WIDEX ALLURE AI RIC WITH CLARITY BOOST: CLARITY AND COMFORT, NATURALLY COMBINED.

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Widex Allure AI with Clarity Boost represents a major advancement in AI driven noise management, combining Widex's long standing commitment to natural sound with a powerful AI co-processor designed to handle a wide range of real-world listening environments.

In a study of 20 adults with moderate to severe sensorineural hearing loss, Clarity Boost demonstrated significant improvements over the Widex Allure's Universal program on both objective and subjective outcome measures. The study showed that listeners achieved 20.5% better word recognition when in the Clarity Boost program for speech from the sides and reported lower listening effort and higher comfort than in the Universal program both in challenging and in more realistic listening environments. Additionally, 95% of participants reported preferring the Clarity Boost program in challenging environments when speech was presented from the sides and 70% when target speech was presented from the front.

These results highlight Clarity Boost as a powerful, user activated enhancement that complements the natural sound quality of the Universal program, offering clinicians a compelling new tool to support patients in a variety of noisy environments, whether very challenging or more realistic in everyday life.

Key findings

In challenging listening environments:

- Speech-in-noise performance was 20.5% better with Clarity Boost than Universal, for target speech presented from the sides.
- Clarity Boost was preferred over Universal by 95% of study participants for speech from the side and by 70% for speech from the front.

In more realistic listening environments, listeners rated Clarity Boost as less effortful and more comfortable than Universal, independent of target speech location.

Introduction

Our auditory worlds are dynamic and rich with overlapping sound sources that combine to create complex soundscapes. The acoustic characteristics of auditory scenes further vary from one environment to the next, creating unique aural fingerprints. In a typical clinic, we might expect to hear a clattering of keyboard keys, the shuffling of footsteps and paper, and a soft hum of conditioned air moving through office ductwork. Driving along a busy street instead brings us sounds of music or chatter from the car stereo and the voices of our passengers, rising against the noise of whirring tires, wind, and traffic. Shared meals at restaurants invoke memories of warm conversations overcoming the clanking of flatware on plates, the pops, simmers, and sputters of the kitchen, and the collective babble of other happy diners. Preserving the sonic signatures of these wonderful auditory environments motivates the Widex Sound Philosophy and underlies our dedication to provide users with the most natural hearing experience.

Commitment to maintaining the naturalness of sound is more than a matter of sound quality. The way our brains process sounds is increasingly understood to rely on making predictions about the auditory scene which then facilitates the maintenance of distinct auditory objects (Friston et al., 2021). This cognitive machinery binds together predictable spectral, temporal, and spatial features of sounds into single coherent sources, like the familiar voices of friends or family members. Maintaining internal representations of distinct auditory objects in the world is considered critical to our ability to selectively focus attention on a single auditory source and tune-out competing sounds in the environment. In the context of speech processing, the brain may further anticipate the next word from the preceding context, as well as which direction the talker's voice should be coming from and how loud or soft the voice should be (Best et al., 2008; Sohoglu et al., 2012). These processes combine to help the brain separate speech that is important to the listener from irrelevant and distracting background noise. When hearing aids are developed to maintain natural acoustic cues, they support these neural prediction mechanisms and reduce demand on the brain to reconstruct missing or distorted speech sounds which can otherwise increase feelings of listening effort and fatigue following social interactions (Peelle, 2018).

Clinical implications

Widex Allure AI RIC with Clarity Boost empowers users with the option of enhancing clarity and comfort across a variety of noisy situations.

Just as sound scenes differ in their acoustic characteristics, so to do the needs of different listeners at different times. Considering speech-in-noise, research has shown that listeners' tolerance of background noise is largely defined by how well they think they can understand the message of the speech (i.e., speech clarity). However, in noisy situations where speech intelligibility is not compromised or speech is not present, listeners still have unique degrees of noise tolerance that are instead determined by emotional/cognitive judgements, such as annoyance, that can affect the feelings of personal comfort (Kuk et al., 2024). The highly complex nature of real-world listening, where different auditory signals such as speech, background noise, and ambient sounds overlap in frequency, vary over time, and interact with room acoustics can be challenging to appropriately process with traditional hearing aid signal processing approaches. For this reason, many hearing aid manufacturers have looked to machine learning (ML) as a data-driven approach for crafting hearing aid algorithms to act in a way that is directly informed by large collections of audio data about how speech and noise typically behave in realistic situations. In the past decade, it was common for ML to be introduced for purposes such as sound scene classification, user-driven sound personalization, and the steering of beamforming directional microphones. The goal of these ML approaches is to predict the needs of the listener in a particular environment and adjust signal processing on the hearing aid accordingly to best meet those needs. The SoundSense Learn feature introduced by Widex in 2018 (Townend et al., 2018), is a prime example of real-time ML being introduced in hearing aids for the first time to quickly and surely guide users to their desired hearing experience.

More recently, ML approaches for denoising have also become available in commercial hearing aids. These denoising algorithms typically rely on deep neural networks (DNNs), which are complex computational systems of interconnected elements that take an input audio signal and gradually transform it into an output that is more desirable according to the DNN's developer. In the context of denoising DNNs, the input audio signal containing a mixture of speech and noise would ideally be transformed into an output signal that contains mostly speech and much less noise. This is accomplished by exposing the network to massive "training" data sets of real-world audio recordings and tuning the networks by providing feedback on how well the network's output matches the desired output.

While the goal of developing a DNN is ultimately to train a machine to automatically accomplish a particular task, development of the DNN itself is hardly automatic. Rather human guidance is vital to nearly every stage of DNN design, from defining the network's architecture (i.e., the number of elements and layers as well as the connections between those elements and layers), to selecting the specific training dataset, to shaping how the network is tuned with feedback. Developing DNN-based noise reduction systems for commercial hearing aids also requires carefully navigating through a series of practical considerations, including computational complexity, processing delay, memory requirements, and battery consumption. It should then come as no surprise that DNN systems currently on the market vary greatly across different hearing aid manufacturers as each manufacturer attempts to balance these factors according to their design philosophies and development budgets. Unfortunately, certain optimizations may come at the cost of natural sound cues or even introduce audible artifacts that reduce sound quality and limit intended speech-in-noise performance in certain listening situations.

Korhonen et al. (2026) recently reviewed how a deep history of natural sound design has informed the signal processing strategies of the Widex Allure platform. The ability of natural sound to support speech-in-noise comprehension was also put to the test against four competitors' premium devices that market DNNs as part of their noise management strategy. The results showed that Widex Allure's natural processing approach matched or exceeded the performance of all four leading competitors, delivering a signal-to-noise ratio (SNR) advantage of between 4.9 and 8.1 dB over the poorest performing device, and between 10 and 26% better word recognition over three out of the four competitors' devices (Korhonen et al., 2026). Although specific design details of these competitors' DDNs are proprietary and not disclosed publicly, the range of performance measured in this comparative study highlights how human-led design choices influence how well different DNN-based noise reduction strategies operate in the same controlled listening situation.

The results of Korhonen et al. (2026) further prompted another compelling question. Given that the Widex Allure's non-DNN-based signal processing algorithm, which preserves natural speech cues, compared very favorably against current generation DNN-based denoisers, what if the Widex commitment to natural sound was used to guide DNN development from the ground-up?

To answer this question, Widex has now introduced the Allure AI RIC with Clarity Boost, a hearing aid designed to deliver the most natural hearing experience for everyday use, while empowering users to activate a 3rd generation Artificial Intelligence (AI) co-processor, whenever needed to achieve greater comfort and clarity. Allure AI RIC with Clarity Boost allows users to deploy a powerful full-audio DNN-based denoising system that operates directly on the time-domain signal for a balance of superior noise attenuation and sound quality in everyday life.

Clarity Boost is built on a class of AI architecture specific to audio processing (Audio-specific AI) called linear recurrent neural networks (L-RNNs). These L-RRNs store information about previous windows of sound in system memory (i.e., model "state") and linearly update this memory state with every window of new audio input. The result is very efficient audio processing that avoids heavy computations associated with other DNN architectures while allowing the model to build up a structure that represents long-term information about the signal. To ensure robust performance in everyday listening environment Clarity Boost was trained using a two-stage approach. In the first stage, the DNN model was pretrained on a very large and diverse dataset with 35,000 hours of speech-in-noise mixtures, featuring 10 different languages, many different voices, and a wide range of noise types at ecologically valid SNRs. In the second stage, the model was fine-tuned with actual hearing aid recordings made in a 3D loudspeaker array (Spatial Audio Laboratory) using higher order ambisonics. This training stage allowed the model to capture device-specific transfer functions and microphone characteristics across multiple spatial configurations to ensure robust performance in real-world acoustic conditions. For both stages, feedback was provided to the model based on a Large Audio Foundation Model (LAM) that prompted the DNN toward producing output audio signals that preserve those acoustic features which are perceptually relevant to human speech processing. This LAM itself has been trained on vast amounts of audio to learn how sound and speech are naturally structured over time, which further teaches the L-RRN to distinguish between perceptually important information that should be stored in the "state," and unimportant information that can be discarded. In line with the Widex Sound Philosophy, this training approach should result in a denoising DNN that preserves the natural timing, structure, and continuity of the original input sound, thus supporting the brain's auditory prediction processes and ensuring stable sound quality.

In a technical study reported by Bianchi et al. (2026), Clarity Boost was measured to deliver the highest average output SNR relative to four premium competitors with AI-based denoising, showing up to 6.2 dB of improvement, and the lowest average processing delay among hearing aids with a dedicated AI co-processor. Moreover, the Clarity Boost program showed up to 5.1 dB of improvement over the Universal (i.e., default) program of the Widex Allure which was shown to perform favorably against 4 competitors' devices that featured DNN-based denoising (Korhonen et al., 2026).

In this white paper, we expand on the results of the Bianchi et al. (2026) technical study to assess the performance of the Clarity Boost program on the Widex Allure AI against the non-AI Universal program in listeners with a hearing loss tested across a variety of listening conditions involving background noise, both with and without speech. Given the excellent performance of the Universal program measured by Korhonen et al. (2026), the potential benefits of Clarity Boost are specifically evaluated in situations where listeners may feel that the Universal program does not meet their particular needs. For example, situations where listeners are likely to prioritize their comfort over the most natural experience of ambient environmental sounds, such as those where active noise cancellation is commonly desired (i.e., waiting rooms, airplanes, train stations), may benefit from how Clarity Boost was trained on ambisonics simulations of real-world acoustic environments. The "memory" inherent to the L-RNN at the heart of Clarity Boost may also help listeners stay "locked in" to speech coming from different talker locations, as they might encounter with friends, family members, or colleagues seated around a table in noisy backgrounds. This benefit of Clarity Boost should be particularly helpful when conversation partners are outside the most sensitive range of conventional directional microphone systems, like car passengers seated to the side of the driver. In addition to testing these different situations, this study also measures potential benefits of Clarity Boost using objective measures of speech-in-noise performance at very challenging SNRs, corresponding to speech reception thresholds for 50% understanding (SRT50) and at SNRs corresponding to 90% understanding (SRT90), which are more realistic for supporting real world communication. Lastly, subjective measures of tolerance, comfort, and effort related to listening in noisy conditions are collected to ensure that any objective benefits of Clarity Boost are also experienced and preferred by hearing aid users.

Methods

Participants

A priori power analyses based on pre-study pilot data determined that a sample of 15 participants would power the study at > 80% to detect a significant difference between Clarity Boost and Universal programs if the effect size was at least 90% of that measured in the pilot data. To ensure the study was adequately powered, a total of 20 older adult listeners (mean age = 73.5 years, range = 55–84 years, 8 female) with moderate-to-severe degrees of sensorineural hearing loss were recruited to participate in the study (Figure 1). Eleven listeners had more than 10 years of hearing aid experience. Of the remaining 9 listeners, 6 had at least 2 years of experience and 3 had never worn hearing aids. All participants were native speakers of American English and passed cognitive screening. Participants gave their written informed consent prior to their participation.

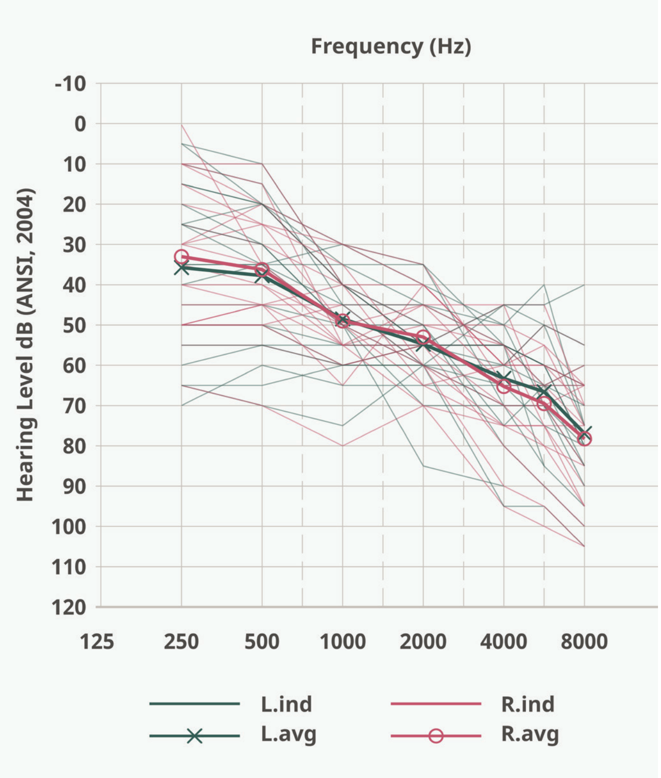

Figure 1. *Individual (thin lines) and average (thick lines) air conduction thresholds of the listeners in the participant sample.*

Study Hearing Aids

Participants were all fitted bilaterally with Widex Allure AI receiver-in-canal (RIC) hearing aids. The study aids were programmed for each participant's hearing loss according to the Widex fitting formula at 100% prescription gain and coupled using instant fit ear tips as recommended by Widex's Compass Cloud fitting software. Following this protocol, 17 out of 20 participants were tested with fully occluding double dome ear tips and the remaining 3 participants were tested with partly vented tulip style ear tips. Feedback tests were conducted for all fittings prior to testing.

The study aids were configured with two programs, the first was the classic Widex Universal (i.e., default) program and the second was the new Clarity Boost program. The Universal program features a high-definition adaptive beamformer (HD Locator) and a noise reduction system (Speech Enhancer Pro) that uses the Speech Intelligibility Index (SII) to reduce noise while preserving speech (Herrlin et al., 2025). The Clarity Boost program features a broadband beamformer and a DNN-based noise reduction system ("AI Mode") powered by a dedicated AI co-processor. The DNN is placed directly in the signal path, receiving the time-domain audio signal as input and returning a time-domain denoised audio signal as output. In line with the Widex Sound Philosophy, the goal of the Clarity Boost program is to attenuate background noise in a way that improves both comfort and speech clarity while still preserving environmental awareness and natural sound quality.

Test Environment

Tests which involved measurement of participants' detectable noise levels, their noise tolerance levels, and their speech-in-noise performance all took place with listeners seated in a double-walled sound-treated booth (internal dimensions: 3 x 3 x 3 m, L x W x H). Eight identical loudspeakers were located within the testing booth at a distance of 1 m from the participant's seated position separated from one another by 45° in the azimuth (Figure 2).

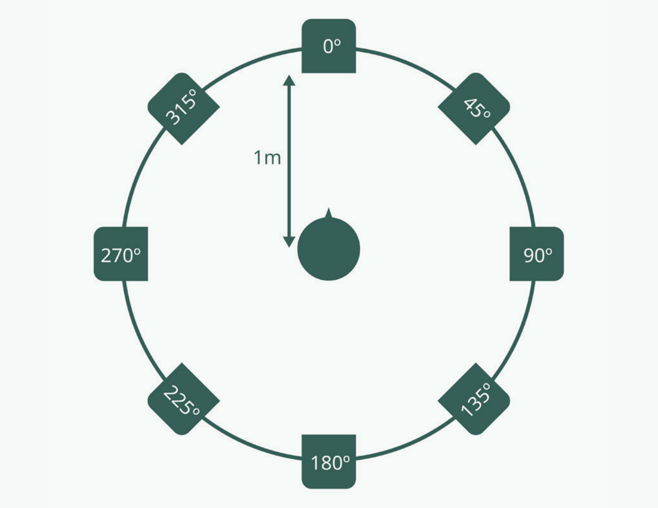

Figure 2. Schematic representation of the loudspeaker configuration used for measurement of minimum detectable noise levels, tolerable noise levels, and speech-in-noise performance during the present study. Participants were seated in the center of the loudspeaker array, with loudspeakers positioned at a distance of 1 m at ear level.

The test which required participants to provide subjective ratings of ambient room noise was conducted outside of the sound-attenuating booth in a medium sized office room (approximate internal dimensions: 3 x 4 x 4 m, L x W x H). The office room contained furniture (desks, cabinets, chairs) of varied dimensions and materials, as well as a collection of electronic equipment. A continuous low level background noise was always present in the room, mostly related to air turbulence created by the office building's heating, ventilation, and air conditioning (HVAC) system and measured an average level of 45 dBA SPL.

Test Stimuli

The loudspeaker array shown in Figure 2 was used to present a complex background noise simulating the acoustic environment of a busy cafeteria. To achieve this, each of the eight loudspeakers in the array presented unique recordings taken in a real cafeteria during lunch service. The recordings comprised a complex mixture of sounds captured in a large dining hall, including the sound of flatware clinking against plates, footsteps, and an unintelligible babble of diners. Loudspeakers were calibrated such that those in front (i.e., 0, 45, and 315°), and to the sides (90 and 270°), presented the cafeteria recordings at the same level while those behind the listener (i.e., 135, 180, and 225°) presented recordings at -10 dB relative to the front and side loudspeakers. The overall level of the background noise varied according to the demands of the different experimental tasks, as described in the Outcome Measures section below.

Speech stimuli used to measure noise tolerance levels were drawn from materials developed and recorded for the Tracking of Noise Tolerance (TNT) test (Seper et al., 2019). The TNT speech materials comprise a series of 2-minute recordings of a male midwestern American talker reading passages related to one of four topics (baseball, bicycles, coffee, or money) with passage material adapted from the simple English version of Wikipedia which targets a 4th to 5th grade reading level.

Speech stimuli used to measure speech-in-noise performance were drawn from materials developed and recorded for the Repeat-Recall Test (RRT) (Slugocki et al., 2018; Kuk et al., 2021). The RRT speech materials comprise short sentences related to different topics (books & movies, food & cooking, music, shopping, and sports) recorded from the same male midwestern American talker that produced the TNT speech materials described above.

Outcome Measures

The study involved participants completing a total of six experimental tasks. Except for collection of ambient room noise ratings (as described below), all tasks were conducted with participants seated in the center of the loudspeaker array within a sound-treated booth (Figure 2).

The hearing aid programs were referred to as "Program 1" and "Program 2," with the assignment of programs counterbalanced across participants (i.e., 50% of participants had Universal as Program 1 and the other 50% had Clarity Boost as Program 1). As necessary, the order of different test conditions (e.g., speech configurations, hearing aid programs) was counterbalanced across participants. Each of the six experimental tasks are described in the sections that follow.

Ambient Room Noise Rating

Participants were asked to provide a subjective rating of the ambient room noise for both Universal and Clarity Boost programs while seated in the office room outside of the sound-treated booth. This task was administered shortly after hearing aid fitting and verification with listeners instructed to *"select the number that best reflects the amount of ambient room noise you hear"* on a 9-point scale, where 1 = none, 3 = slight, 5 = moderate, 7 = high, and 9 = extremely high.

Detectable Noise Level

The detectable noise level (DNL) task required participants to adjust the level of the cafeteria noise to the softest level that was still audible/detectable. Participants adjusted the level of the cafeteria noise using "softer" and "louder" buttons presented on a touchscreen monitor until they were satisfied with the noise level and pressed the "next" button. The softer/louder buttons adjusted the noise by 1 dB per press. The noise level recorded by the test software whenever participants pressed the "next" button defined their DNL scores. The DNL task was repeated twice per hearing aid program (Universal and Clarity Boost), once with the initial noise level set higher at 40 dBA SPL (i.e., descending approach) and once with the initial noise level set lower at 30 dBA SPL (i.e., ascending approach). The average of ascending and descending approaches was calculated as the final DNL for each hearing aid program.

Noise Tolerance Level

The noise tolerance level (NTL) task required participants to adjust the level of the cafeteria noise using the same software interface as the DNL task, described above. However, participants were now instructed to set the noise level to the *"maximum that is comfortable and yet allows 90% understanding of speech."* Speech passages were presented concurrently with the background noise either from the loudspeaker directly in front (0° azimuth) or to the sides (±90° azimuth) of the participant's seated position, with each configuration (i.e., front and sides) tested separately. Speech was always presented at a fixed level of 68 dBA SPL. Testing of the "sides" configuration involved speech alternating between loudspeakers at 90° and 270° every three sentences (about every 10 s). The noise level recorded after participants pressed the "next" button defined their noise tolerance levels (NTLs). The NTL task was repeated twice per hearing aid program (Universal and Clarity Boost) and speech configuration (front and sides), once in a descending approach with the initial noise level set at 78 dBA SPL and once in an ascending approach with the initial noise level set at 70 dBA SPL. The average of ascending and descending approaches was calculated as the final NTL for each hearing aid program.

Estimation of Speech Reception Thresholds

Participants' speech-in-noise abilities were assessed using the ezSRT test (Slugocki et al., 2026). The ezSRT test uses a Bayesian adaptive psychometric testing method, known as QUEST+ (Watson, 2017), to estimate the complete performance-intensity (P-I) function. Participants were required to listen to and repeat each of 24 sentences, drawn from the RRT speech corpus, presented one at a time with the cafeteria noise in the background. Performance was scored based on the accuracy of repetition for three or four designated target words within each test sentence. Sentences were always presented at fixed level of 68 dBA SPL. The level of background noise and hence, the effective SNR for each trial (i.e., sentence presentation) was selected by the ezSRT test based on the performance measured across all previous trials according to the QUEST+ algorithm. The QUEST+ algorithm uses entropy minimization principles to reduce uncertainty about the threshold and slope parameters that define a participant's P-I function for speech-in-noise. Estimates of SNRs required for different levels of speech understanding can then be derived from the P-I function. In this task, each participant's speech-in-noise performance was quantified by the SNR required to achieve 50% understanding (i.e., speech reception threshold, SRT50). Test sentences were presented either from the loudspeaker directly in front (0° azimuth) or to the sides (90° and 270° azimuth) of the participant's seated position, with each configuration (i.e., front and sides) tested separately. Testing of the "sides" configuration in this task involved speech alternating between loudspeakers at 90° and 270° every other trial/sentence.

Non-adaptive Testing at SRT50

Given that the ezSRT is an adaptive test, there is a possibility that the trial-to-trial changes in SNR could have affected how the noise mitigation features in the two study hearing aid programs were engaged at any given moment. To address this possibility, the fifth task reassessed participant's speech-in-noise performance but with the background noise level fixed to an SNR corresponding to each participant's SRT50 as measured for the Universal program. Testing in a stable (i.e., fixed SNR) condition further allowed for collection of subjective ratings related to *listening effort* and *listening comfort* as well as for surveying of listener *preference* between the hearing aid programs when tested in the same acoustic conditions.

Before the fixed SNR test began, participants were instructed on which hearing aid program was being evaluated (masked as "Program 1" and "Program 2") and that they would be required to provide a final preference at the conclusion of the task. Participants were once again required to listen to and repeat each of 24 RRT sentences, presented one at a time at a fixed level of 68 dBA SPL with the cafeteria noise in the background at individualized levels corresponding to SRT50. Performance was scored for three or four designated target words per sentence. After the final test sentence, participants were asked to provide a rating of *listening effort* on a 10-point scale, where 1 = not effortful, 5 = moderately effortful, and 10 = very effortful, as well as a rating of *listening comfort* with specific instruction to consider comfort in the context of the background noise. Ratings of listening comfort were also collected on a 10-point scale, where 1 = not comfortable, 5 = moderately comfortable, and 10 = very comfortable. Sentences were again presented in "front" and "sides" configurations, as done for the ezSRT test. Preference judgements were collected after testing both hearing aid programs in a given speech configuration.

Non-adaptive Testing at SRT90

The sixth and final task largely followed the same protocol as the fifth task, described above, but tested listeners at individualized SNRs corresponding to SRT90 to capture performance in challenging conditions that are more realistic for supporting real world communication. The task was further modified to only test 12 sentences for each combination of hearing aid program and speech configuration.

Results

Comfort – Ambient Room Noise and Detectable Noise Level

Ratings of the ambient room noise assigned to Universal and Clarity Boost programs are summarized in Figure 3. This figure shows that, on average, listeners rated ambient room noise to be significantly lower (i.e., less noisy) by about 1 interval when in the Clarity Boost program relative to the Universal program (paired-samples sign test = 9, $p < 0.01$).

Minimum detectable noise levels (DNLs) measured for the Universal and Clarity Boost programs are presented in Figure 4. On average, participants were able to hear the cafeteria noise at a level of 27 dBA SPL while in the Universal program. In the Clarity Boost program, the minimum DNL increased to 33 dBA SPL. The 6 dB difference in DNLs reflects a statistically significant advantage of the Clarity Boost program over the Universal program for reducing low-level background noise (paired-samples t-test: $t_{(19)} = 8.0$, $p < 0.001$).

Together, the results of these two experimental tasks show the Clarity Boost program to be effective at reducing low-level background noise to provide listeners with greater comfort compared to the Universal program.

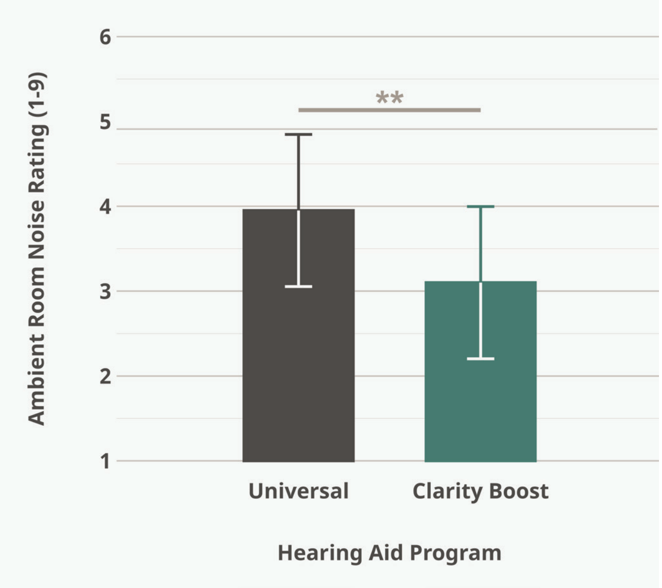

Figure 3. *Average ratings of ambient room noise assigned by participants for Universal (grey) and Clarity Boost (green) programs of the Widex Allure AI hearing aid. Asterisks indicate a significant advantage for the Clarity Boost program over the Universal program based on a paired-samples sign test, ** p < 0.01.*

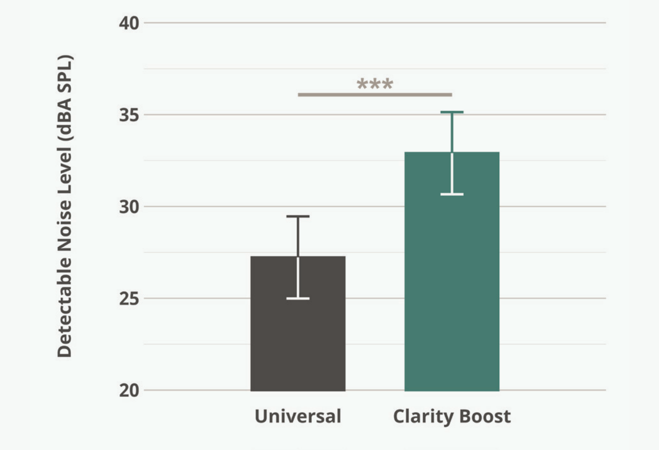

Figure 4. *Plots showing the minimum level required for participants to detect a cafeteria noise while wearing Widex Allure hearings aids in either the Universal (grey) or Clarity Boost (green) programs. Bars represent average detectable noise levels (DNLs) and error bars represent ±1 standard deviation. Higher values indicate that the cafeteria noise needed to be louder before participants reported hearing the noise. Asterisks indicate a significant advantage of the Clarity Boost program over the Universal program based on a paired-samples t-test, *** p < 0.001.*

Clarity – Noise Tolerance Levels, Speech-in-Noise Performance and Preference

Noise tolerance levels (NTLs) measured when speech was presented from the front and from the sides are presented for the Universal and Clarity Boost programs in Figure 5. On average, listeners were able to tolerate 1.3 dB more noise in the Clarity Boost program (67.7 dBA SPL) compared to the Universal program (66.4 dB SPL) when speech was presented from the front ($t_{(19)} = 2.4$, $p < 0.05$). When speech was presented from the sides, the difference between the two programs increased, where listeners were now able to tolerate 4 dB of additional noise in the Clarity Boost program (67.4 dBA SPL) compared to the Universal program (63.2 dBA SPL) ($t_{(19)} = 6.0$, $p < 0.001$).

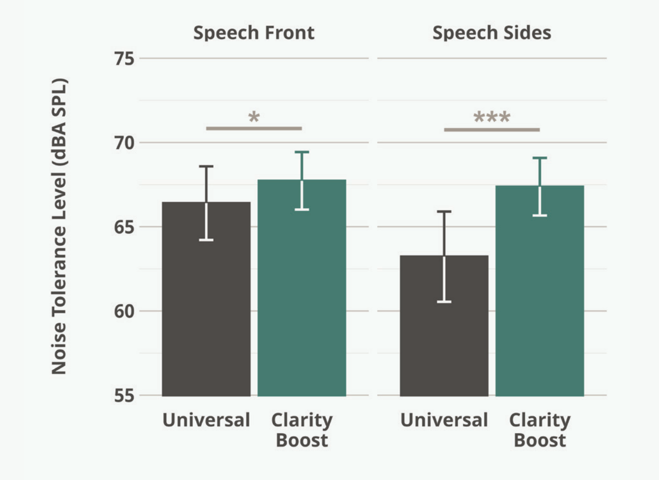

Figure 5. *Plots showing the maximum level of cafeteria noise participants could tolerate while still understanding 90% of speech presented from the front (left panel) or from the sides (right panel). Bars represent average noise tolerance levels (NTLs) and error bars represent ±1 standard deviation as measured for Widex Allure hearings aids in either the Universal (grey) or Clarity Boost (green) program. Higher values indicate better performance. Asterisks indicate a significant advantage of Clarity Boost over Universal based on a paired-samples t-tests, * p < 0.05, *** p < 0.001.*

The average performance-intensity (P-I) functions for participant's speech-in-noise performance as measured by the ezSRT test are presented in Figure 6. Similar to the noise tolerance results reported above, these P-I functions show that participants' speech-in-noise abilities were similar between Universal and Clarity Boost programs when speech was presented from the front. However, the P-I function for the Clarity Boost program appeared to be shifted towards more negative SNRs, suggesting better speech-in-noise performance, relative to the Universal program when speech was presented from the sides.

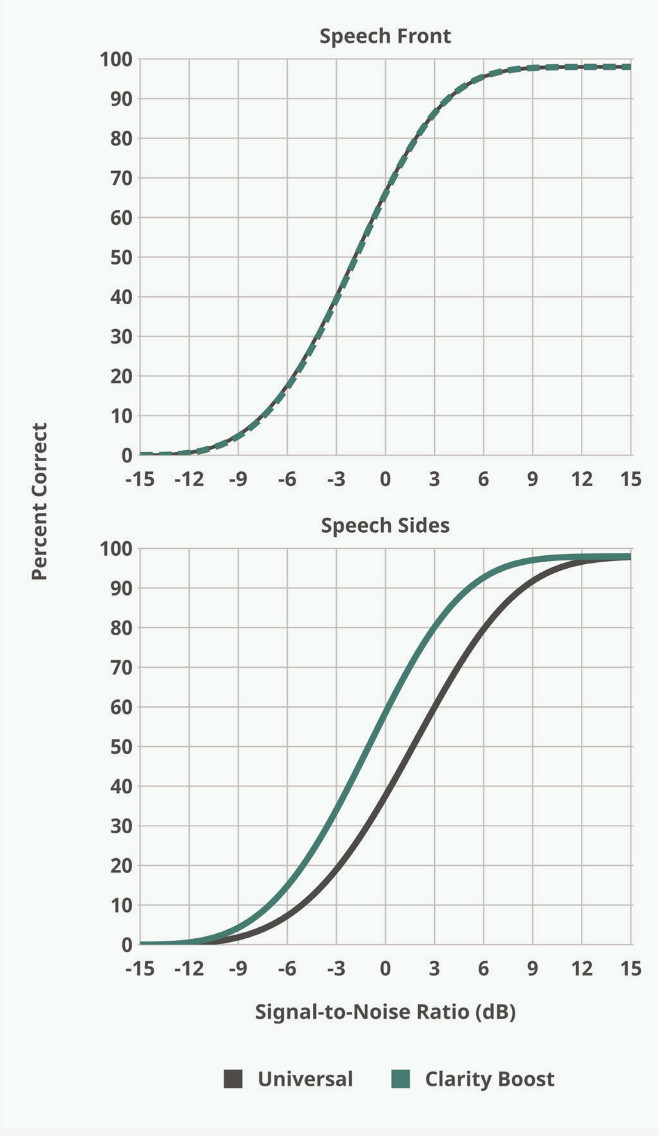

Figure 6. Performance-intensity (P-I) functions for speech-in-noise performance measured when speech was presented from the front (top) and from the sides (bottom). Each P-I function, corresponding to performance for Universal (grey) and Clarity Boost (green) programs, was derived from the average participant's threshold and slope parameters as measured by the ezSRT test.

The average SNRs corresponding to SRT50s and SRT90s estimated from the P-I functions of individual listeners are shown Figure 7. Estimates of SRT50 and SRT90 were analyzed using two separate linear mixed effects (LME) models that each assessed the fixed effects of hearing aid program (2 levels: Universal and Clarity Boost) and speech configuration (2 levels: Speech Front and Speech Sides). The LME model analyses found that speech-in-noise performance at both SRT levels was significantly affected by the fixed effects of hearing aid program and speech configuration, where both fixed effects were qualified by a significant two-way interaction.

Post-hoc analysis of the significant two-way interactions in Figure 7 confirmed that participant speech-in-noise performance at SRT50 was significantly better (i.e., more negative SNR) when tested in the Clarity Boost program (average SRT50 = -1.1 dB SNR) compared to the Universal program (average SRT50 = 1.7 dB SNR) for target speech presented from the sides. On the other hand, when target speech was presented from the front, both the Clarity Boost program (average SRT50 = -1.8 dB SNR) and the Universal program (average SRT50 = -1.9 dB SNR) performed equally well. A similar pattern was observed for SRT90, where speech-in-noise performance was significantly better for the Clarity Boost program (average SRT90 = 5.4 dB SNR) compared

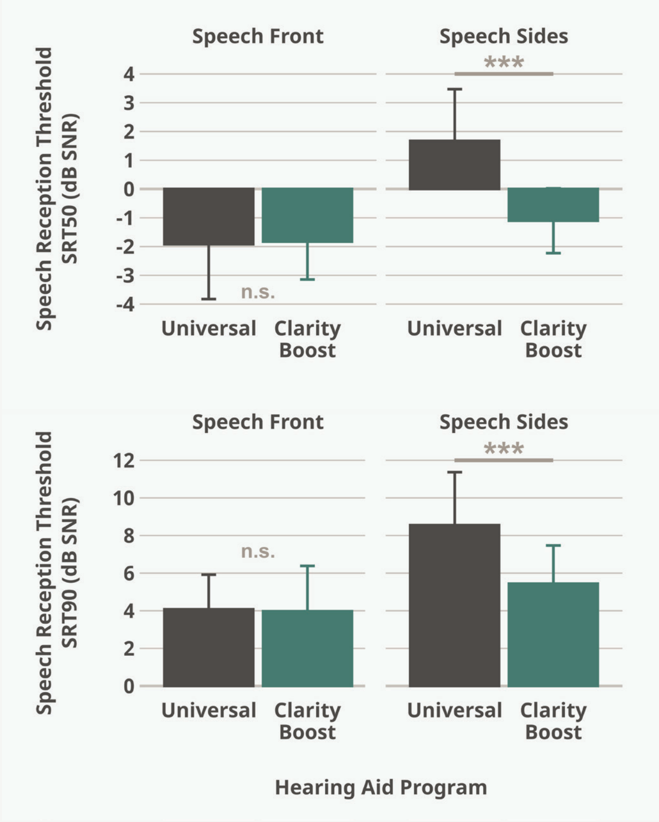

*Figure 7. Plots exploring significant two-way interactions of hearing aid program (x-axes, colors) and speech configuration (panels) on speech-in-noise performance measured by the ezSRT test for speech reception thresholds of 50% (SRT50; top row) and 90% (SRT90; bottom row) understanding. Bars indicate average signal-to-noise ratios (SNRs) corresponding to the SRTs and error bars represent ±1 standard deviation for the Universal (grey) and Clarity Boost (green) programs. Lower values indicate better performance. Asterisks indicate a significant advantage of Clarity Boost over the Universal at both SRT levels when speech was presented from the sides, *** p < 0.001.*

to the Universal program (average SRT90 = 8.5 dB SNR) when speech was presented from the sides, with no significant difference between Clarity Boost (average SRT90 = 4.0 dB SNR) and Universal (average SRT90 = 4.1 dB SNR) programs when speech was presented from the front.

The advantage of the Clarity Boost program over the Universal program was also observed when listeners were tested at fixed SNRs corresponding to their individual SRT50s and SRT90s. Average *speech-in-noise performance* (quantified as the percentage of correctly identified words), ratings of *listening effort* and ratings of *listening comfort* are plotted separately for tests conducted at SRT50 (Figure 8, left panels) and SRT90 (Figure 8, right panels). A series of six LME models was used to evaluate each of these three outcome measures for possible fixed effects of hearing aid condition (2 levels: Universal and Clarity Boost) and speech configuration (2 levels: Speech Front and Speech Sides) as measured at SRT50 and SRT90, separately.

The three LME models assessing performance measured at SRT50 revealed that all three outcome measures were significantly affected by hearing aid program and by speech configuration, where these fixed effects were always qualified by a significant two-way interaction. The three LME models assessing performance measured at SRT90 did not find listener *speech-in-noise performance* to be significantly affected by hearing aid program nor by speech configuration. Instead, word recognition performance was near ceiling across all test conditions. On the other hand, the outcome measures of *listening effort* and *listening comfort* assessed at SRT90 were both significantly affected by hearing aid program but not speech configuration nor their two-way interaction.

Post-hoc analyses conducted to explore the significant two-way interaction of hearing aid condition and speech configuration on word scores, listening effort ratings, and ratings of listening comfort measured at SRT50 are further summarized in Figure 8 (left panels). Here, each of the outcome measures was significantly better for the Clarity Boost program compared to the Universal program when speech was presented from the sides. Specifically, Clarity Boost improved speech-in-noise performance (i.e., word scores) by 20.5% (Universal = 55.7%, Clarity Boost = 76.2%), lowered ratings of listening effort by 2.5 intervals (Universal = 8.2, Clarity Boost = 5.7), and increased ratings of listening comfort by 1.6 intervals (Universal = 4.1, Clarity Boost = 5.7). On the other hand, speech-in-noise performance (Universal = 56.9%, Clarity Boost = 57.1%), listening effort ratings (Universal = 8.2, Clarity Boost = 8.1), and ratings of listening comfort (Universal = 4.0, Clarity Boost = 3.5) did not differ significantly between the two programs when speech was presented from the front.

The significant fixed effect of hearing aid program on ratings of listening effort and listening comfort collected at SRT90 is explored in Figure 8 (right panels). At this higher SRT level, participants' word recognition scores approached performance ceilings for both hearing aid programs in speech front (Universal = 96.8%, Clarity Boost = 96.6%) and speech sides (Universal = 96.4%, Clarity Boost = 98.3%) configurations. Despite the similarity of speech-in-noise performance, ratings of listening effort were still significantly lower for the Clarity Boost compared to Universal program both when speech was presented from the front (Universal = 3.2, Clarity Boost = 2.6) as well as from the sides (Universal = 3.6, Clarity Boost

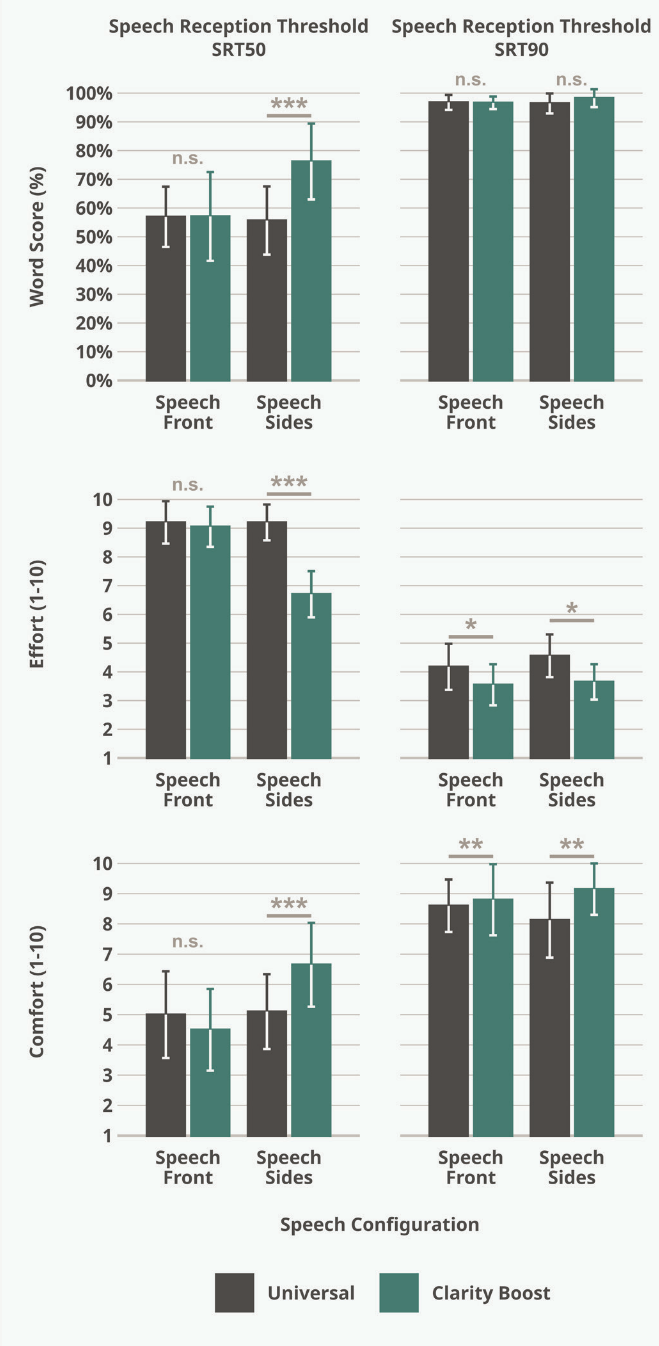

Figure 8. *Plots showing word scores (top row), listening effort ratings (middle row), and ratings of listening comfort (bottom row) measured in two speech configurations (x-axes) at fixed signal-to-noise ratios (SNRs) corresponding to speech reception thresholds for 50% (SRT50; left panels) and 90% (SRT90; right panels) understanding. Bars indicate average scores/ratings and error bars represent ±1 standard deviation as measured for Widex Allure hearing aids in the Universal (grey) and Clarity Boost (green) program. For data measured at SRT50, asterisks indicate significant advantages of the Clarity Boost program over the Universal program on all three outcome measures when speech was presented from the sides as determined by post-hoc analysis of the significant two-way interaction of hearing aid program and speech configuration, *** $p < 0.001$, n.s. = non-significant. For data measured at SRT90, asterisks indicate significant fixed effects showing advantages of the Clarity Boost program over the Universal program on ratings of listening effort and comfort for both speech configurations, * $p < 0.05$, ** $p < 0.01$, n.s. = non-significant.*

= 2.7). Ratings of listening comfort were also significantly higher for the Clarity Boost than for the Universal program when speech was presented from the sides (Universal = 7.2, Clarity Boost = 8.2) and from the front, albeit with the difference between the two programs becoming smaller (Universal = 7.6, Clarity Boost = 7.8).

Lastly, Figure 9 shows the number of participants who reported preferring Universal or Clarity Boost programs after being tested with the fixed SNR task in each of the speech configurations at SRT50 and SRT90. This figure shows that 95% of participants (19 out of 20) reported preferring the Clarity Boost program over the Universal program after being tested at SRT50 with speech presented from the sides and 75% (15 out of 20) preferred Clarity Boost over Universal in this speech configuration when being tested at SRT90. In addition, 14 out of 20 participants (70%) reported preferring the Clarity Boost program over the Universal program when tested at SRT50 with speech from the front. Participants exhibited no clear preference between the two programs when tested at SRT90 with speech from the front (60% preferred Clarity Boost).

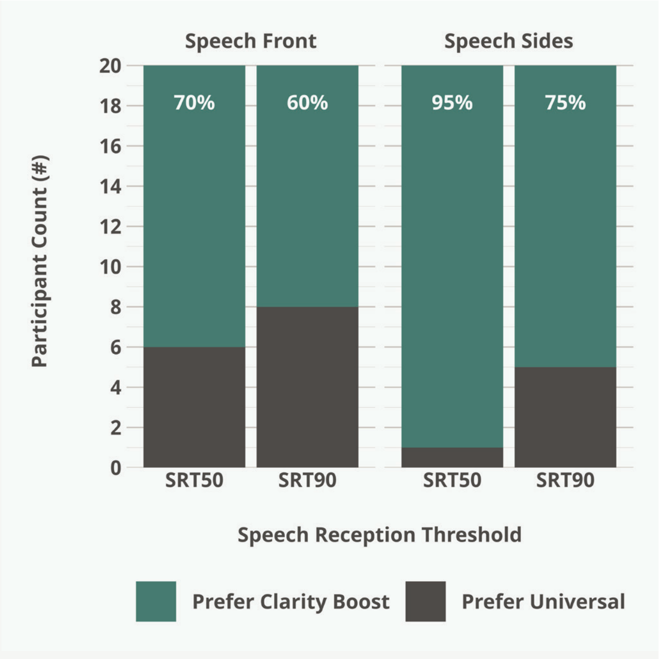

Figure 9. Plots showing the number of participants (y-axis) selecting either Universal (grey) or Clarity Boost (green) as their preferred program after speech-in-noise testing with speech presented from the front (left panel) or from the sides (right panel) at SNRs corresponding to SRT50 or SRT90 (x-axes). Numbers printed atop each green bar show the percentage of participants preferring Clarity Boost over Universal.

Discussion

The present study demonstrates how Clarity Boost on the Widex Allure AI RIC, powered by a 3rd generation AI co-processor, empowers users with the option to enhance comfort and clarity on demand, as needed, for a wide range of listening situations. While the Universal program already delivers strong performance rooted in natural sound preservation, Clarity Boost offers additional benefits in situations where listeners prioritize comfort, reduced noise, or improved speech-in-noise understanding from talkers at different locations around the listener.

A key outcome of this study is the consistent improvement in subjective comfort and noise tolerance. Specifically, the study found that Clarity Boost lowered the perceptible level of softer ambient room noise by 6 dB compared to the Widex Allure's Universal program and also increased the level of noise that listeners were willing to tolerate in a louder cafeteria setting by 1.3 to 4 dB. These results suggest that Clarity Boost effectively reduces low-level and intrusive noise without compromising audibility for speech and environmental awareness.

Regarding clarity, when speech was presented from the front, the speech-in-noise performance of the Clarity Boost program was equally good to that measured for the Universal program which has already been shown to match or exceed the speech-in-noise performance of four leading competitor hearing aids with DNN-based denoising systems (Korhonen et al., 2026). However, while conventional directional microphone systems are optimized for frontal speech, real-world communication often involves talkers seated around a table, in a car, or in other spatial arrangements. To assess these situations the study's collection of speech-in-noise outcome measures also involved configurations where speech was presented to listeners from the sides. Here, Clarity Boost helped listeners to better understand speech in busy cafeteria noise by 2.8 dB in very challenging situations of SRT50. In more realistic conversation conditions of SRT90, the performance advantage of Clarity Boost was even greater (3.4 dB). These benefits would be especially useful when trying to follow speech from different talkers seated around a table at a restaurant, or when conversing with a passenger in a car where listeners are unable to turn their heads away from the road.

Speech-in-noise benefits were also confirmed by testing at fixed SNRs individualized to each listener according to their SRT50. In this case, word recognition scores improved by 20.5% in the Clarity Boost program compared to the Universal programs. Importantly, listeners were able to subjectively appreciate this benefit and reported following speech in the noisy background with Clarity Boost to be less effortful and listening to be more comfortable when compared with Universal. Reduced listening effort and increased comfort were not only observed at SRT50, but also at SRT90 where speech-in-noise performance was near ceiling for both Universal and Clarity Boost programs. These results suggest that the L-RNN architecture effectively preserves speech cues across a range of SNRs where speech is still intelligible and across a wider spatial field compared to typical directional microphone systems. This aligns with how Clarity Boost was designed to leverage long-term temporal modeling of the audio signal and how Clarity Boost was refined with ambisonics fine-tuning to maintain the natural perceptually relevant structure of speech while attenuating noise.

Importantly, the strong listener preference for Clarity Boost across a variety of test conditions underscores the practical value of offering users a choice between natural and AI-enhanced processing. Rather than replacing the Universal program, Clarity Boost complements it by giving users control to activate more aggressive noise management *wherever* it is needed. The efficient audio-specific AI-architecture also results in reduced power consumption relative to other hearing aid DNNs so users can also activate Clarity Boost *whenever* it is needed. This flexibility may support greater satisfaction and confidence in real-world listening, particularly in environments where comfort and clarity are prioritized over full ambient transparency.

Overall, the results of this study indicate that Clarity Boost provides measurable and meaningful benefits in comfort, clarity, and listening ease, especially in complex, noisy environments. These findings support the clinical value of Clarity Boost on Widex Allure AI RIC and highlight the potential of perceptually guided AI architectures to enhance hearing-aid performance while maintaining the natural sound quality central to the Widex philosophy.

Conclusion

Clarity Boost extends the Widex Allure AI RIC platform by giving users an on-demand solution for handling both noisy, complex listening environments as well as more manageable everyday listening environments. Combining advanced AI-based denoising with Widex's signature natural sound, Clarity Boost delivers measurable improvements in comfort, clarity, and listening ease. With strong user preference and consistent performance benefits across objective and subjective measures, Clarity Boost offers a compelling new tool to help users stay engaged, confident, and connected in the real world.

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