Haptic Hearing Aid for Auditory Assistance

May 2024

Background: The accessibility of hearing devices such as bone conduction implants and cochlear implants is limited by their need for invasive surgery, high costs, and irreversibility. This project proposes to sidestep these limitations with the development of a non-invasive haptic hearing aid that uses tactile feedback to convey sound information via microstimulators on the inner forearm. The concept of sensory substitution takes advantage of the high density of mechanoreceptors in human skin—dozens per square millimeter—to potentially provide high-resolution sensory input. The obvious difficulty is that haptic hearing aids do not interface with the auditory system, so users must learn to associate certain patterns of tactile stimuli with sound information. The technical challenge is to develop a concept that effectively translates acoustic signals into tactile patterns, thereby facilitating intuitive understanding and expediting the learning process. This requires careful consideration of signal delivery mechanisms to optimize the learning process and user adaptation.

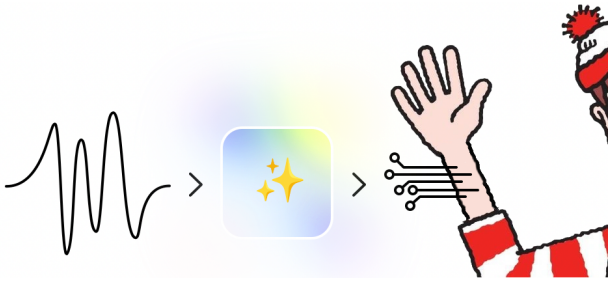

Figure 1: *A haptic hearing aid converts acoustic signals into tactile feedback. In the present project, it is delivered to the forearm via microstimulators.*

Aim: Design, development and initial validation of a haptic hearing aid prototype. This device will convert acoustic signals into tactile stimulation patterns, which will be perceived through a microstimulator array interfacing with the user's skin.

Materials and Methods: The project includes the development of a prototype for a haptic hearing aid. Initially, appropriate materials and configurations are selected to optimize tactile feedback and user comfort. This process involves choosing suitable microstimulators and designing their arrangement to ensure effective signal delivery. Subsequently, a prototype is assembled, and its efficacy in conveying acoustic information is assessed across various listening scenarios. These evaluations are intended to inform future development of the device.

Nature of the Thesis

- Literature review and conceptualization: 25%
- Prototype development: 50%
- Experimental validation: 25%

Requirements

- Knowledge of actuator/stimulator technology
- Proficiency in hardware design
- Interest in translational research

Our offer

The candidate will have the unique opportunity to engage in innovative clinical research as part of an interdisciplinary team of scientists, engineers, and physicians. The collaboration partners provide state-of-the-art infrastructure and equipment for the development of biomedical technologies.

Institute: Hearing Research Laboratory, ARTORG Center for Biomedical Engineering Research

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