Field Study News

auto ZoomControl

Automatic change of focus to speech signals of interest

Abstract

In hearing instruments, multi-microphone technology is the most significant and effective method of differentiating between wanted and unwanted signals. With ZoomControl, hearing instrument users for the first time were able to select a preferred direction of focus other than front. They could choose to focus to the right, to the left or to the back for situations where they can not face the speaker. Until now, the hearing instrument user had to select the focus direction and manually adjust it if the listening situation changed. With auto ZoomControl, the hearing instrument selects the direction of the dominant speech signal and automatically adjusts the focus direction when the signal source direction changes. In this study of speech intelligibility in noise, 20 experienced hearing instrument wearers with a mild to moderate hearing loss compared two different microphone settings: Phonak Ambra microM with auto ZoomControl and Phonak Ambra microM with ZoomControl (manual). Overall, subjects showed good speech intelligibility using the hearing instruments with auto ZoomControl when listening to the side or to the back in different SNRs. Further, the equality of test results between the automatic and the manually chosen ZoomControl conditions show the reliable switching behavior of the automatic system.

Introduction

Multi-microphone technology makes use of the fact that an individual typically looks in the direction of the desired audio signal. By connecting the directional characteristics of the two microphones, signals from the front are typically emphasized and those from other directions are suppressed.

ZoomControl made it possible for the first time to produce new microphone patterns by allowing an interactive, real time wireless exchange of data between the left and right hearing instruments. This enabled the user to selectively focus to the right, to the left or to the back. ZoomControl is an independent program which is activated via the onboard program button or remote control. If the user decides to use ZoomControl and direct his focus to the right, several events occur simultaneously. The gain of the left microphone is reduced so that it does not pick up signals from the left, while the right hearing instrument adopts a setting which ensures the best possible signal reception from the right. The signals from the right hearing instrument are transmitted wirelessly and in real time to the left hearing instrument where they are amplified with the gain model of the left hearing instrument. As a result, the end user hears the optimized signals from the right amplified at appropriate levels in both ears. The effect is remarkable because the end user experiences a directional focus just as he would with a regular beamformer, but it is oriented to the chosen side.

Phonak has now taken another major step forward in directional microphone technology. Until now, the end user had to select the focus direction and manually alter it if the situation changed. In the Phonak Spice Generation, this unique innovation has become even more advanced. Now, when the listener wishes to focus in a direction other than the front, he only needs to select the auto ZoomControl program. From there, the hearing instrument selects the direction of the dominant speech signal and automatically adjusts the focus direction if and when the signal source direction changes. The goal of this study was to determine the benefits of auto ZoomControl and thereby improved speech intelligibility in noise.

Test subjects and devices

This study was performed at the University of Applied Science in Lübeck, Germany. Twenty adult subjects with mild to moderate hearing loss participated in the study. They were all experienced hearing instrument wearers. Test subjects were fitted with Phonak Ambra microM hearing instruments. In order to evaluate the benefits of auto ZoomControl, the following microphone modes were compared to each other: Phonak Ambra microM with auto ZoomControl and Phonak Ambra microM with manual ZoomControl. The reliability of the automatic switching was tested by evaluating whether the switching behavior was equal to the manual adjustments. Hearing instruments were fitted based on the Phonak Target first fit. Loudness balance between instruments and feedback tests were performed. In this study,

the adaptive Oldenburg Sentence Test (OLSA) was used. It determines Speech Reception Thresholds (SRT: signal-to-noise ratio for 50% intelligibility) of five-item sentences. Speech signals were presented from the right side or from the back, at head height, at a distance of 1 m from the test participant (Nyffeler, 2009). A loudspeaker set-up simulating a car ride was used with a constant noise signal, according to a standardized adaptive method (Wagener et al., 1999). The adaptive speech signal was presented randomized from the right side or the back (Nyffeler, 2009). In order to simulate a real car situation with an open window (high frequency emphasis) on one side and speech signal with engine noise (low frequency emphasis) from the opposite side, two different noise sources were used with a sum level of 50 dB in the OLSA. Loudspeakers at 240°, 270° and 300° simulated the open window with a sum level of 60 dB. Loudspeakers at 30° and 150° simulated engine noise at a sum level of 55 dB. The adaptive speech signal was presented from the right side, 90° to simulate speech from a front seat passenger. Simulation of a back seat passenger was performed by the presentation of a speech signal from the back, 180°.

Results

With the OLSA, the signal-to-noise ratio for 50% speech intelligibility was measured. Results obtained with auto ZoomControl at -10 dB SNR did not significantly differ from speech intelligibility scores obtained with manual ZoomControl settings in listening condition where test subjects were in a car situation with passengers and speech signals presented from the right side (front seat passenger). Thus, automatic ZoomControl switched reliably towards the intended signal, leading to improved speech intelligibility in noise (Fig. 1).

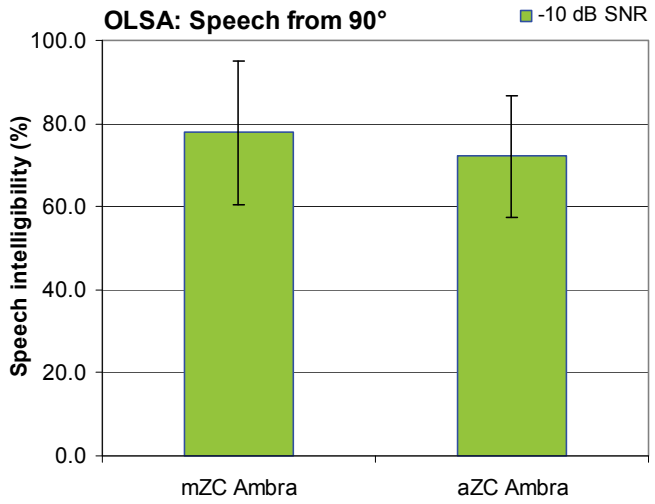

Fig. 1: auto ZoomControl performed comparably to the manual ZoomControl setting at -10 dB SNR, indicating the reliable automatic switching towards the intended speech signal

Similar results were obtained with an SNR of -15 dB. auto ZoomControl switched reliably in the direction of the desired signal and did not significantly differ from the manual setting (Fig. 2).

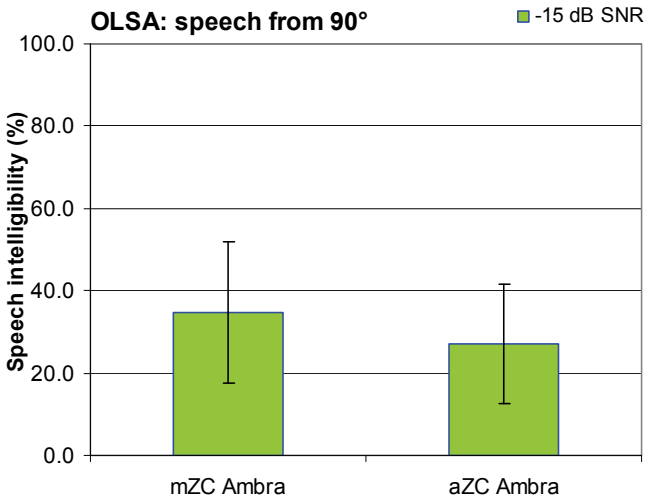

Fig. 2: Even at –15 dB SNR the auto ZoomControl performed comparably to the manual ZoomControl, showing the reliable switching behavior towards the intended speech signal.

The percentages of speech intelligibility did not significantly differ between the manual and the automatic settings in both SNR's. Therefore, it can be concluded that the reliability of the automatic switching is given for the automatic ZoomControl because they performed equally well as with the manual setting of ZoomControl.
Data for signal presentation from the back showed similar results for both SNR's, -10 dB and -15 dB, indicating reliable automatic selection of focus to the back.

Conclusion

With auto ZoomControl, Phonak enables hearing instrument users to comfortably select a program which adapts automatically when users can not face the speaker and would benefit from a focus direction to the back or sides. The hearing instrument selects the direction of the dominant speech signal and automatically adjusts the focus direction if and when the signal source direction changes. This is accomplished by wirelessly linking the hearing instruments and exchanging audio signals in real time. Most recent data have shown that this automatic switching behavior occurs as reliably as a manual change of direction even with negative signal-to-noise ratios (SNRs).

References

Nyffeler, 2009. Significant improved speech intelligibility in noise while listening to the side or back. *Field Study News, March:* www.phonakpro.com

Wagener K, Kuehnel V, Kollmeier B. Development and evaluation of a German sentence test; Part I-III: Design, Optimization and Evaluation of the Oldenburg sentence test. *Zeitschrift für Audiologie. 1999; 38:86-95*

Myriel.Nyffeler@phonak.com