ul style="list-style-type: none"> • 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, 2022 |
| 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 |

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 | <p>Theme is rather interesting.</p> <p>However, 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.</p> <p>University contribution is also not so likely since it is a topic mostly in the business domain.</p> <p>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.</p> <ul style="list-style-type: none"> • OTC ("over the counter" products) belongs to the category of medical product, 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. <p>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.</p> | <p>Niels Pontoppidan Jonas Raun Hansen Morten Kroman Clément Laroche Tobias Neher Peder Costa</p> |

Appendix 4: Noise added to electric cars

Response mail from Torben Holm Petersen in relation to the requirement of noise added to electric cars.

Hej Tore.

Ja, jeg lavede et projekt om det. Resultaterne kan ses i:

T. H. Pedersen, T. Gadegaard, K. Kjems, and U. Skov, "White paper on external warning sounds for electric cars - Recommendations and guidelines," 2011.

som ligger i Mendeley og på vores hjemmeside. Jeg har også et par PP-shows om emnet.

Jeg forsøgte dengang at overtale kommissionen til at lade lydstyrken afhænge af tydeligheden af det specifikke signal i baggrundsstøj. Ideen er også beskrevet i de amerikanske forskrifter.

Man ville dog kun have en metode, der var så enkel, at den kunne kontrolleres med en billig lydtrykmåler. Dvs. at kravene er specificeret i dB(A), detaljerne kan ses i EU direktivet.

Konsekvensen er så, at nogen signaler er svære at høre og andre opfattes som unødigt larmende. De gælder både kørsels- og baklyde, hvilket man kan observere hvis man lytter efter i trafikken og på P-pladser.

Hvis man er opmærksom på det, kan man også konstatere, at i langt de fleste tilfælde hører man lyden af dæk før advarsels- og motorlyde. Det gælder både for el- og mange fossilbiler.

Måske er reglerne nu så gamle, at der er basis for at se på dem igen. Dels er der mange flere typer af elbiler og dels er der mange fossilbiler med meget støjsvage motorer.

Vh. Torben.