

Development of an Auditory Assistance System for Automobile Driving for Individuals with Severe Hearing Loss

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Ultrasound at frequencies of 20 kHz or higher presented via bone conduction, known as bone-conducted ultrasound, can be perceived even by individuals with severe hearing loss. Moreover, bone-conducted ultrasound can be clearly perceived even when it is presented at sites away from the head, that is, by distal presentation.

In this study, we applied our accumulated expertise in bone-conducted ultrasound research to develop an auditory assistive technology for individuals with severe hearing loss during automobile driving. In particular, we focused on enabling the identification of the direction from which warning sounds, such as sirens and car horns, arrive, namely sound localization.

The results showed that when bone-conducted ultrasound was presented to two left and right sites on the trunk or upper limbs, the presentation sites could be distinguished with practical accuracy. In addition, analysis of the vibration distribution observed on the trunk surface during bone-conducted ultrasound presentation showed that propagation efficiency improved when the stimulus was presented to regions with a flat surface and large underlying muscles. Based on these findings, we developed a prototype two-channel distally presented bone-conducted ultrasound device. In the future, we plan to evaluate its practical usability in daily-life situations.