Hearables in hearing care: discovering usage patterns through IoT devices

Hearables are on the rise as next generation wearables, capable of streaming audio, modifying soundscapes or functioning as biometric sensors. The recent introduction of IoT (Internet of things) connected hearing aids offer new opportunities for hearables to collect QS quantified self data that capture user intents and thereby provide insights to adjust the settings of the device. In our study 6 participants shared their QS data capturing when they remotely changed their device settings over 6 weeks. The data confirms that the participants preferred to actively change programs rather than use a single default setting provided by an audiologist. Furthermore, their unique usage patterns indicate a need for designing hearing aids, which as hearables adapt their settings dynamically to individual preferences during the day.

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Rethinking Hearing Aid Fitting by Learning From Behavioral Patterns
The recent introduction of Internet connected hearing instruments offers a paradigm shift in hearing instrument fitting. Potentially this makes it possible for devices to adapt their settings to a changing context, inferred from user interactions. In a pilot study we enabled hearing instrument users to remotely enhance auditory focus and attenuate background noise to improve speech intelligibility. N=5, participants changed program settings and adjusted volume on their hearing instruments using their smartphones. We found that individual behavioral patterns affected the usage of the devices. A significant difference between program usage, and weekdays versus weekends, were found. Users not only changed
programs to modify aspects of directionality and noise reduction, but also continuously adjusted the volume. Rethinking hearing instruments as devices that adaptively learn behavioral patterns based on user interaction, might provide a degree of personalization that has not been feasible due to lack of audiological resources.

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**Obtaining Data on Hearing Experience Through Self-tracking**
This position paper argues that self-tracking data can enrich a pre-fitting process of hearing aids. It is argued that hearing loss consist of three parts. Tonal sensitivity, signal to-noise-sensitivity, and cognitive capabilities which can be assessed by using smartphones. Combining this with contextual data and subjective data (perceived fatigue for example), could generated a hearing profile for the end user. This could be used for continuous fitting based on user feedback of the hearing instruments at a later point in time.

We suggest, that pre-fitting and a continuous process could create a paradigm shift empowering and transforming the user into an essential part of the solution, through increased awareness and inclusion. The end result could be a potentially better fitting, and a better hearing experience for the individual.

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**Projects:**
Personalizing Hearing Care and Enhancing User Experience by Adapting Devices to the Changing Mobile Context

Technical University of Denmark

Period: 01/04/2016 → 31/03/2019

Number of participants: 3

Phd Student:
Johansen, Benjamin (Intern)

Supervisor:
Petersen, Michael Kai (Intern)

Main Supervisor:
Larsen, Jakob Eg (Intern)

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