



Real Ear Sound: A simulation of the pinna effect optimizes sound localization also with open fittings.

Summary

Behind-The-Ear hearing instrument wearers find it very difficult to localize sounds. The reason for this problem is the fact that the microphones are located outside of the pinna. This is the case with open fittings, too. Therefore, BTE wearers inevitably suffer from a loss of orientation as far as the front/back discrimination is concerned. In Savia, the unique functionality Real Ear Sound solves this problem. *Real Ear Sound* significantly improves the sound localization ability in comparison with omnidirectional microphones even with open hearing systems. This has been proven with clinical tests [1].

Sound localization is based on several acoustic cues:

- Interaural time difference (ITD)
- Interaural level difference (ILD)
- Frequency dependent properties of the pinna

microSavia with Real Ear Sound

Earlier studies have shown that *Real Ear Sound* significantly improves the sound localization with BTE instruments [2].

The omnidirectional microphone mode is an established method for hearing in quiet situations. It offers audibility from all directions but limits the sound localization ability and spatial orientation noticeably.

For BTE wearers, sound localization ability is reduced because the frequency dependent pinna cues are lost and the front/back discrimination is not supported. Thanks to Savia with *Real Ear Sound*, the hearing instrument wearer regains the natural ability of frequency specific filtering. *Real Ear Sound* simulates the sound localization ability of the pinna and enables an accurate sound localization with front/back discrimination.

The following two questions are addressed in this sound localization study:

1. Does the omnidirectional microphone mode limit the localization abilities also with entirely open fittings?
2. Is it possible for *Real Ear Sound* to successfully simulate the lost pinna effect with open fittings?

Study setup

The sound localization ability of BTE instruments with open fittings was examined with 20 hearing impaired subjects. Their age ranged from 47 to 79 years (average: 65 years).

The average hearing loss had a high frequency slope of 15 dB per octave from 1 kHz on (pure tone average). The subjects were fitted binaurally with microSavia 100 dSZ.

Speech shaped noise (500 ms duration) was presented from one of eight loudspeakers (LS) which were located around the subject, as shown below.

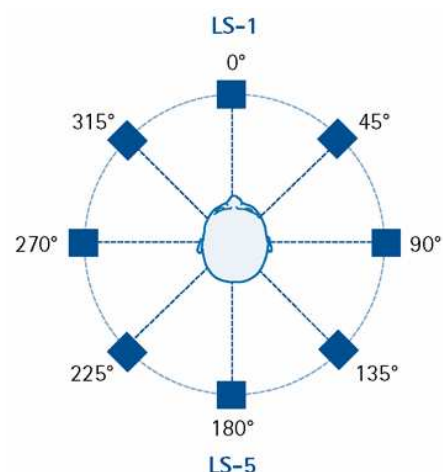


Figure 1: Setup of the localization test with eight loudspeakers

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From each direction, test signals were presented five times in randomized order. Two test conditions were accomplished: with microphones in omni-directional mode, and with *Real Ear Sound*. A training run was conducted prior to each test condition.

Results

The results show a clear reduction of front-back confusions with *Real Ear Sound*. The rate of confusions was reduced by 21% when *Real Ear Sound* was used instead of the omni-directional microphone (Figure 2).

Front-back sound localization with a conventional omni-directional configuration leads to orientation difficulties with open fittings. Even though the signal was presented from the rear loudspeaker (LS-5, 180°), 36% of the subjects thought that the signal had come from the front (LS-1, 0°; see Figure 1).

The first question of the study can be answered with an unequivocal yes. An omni-directional mode with open fittings leads to front-back confusions. In contrast to this, the *Real Ear Sound* configuration offers very high front-back localization accuracy. 72% of the subjects' answers were correct.

The sound localization ability of hearing impaired people is increased with *Real Ear Sound* in contrast to the omni-directional microphone mode. Therefore, also the second question can be answered with a clear yes. *Real Ear Sound* also simulates successfully the lost pinna effect with open fittings. *Real Ear Sound* improves the listening comfort considerably.

[1] The study was carried out by Hörzentrum Oldenburg, Germany, 2005.

[2] Savia Studies Special: The outstanding benefits of Savia scientifically proven (http://www.phonak.com/com_028-0420-02-xx_savia_stories_collection.pdf)

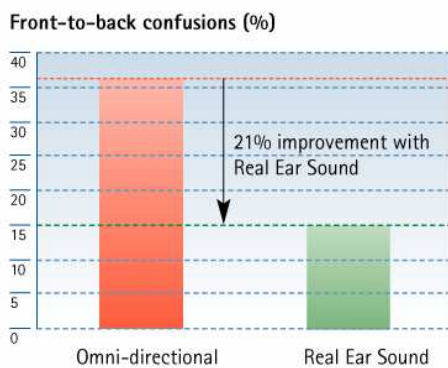


Figure 2: *Real Ear Sound* allows for a substantial reduction in front-back confusions even with open fittings.