Validation of a Virtual Sound Environment System for Testing Hearing Aids

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In the development process of modern hearing aids, test scenarios that reproduce natural acoustic scenes have become increasingly important in recent years for the evaluation of new signal processing algorithms. To achieve high ecological validity, such scenarios should include components like reverberation, background noise, and multiple interfering talkers. Loudspeaker-based sound field reproduction techniques, such as higher-order Ambisonics, allow for the simulation of such complex sound environments and can be used for realistic listening experiments with hearing aids. However, to successfully employ such systems, it is crucial to know how experimental results from a virtual environment translate to the corresponding real environment. In this study, speech reception thresholds (SRTs) were measured with normal-hearing listeners wearing hearing aids, both in a real room and in a simulation of that room auralized via a spherical array of 29 loudspeakers, using either Ambisonics or a nearest loudspeaker method. The benefit from a static beamforming algorithm was considered in comparison to a hearing aid setting with omnidirectional microphones. The measured SRTs were about 2-4 dB higher, and the benefit from the beamformer setting was, on average, about 1.5 dB smaller in the virtual room than in the real room. These differences resulted from a more diffuse sound field in the virtual room as indicated by differences in measured directivity patterns for the hearing aids and interaural cross-correlation coefficients. Overall, the considered VSE system may represent a valuable tool for testing the effects of hearing-aid signal processing on physical and behavioural outcome measures in realistic acoustic environments.

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