

Field Study News

Naída S and Zoom Technology State of the art directionality for power users

Summary

The latest addition to the Spice Generation portfolio, Naída S brings new levels of audibility for those who need it the most – clients with a severe to profound hearing loss. The premium class of Naída S introduces new binaural signal processing features: StereoZoom and auto ZoomControl. Together they offer these power clients additional improvement in speech understanding, particularly in difficult listening situations where there is diffuse, uncorrelated cafeteria noise or when the speaker is positioned at the side or back.

In this study, 20 test subjects with a severe to profound hearing loss subjectively and objectively evaluated the benefits of StereoZoom compared to conventional directional microphone systems of Spice (UltraZoom with SNR-Boost) and CORE (VoiceZoom). The second part of the study investigated the subjective and objective improvements of speech understanding and listening comfort with auto ZoomControl compared with the automatic program (SoundFlow).

The results show that the subjects perceived StereoZoom to be significantly better than the default SoundFlow speech in noise program, UltraZoom, or the CORE Naída (Voice Zoom). Results also showed that subjects performed significantly better with auto ZoomControl compared to SoundFlow for speech understanding and listening comfort from the sides and back.

Introduction

Phonak is well known for its dedication to providing the best power hearing solutions for those who rely on them most, severe to profound users. Naída S brings the latest technological innovations to the power segment. New ground-breaking binaural signal processing technological solutions like in StereoZoom and auto ZoomControl make it easier for people with a hearing loss to hear in a wider range of environments.

StereoZoom

Other directional systems in the market have a wide front focus and often fail to meet the challenge of one-to-one communication in situations where high levels of surrounding background noise are present. Naída S overcomes this challenge with StereoZoom by creating a narrow beam that can focus on a single speaker in a diffuse and noisy situation.

StereoZoom employs wireless full bandwidth audio streaming and sophisticated binaural processing technologies to create a bi-directional network of four microphones. The signals from both sides are analyzed and processed in real time to create a narrow beam, which effectively zooms in on a single voice.

StereoZoom significantly improves the Directivity Index (DI) across a broad frequency range, achieving a valuable additional improvement in signal-to-noise ratio and significantly reducing the listening effort required (Nyffeler, 2010). It is designed to perform best when the listening goal is to focus in on a single voice in a noisy crowd. The end user is therefore able to concentrate fully on communicating with a particular individual, even under extremely difficult listening conditions (Nyffeler, 2010).

ZoomControl

The introduction of ZoomControl revolutionized directional hearing, setting a new benchmark for binaural processing. For the first time, ZoomControl was able to give users the ability to manually select a preferred hearing direction, other than to the front (Nyffeler, 2009). The premium hearing instruments of the Phonak Spice Generation not only give power users the option of manually selecting the direction, but also allow them to use the auto ZoomControl function to automatically select the direction of the dominant speaker (Stuermann, 2011). When focusing on one side, the speech signal is amplified by the corresponding instrument on that side; simultaneously the entire signal is streamed to the other ear. As a result, the desired signal is heard in both ears, dramatically improving the signal-to-noise ratio (SNR).

Field study results show that compared to omnidirectional mode, auto ZoomControl provides an SNR improvement of 2-4 dB for signals coming from either side and 4-6 dB for signals coming from the back (Stuermann, 2011; Nyffeler, 2010).

Goal of the Trial

The goal of this two-part study was to determine if users with a severe to profound hearing loss experience an improvement in speech understanding with StereoZoom compared with the standard speech in noise program of Naída S and its predecessor, CORE Naída. The second part of the study was to determine if there was an advantage of auto ZoomControl over the Naída S SoundFlow speech in noise program. It was also important to investigate if the automatic switching of direction was comfortable, inaudible and smooth.

Subject and Devices

Test subjects

Twenty test subjects (18 male and 2 female) with a severe to profound hearing loss took part in the Naída S study. The audiograms of the subjects were in the fitting ranges for Naída S SP and UP (fig 1). The age was in the range of 47 years to 86 years with an average (mean) of 68.25 years.

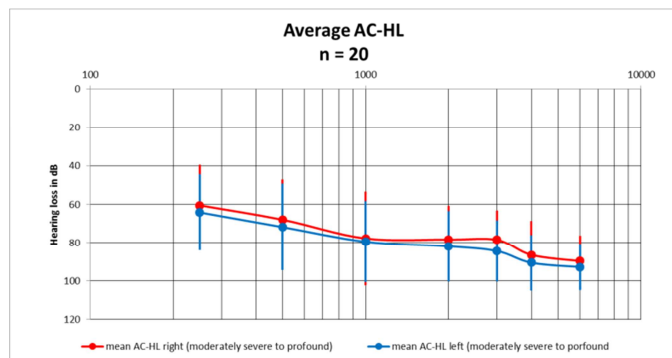


Fig 1: Averaged hearing loss of the Naída S SP and UP subjects

Test devices

All participants were fit with Naída S IX in SP and UP models and individual ear pieces. Benchmark devices were CORE Naída IX (SP and UP).

Fitting software used was Phonak Target 1.2 for the new Naída S. The CORE Naída devices were fitted with iPGF 2.6.

Test Method

This study was divided into 2 parts to investigate the benefits of StereoZoom and auto ZoomControl for power users. Objective testing took place in the laboratory and real-life everyday situations by means of a questionnaire. The questionnaire was filled in by each participant at home before each appointment. Due to limitations of the test set up, not all the subjects were able to perform the speech in noise due to an exclusion criteria of an SNR > +15 dB. This means for these subjects with a SNR higher than +15 dB, the speed of the speech presentation together with the background noise was considered too difficult.

StereoZoom

The speech signal of a speech in noise test was presented from 0°. The background noise consisted of uncorrelated cafeteria noise from a circle of five loudspeakers (at 60°, 120°, 180°, 240° and 300°) at a volume of 65 dB (A). The test subject was seated in the middle of a loudspeaker circle which was placed at head height and a distance of 1.4m. With the help of a speech in noise test, the adaptive measuring method was used to measure the speech understanding threshold (SRT, SNR at 50% speech understanding). The test compared speech understanding between UltraZoom with SNR-Boost, StereoZoom and a VoiceZoom in CORE Naída hearing instrument. Two manual program settings were used for the hearing instruments: a copy of the program for speech in noise with UltraZoom with SNR-Boost and a StereoZoom program. These programs could be selected using the Phonak PilotOne remote control.

auto ZoomControl

auto ZoomControl was compared to the SoundFlow program using a "sound parcou" (a series of examples of real-life listening environments) with four Surround Router loudspeakers (at 0°, 90°, 180° and 270°) provided background noise that replicates a listening situation in a car. The noise was presented from all four loudspeakers. A male speaker was presented from four directions (front, right, left and back). The direction of the speaker's voice was varied between the side and rear loudspeakers with a delay of five seconds.

Results

StereoZoom

The comparison of the different beamformer settings in speech test in noise shows a highly significant better result for StereoZoom setting compared to UltraZoom with SNR-Boost ($p=0.000035$) and CORE VoiceZoom ($p=0.000014$; dependent t-test). The Spice UltraZoom with SNR-Boost is significantly better than CORE VoiceZoom ($p=0.023$; dependent t-test). These results show that Naída S IX SP and UP have significant speech understanding benefits when in a speech in noise situation compared to the predecessor, CORE Naída IX. Figure 2 shows the overall result for $n=15$ subjects including all SP and UP subjects.

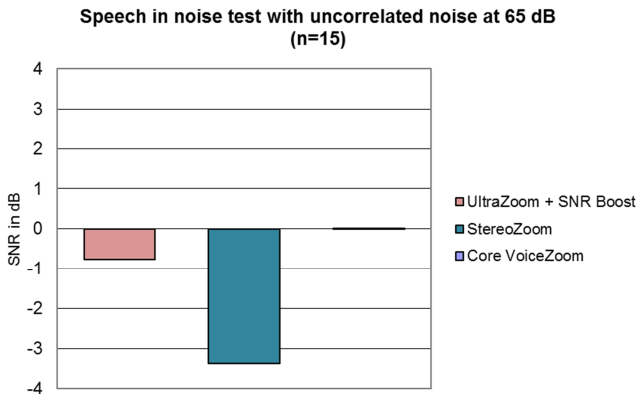


Fig. 2: Speech in noise test with Naída S IX beamformer setting compared to CORE Naída IX beamformer setting including all subjects SP and UP subjects ($n=15$; 6 UP / 9 SP).

auto ZoomControl

Only 14 subjects were able to perform the auto ZoomControl test in the laboratory. The remaining 6 subjects were unable to take the test due to limitation with the test procedure. In real life situations three of the six subjects found auto ZoomControl to be beneficial in their daily life. Two subjects did not test auto ZoomControl and only one subject did not find it to be beneficial.

The results in Figure 3 show that the speech intelligibility from the side 90° with Naída S IX in the auto ZoomControl program is significantly better than the SoundFlow speech in noise setting ($p=0.0012$, dependent t-test).

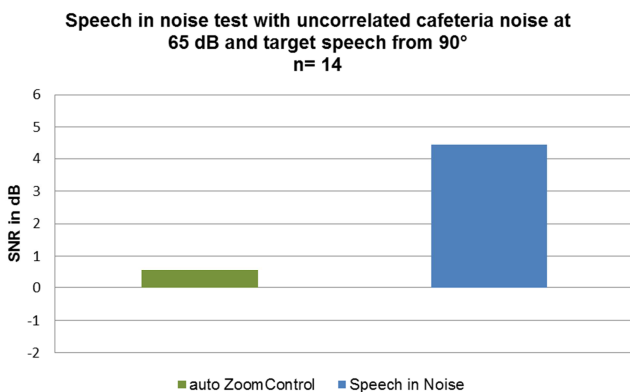


Fig. 3: Speech in noise test with target speech from the side 90° shows a significant better speech intelligibility with auto ZoomControl including all subjects SP and UP ($n=14$; 5 UP / 9 SP).

Additionally the results show that 93.3% of the subjects rated the changing speed as comfortable and with no audible switching. Auto ZoomControl was preferred by 47% of the subjects compared to SoundFlow (6%) and 47% had no preference.

Conclusion

The new manual programs in Naída S IX, StereoZoom and auto ZoomControl, were used in real life and the subjects perceived a benefit compared to SoundFlow. The laboratory tests show that StereoZoom is significantly better than default Spice SoundFlow speech in noise program or the CORE Naída Speech in noise default setting.

Finally the auto ZoomControl program was considered to be significantly better than SoundFlow for understanding speech from the side. The switching time was also considered to be reasonable and without any switching artifacts.

References

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