

# Field Study News

## ZoomControl: part 1

Significantly improved speech intelligibility in noise while listening to the side or back

### Summary

ZoomControl utilizes the wireless link of binaurally balanced microphones for real-time streaming between hearing instruments (HI). This allows the listener to select different focus directions, thereby enhancing speech intelligibility in noise for listening situations in which the speech signal originates from the back or the sides of the listener.

21 experienced adult test subjects with a mild to moderate hearing loss participated in this study. ZoomControl was compared to the Omni directional mode, the speech in noise program with VoiceZoom and their own HI. Overall, subjects showed a significant increase in speech intelligibility using the CORE HI with ZoomControl when listening to the side or to the back.

### Introduction

Previous studies evaluating the benefits of ZoomControl compared to the standard CORE speech in noise program with VoiceZoom yielded significant improvements for speech intelligibility in noise in all relevant listening directions for ZoomControl compared to VoiceZoom when speech is not presented from the front (Nyffeler and Dechant, 2009). However, one could argue that the Omni directional mode provides benefits compared to VoiceZoom if a sound source is presented from the back or the side. ZoomControl is designed to allow HI wearers to choose the directional focus of their hearing. Because speech signals, especially in comprehensive communication situations, do not always come from the front and facing the speaker is not always possible, ZoomControl enables the hearing system wearer to select the focus of the system in four directions: front, back, left, and right. If listening from the right side is the chosen direction, the signal is amplified with the accurate gain model for this ear and due to very fast broadband data transfer function, the microphone signal of the chosen side will be transferred to the opposite HI. These microphones on the "non-focus" side receiving streamed data are attenuated, therefore emphasizing the better SNR of the chosen side.

The following study was performed at the University of Applied Science in Lübeck, Germany, to systematically evaluate the benefits of ZoomControl for HI wearers with a mild to moderate hearing loss (Fig. 1) when the speech signal does not originate from the front.

Averaged hearing loss (n=21)

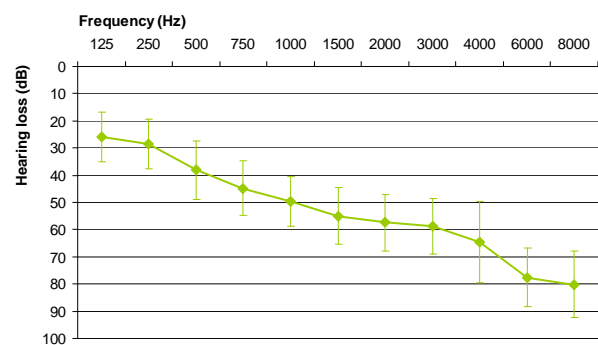


Fig. 1: Averaged hearing loss of test participants.

### Subjects and Hearing Instruments

21 test persons (10 female and 11 male participants) between the ages of 24 and 86 years participated in the study. All test persons have mild to moderate hearing loss and were provided with binaural HI. Further, they were all experienced HI wearers. The client's perceived loudness was similar to own HI and gains of HI were adjusted to own HI. Own HI were measured using their default settings.. ZoomControl was evaluated with newly fitted HI without acclimatization. Therefore, results are even more impressive.

### Set-up of the Study

To compare ZoomControl to VoiceZoom and to the Omni directional mode of CORE HI and test subjects own HI, objective measuring procedures were used. The adaptive OLSA where the Speech Reception Threshold (SRT: signal-to-noise ratio for 50% intelligibility) of five-item sentences is obtained, was performed for measurements including the comparison of speech intelligibility in noise of the HI in Omni, VoiceZoom, ZoomControl and their own HI. Speech signals were presented from the right side (Fig. 2) or from the back at head height (Fig. 3) at a distance of 1 m from the test participant. As noise source, 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 (Fig. 4) or the back (Fig. 5). In order to simulate a real car situation with an open window (high frequency emphasis) on one side and a

speech signal with engine noise (low frequency emphasis) from the opposite side, two different noise sources have been used with a sum level of 61,2 dB in the OLSA. Loudspeakers in the direction of 240°, 270° and 300° (light grey) simulated the open window with a sum level of 60 dB. Loudspeakers from the direction of 30° and 150° (black) simulated engine noise at a sum level of 55 dB. The adaptive speech signal was presented from the right side, 90° (white) to simulate speech from a front seat passenger.

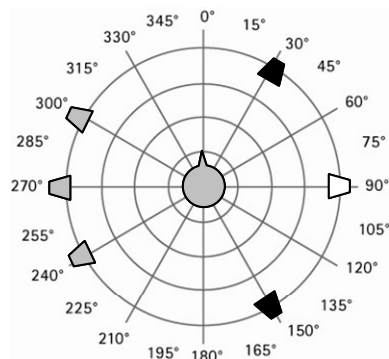


Fig. 2: Presentation of speech signals (white loudspeaker) from the right side (90°) with loudspeakers simulating the open window (light grey) and loudspeakers simulating engine noise (black).

Simulation of a back seat passenger has been performed by the presentation of a speech signal from the back, 180° (white loudspeaker), whereas loudspeakers on 240°, 270° and 300° again simulated noise of an open window and loudspeakers on 30° and 150° (black) simulated engine noise.

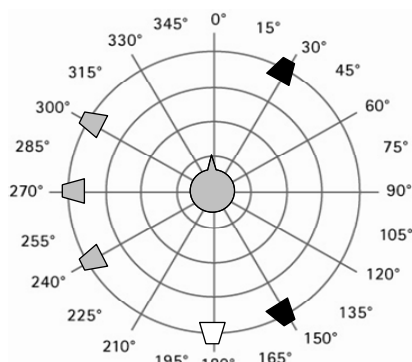


Fig. 3: Presentation of speech signals (white loudspeaker) from the back (180°) with loudspeakers simulating the open window (light grey) and loudspeakers simulating engine noise (black).

## Results

With the OLSA, the signal-to-noise ratio for 50% speech intelligibility was measured. In the listening condition where test subjects are to be found in a car situation with passengers and speech signals were presented from the right side (front seat passenger), test subjects showed significantly increased speech intelligibility with ZoomControl compared to the Omni directional mode ( $p < 0.05$ ) and to the standard speech in noise program with VoiceZoom ( $p < 0.05$ ), evaluated with a paired t-test (Fig. 4). Improved speech intelligibility with ZoomControl resulted also compared to the own HI. However, this improvement was not significant. The lower the displayed SNR in dB, the better is speech intelligibility in the respective setting. Presentation of the signal from the back (back seat passenger), speech intelligibility was significantly increased with ZoomControl compared to all conditions (Own HI:  $p < 0.05$ ; Omni:  $p < 0.001$ ; VoiceZoom:  $p < 0.001$ ; Fig. 5).

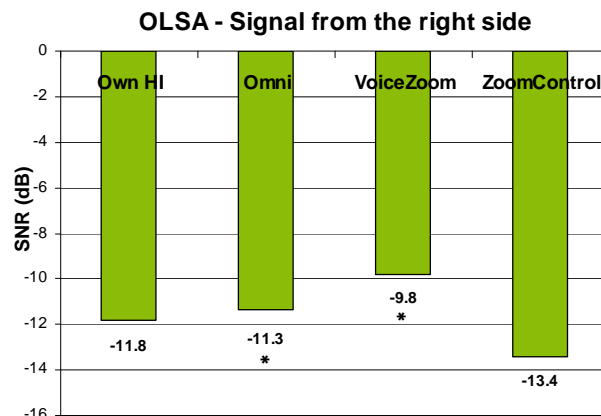


Fig. 4: Significantly increased speech intelligibility in the car situation with ZoomControl, compared to Omni directional mode and VoiceZoom if speech signals are presented from the right side.\* $p < 0.05$ .

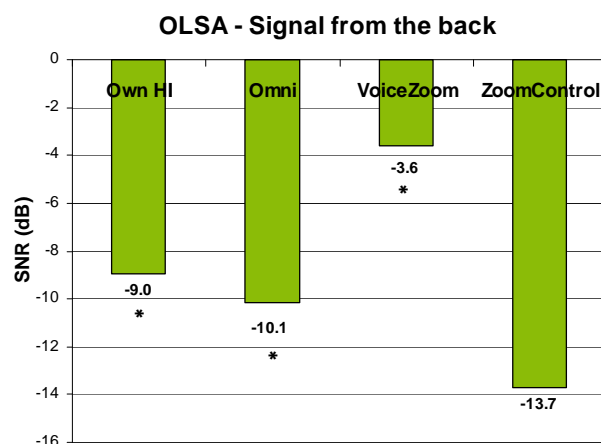


Fig. 5: Significantly increased speech intelligibility in the car situation with ZoomControl, compared to the own HI, the Omni directional mode and VoiceZoom if speech signals are presented from the back.\* $p < 0.05$ .

## Conclusion

The results of this study substantiate significant improvements with ZoomControl for speech intelligibility in noise for listening situations where the speech signal does not originate from the direction in which the end user is looking. ZoomControl provided a significant advantage compared to the own HI which had been accurately fitted and acclimatized to clients and, the Omni directional mode and to the SPiN program VoiceZoom.

## References

- Nyffeler M, Dechant S. Field Study on User Control of Directional Focus: Benefits of Hearing the Facets of a Full Life. *Hearing Review*. 2008;16(1):24-28.
- 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.

For further information, please contact:  
Myriel.Nyffeler@phonak.com