Field Study News

Exélia: Facets of the Full Life Experience

ZoomControl: Beneficial user control of hearing focus

Summary

Thanks to the real time streaming made possible by the Communication Optimized Real-audio Engine (CORE) platform, ZoomControl enables the end user to select four different focus directions. ZoomControl was scrutinized and compared to the standard Exélia speech in noise program with VoiceZoom in the standardized Oldenburger Satztest (OLSA), an adaptive noise test to detect changes in speech reception thresholds (SRT). The patient's orientation was changed in 90° steps and ZoomControl was used to select the direction towards the speech signal.

The results show distinct and significant improvements in speech reception in noisy environments when comparing ZoomControl against VoiceZoom when speech is not presented from the front.

Introduction

Directional microphones have been proven to be the only way to improve signal-to-noise ratio, but the benefits of directional microphones are based on the speech source being in front of the end user. The polar patterns of a common beam former are designed to cancel noise which enters the microphones from the side or the back, whereas the front direction is open for incoming signals (speech) in order to increase the Signal-To-Noise ratio (SNR) (Richards *et al.*, 2006).

Speech signals do not always come from the front and facing the speaker is not always possible. In these situations a traditional front focus polar pattern is of minimal benefit. For example, when a hearing instrument user is driving a car with a passenger talking from the side or back, the hearing system is using the standard speech in noise program with a cardioid pattern directed to the front. As the user needs to keep his concentration focused on the traffic, it is not possible for him/her to turn the head constantly towards the speech signal, which is coming from the side or the back.

The ZoomControl feature enables the end user to select the focus of the system in four directions: front, back, left and right. If listening to the side is chosen, due to very fast broadband data transfer function, the microphone signal of the chosen side will be transferred to the opposite hearing instrument avoiding the head shadow and therefore emphasizes the better SNR of the chosen side. The signal is then amplified with the accurate gain model for this ear. The microphones of the hearing instrument on the 'non focus' side, receiving the streamed data, are attenuated.

Goal of the Trial

The goal of this explorative study was to survey the benefits of the ZoomControl feature in a standardized test setup for a group of participants with a moderate-to-severe HL compared to the standard speech in noise program with the beam former oriented to the front.

Set-up of the Study

The test setup is based on the adaptive OLSA test. This test measures the speech-reception-threshold (SRT: signal-to-noise ratio for 50% intelligibility) of five-item sentences presented from the front (0°) against a broadband uncorrelated cafeteria noise, played from 5 background loudspeakers (60°, 120°, 180°, 240° and 300°). Participants were asked to repeat the words they heard. The noise intensity was kept constant at 65dB SPL and the intensity of speech signals varied according to a standardized adaptive method (Wagner *et al.*, 1999).

To measure the differences between the standard speech in noise and ZoomControl program, the patient's position in relation to the speech signal was varied by turning around in 90° steps. In order not to provoke unwanted changes in the room acoustic conditions, the loudspeaker configuration was maintained during the measurements, but the client's listening position was 0° (front), 90° (left), 180° (back) and 270° (right) angle to speech signal, measured in randomized order. Exélia's ZoomControl was used to focus towards the speech signal (see Fig. 1) (Hawley and Litovsky, 2003).

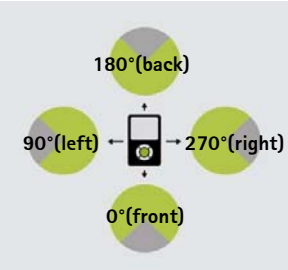

Fig. 1: The four listening directions

Subject and Devices

Overall 28 patients participated in this study. In detail, 11 Exélia ITC wearers with an age range of 52-73 years (mean age 67.2 years), 12 patients fitted with Exélia M (age range 48-81 years, mean 66.5 years) and 5 Exélia SP patients with an age range between 41 an 76 years (mean age of 61.2 years) entered the study. The participants' previous experience with hearing instruments ranged from short term users (6 month-3 years) to long term users (over 6 years). All patients were fitted with custom ear molds or shells and ventings according to their hearing loss. The average hearing losses of all participants for the different HI styles are shown in Fig. 2.

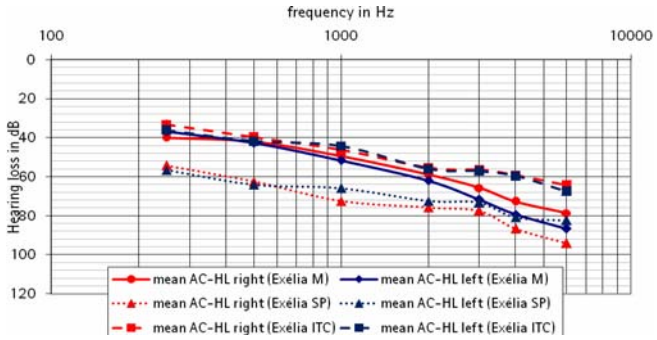

Fig. 2: Average air conduction threshold for all participating patients, itemized by HI models

Results

In the described listening conditions, the results for patients wearing Exélia ITC show improvements in SRT of -2.2dB when focusing to the left, -2.8dB when using ZoomControl to the right and -6.2dB when changing the beam former to the back compared to the standard speech in noise program (see Fig. 3). When speech is presented from the back the large difference between ZoomControl and VoiceZoom can be traced back to the fact that here the beam former effects are most distinct.

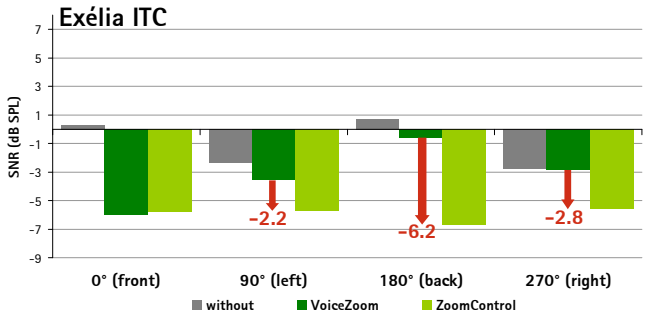

Fig. 3: Results from OLSA test: Exélia ITC VoiceZoom vs. ZoomControl

The results for the M model show similar characteristics. For this group the benefit of ZoomControl compared to VoiceZoom are -1.5dB when speech is presented from the left, -3.3dB when the target is on the right side and -6.3dB when the signal is coming from behind (see Fig. 4).

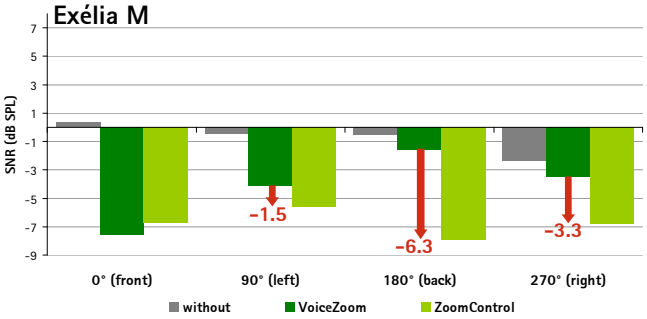

Fig. 4: Results from OLSA test: Exélia M VoiceZoom vs. ZoomControl

Patients wearing Exélia SP with ZoomControl show likewise benefits in an environment where speech can not picked up from the front. The improvements are -2.7dB from the left, -4.3dB from right side and -5.8dB from the back (see Fig. 5).

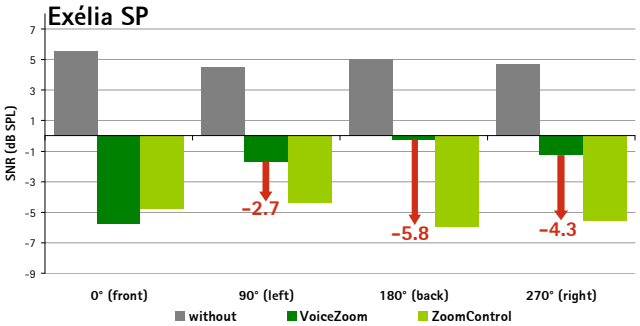

Fig. 5: Results from OLSA test: Exélia SP VoiceZoom vs. ZoomControl

A paired Wilcoxon Signed Ranks Test on dependent samples comparing comprehension scores led to distinct, significant effects of ZoomControl compared to VoiceZoom when the target signal was not presented from the front. Significance was not shown only for Exélia M when speech was presented from the left, nevertheless improvements are existent. For all other instruments and directions, differences were statistically significant.

Conclusion

The presented results of this test series substantiate significant improvements for speech understanding in noise for listening situations where the speech signal does not originate from the direction in which the end user is looking. The provided benefits can be observed for all tested models and all relevant directions. Clearly ZoomControl is able to enhance speech comprehension abilities in various environments where it is not always possible to face the speaker and the listening focus is not laying in the same direction as the line of sight.

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References

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