Phonak Insight.

Spheric Speech Clarity for adolescents: Optimizing preference and real-world experience.

In a study at Vanderbilt university, adolescents preferred Spheric Speech Clarity (SSC) over other noise-management strategies and consistently selected settings stronger than the default. For hearing care professionals, this paper offers practical guidance to optimize Sphere fittings and improve outcomes for adolescents.

Nelson, J., Picou, E., Rich, S. May 2026.

Introduction

Children with hearing loss are often in social and educational environments where there is a significant amount of noise and reverberation. We know that these conditions make understanding speech particularly challenging (Crukley et al., 2011; Shield & Dockrell, 2004; Spratford et al., 2019). Even with amplification, these children typically require more favorable signal-to-noise ratios than their peers with typical hearing to achieve comparable speech understanding (Browning et al., 2019; Gravel et al., 1999). Fortunately, there are several hearing aid technologies available for school-aged children to improve their speech understanding in these challenging environments.

Directional hearing aid microphones can reduce the influence of sounds coming from the back or sides. This can yield meaningful improvements in signal-to-noise ratio (SNR) and the ability to understand speech in noise. The extent of benefit, however, depends on the specific spatial arrangement of speech and noise and how the child is oriented within the environment (Ricketts & Hornsby, 2003; Ricketts & Hornsby, 2006; Gravel et al., 1999; Hawkins & Yacullo, 1984; Ricketts et al., 2007; Ricketts & Picou, 2013; Wolfe et al., 2022).

In recent years, advances in artificial intelligence–based noise reduction, specifically large deep neural networks (DNN), offer the potential to extract speech from noise in a location-agnostic way, which is particularly attractive for the multi-talker, dynamic environments children routinely encounter (Wright et al., 2024; Hasemann & Krylova, 2024; Vaisberg et al., 2025). While studies with adults have demonstrated benefits in speech recognition and listening effort in noise, translating feature benefits to pediatric populations remains an active area of investigation (Crukley & Scollie, 2014; Auriemmo et al., 2009; Wolfe et al., 2017).

Children with hearing loss have different needs than adults, especially the need for a higher SNR. In addition, they are in challenging, noisy listening environments for a large proportion of their day. A guiding principle for for Phonak is to investigate and measure the benefits of our technology to ensure that they meet the needs of children in their everyday lives independent from our studies with adults.

Ongoing pediatric research is also used to inform default fitting settings and provide Hearing Care Professionals (HCPs) with evidence and guidance to optimize fittings. Against this backdrop, a study was undertaken at Vanderbilt University focusing on benefits of DNN for adolescents with bilateral hearing loss.

This Insight will provide:

- An introduction to artificial intelligence in the form of DNN technology in hearing aids
- An overview of the evidence and benefits of DNN sound processing for adults
- A discussion of results from the study with adolescents at Vanderbilt University, and
- Recommendations for optimizing fittings using DNN sound processing with adolescents.

How is artificial intelligence technology used in Phonak hearing aids?

Artificial intelligence (AI) has become a common term across many areas of modern life. AI is essentially an umbrella term which describes systems that mimic human intelligence such as machine learning or DNN. For hearing aids there are two main applications – classification of the environment and steering programs and features, and extracting target speech and enhancing it.

Machine learning has been used by Phonak for more than 25 years to train our classification systems like AutoSense OS and AutoSense Sky OS.

In contrast to machine learning, extracting speech from noise in real-time is a much more challenging task requiring a large DNN. In 2024, Phonak launched Infinio Sphere with a dedicated, proprietary chip to run this large DNN in a hearing aid. Spheric Speech Clarity (SSC) works like no other DNN. It extracts the speech signal and then integrates it with heightened contrast for enhanced speech clarity.

The extraction of speech from noise in real-time provides perceptual benefit to the end-user in a way that surpasses other noise management strategies. Because SSC acts in real-time, it potentially provides immediate gains from multiple directions and supports comprehension in spatially dynamic conversations.

Overview of research findings for SSC with adults

Many studies have been undertaken with SSC with adults. They have focussed on speech understanding, listening effort, working memory and fatigue.

Speech understanding

SSC in Sphere devices delivers significant gains in speech understanding under noisy, real-world conditions, particularly for off-axis or multi-talker speech. These studies focused on the benefit of SSC compared with StereoZoom 2.0 (SZ2.0).

A 2025 study in Shanghai by Tian et al., found SSC improved speech intelligibility by up to 31% versus SZ 2.0, with the biggest improvements at 60° and 300°. A study in Hörzentrum Oldenburg (Latzel et al., 2025) found a 44% advantage over SZ 2.0 in diffuse multi-talker noise for adults with moderate-to-severe loss.

Taken together, these results support the advantage of SSC in challenging real-world settings with several talkers and shifting spatial cues. Considering this from an adolescent's perspective, this could provide significant benefit both in the classroom and in social situations, for example, taking part in conversations in the lunchroom, while walking down the hallway to their next class or during lively family activities.

Listening effort

Listening effort, cognitive load, and fatigue have been evaluated in studies in the USA, Germany and China.

Across these studies, listening effort was measured using Adaptive Categorical Listening Effort Scaling (ACALES). ACALES gives us a way to understand how SNR influences a participant's rating of their subjective listening effort. When we use it to compare technologies, we expect to see SNRs shift towards the negative (i.e., more difficult). This shows us that the participant is listening in more challenging SNRs without an increase in subjective effort.

When comparing listening effort with SSC and SZ2.0, Tian et al (2025) found a reduction of up to 4.2 dB SNR with SSC which equates to approximately 35% reduced listening effort. That might seem counter-intuitive but it means that their subjective effort was the same even in a poorer SNR.

Similarly, Latzel et al (2025) found 3.4 dB lower SNR with SSC compared to SZ2.0. Wright, A. et al (2024) compared SSC-on vs SSC-off and showed a 2.9 dB poorer SNR with SSC on indicating participants felt listening required less effort with SSC engaged.

Cognitive load and fatigue

Cognitive load and fatigue tend to increase with age and hearing loss because processing speed slows and working memory is taxed, making it harder to filter irrelevant input and manage complex listening tasks in noise (Windle, et al., 2023). In real-world listening, SSC has been shown to ease these cognitive demands.

In the study at Hörzentrum Oldenburg (Latzel et al 2025) it was reported that listening with SSC compared with SZ2.0 reduced cognitive load, listening effort, and fatigue over a 2.5-hour time-compressed auditory day. This aligns with findings from Huang et al (2025) who reported DNN denoising in Spheric Speech Clarity significantly improved working memory, allowing for more words to be recognized and remembered.

Preference and dependence of coupling

A study at Phonak Audiology Research Centre by Cox et al. (2024) focused on adult preferences for the position of the DNN controller (SSC slider in Target) and on the benefit of speech understanding with different acoustic couplings. The study used open, vented and power couplings and compared speech intelligibility with DNN (Off), DNN (position 5) and DNN (participant's preferred setting).

Regardless of the acoustic coupling, adults self-selected position 6 or 7 on the SSC slider. Speech intelligibility was significantly better with DNN-on compared with DNN-off for all acoustic couplings with an average of 23% improvement across the 3 couplings.

Collectively, these results with adults indicate that SSC not only improves speech understanding in multi-talker and spatially dynamic environments but also meaningfully reduces cognitive load and fatigue during demanding listening tasks.

Vanderbilt study with adolescents

Having established the adult advantages of Phonak's large DNN in adults, a recent study at Vanderbilt University extended the investigation to younger listeners with a focus on pediatric fitting implications. This study aimed to assess whether DNN-based SSC yielded measurable speech intelligibility benefits for adolescents with bilateral sensorineural hearing loss. Furthermore, it aimed to evaluate whether these listeners prefer SSC processing both in the lab and during a home trial over other Phonak noise managegement strategies.

The objectives of this study were to:

- Primary: Assess whether SSC improves speech intelligibility for adolescents in challenging listening environments.
- Secondary: To determine adolescents' preferences for SSC processing in both lab and field settings, compared with other Phonak noise-management options.
- If SSC sound processing was preferred, a final objective was to identify the preferred SSC setting.

Methodology

Twenty-three adolescents (aged 10 – 17 years) participated in a study across two laboratory visits with a home trial between the visits. All participants had bilateral, mild to severe symmetrical sensorineural hearing loss and were all experienced hearing aid wearers. They were fit bilaterally with Phonak Audéo Infinio Sphere 90 hearing aids with either an open, vented or power dome for the purpose of the study. The hearing aids were programmed with 5 manually accessible programs (with the help of the smartphone app) – see Table 1. Three of them used SSC, each set at a different strength, 1 being the default strength setting, 7 being the highest strength setting.

Base program	Noise management
Calm	Real Ear Sound (RES) NoiseBlock On
Speech in Loud Noise	StereoZoom 2.0 (SZ 2.0) NoiseBlock and Dynamic Noise Cancellation On
Spheric Speech in Loud Noise	Fixed directional, SSC 1
Spheric Speech in Loud Noise	Fixed directional, SSC 5
Spheric Speech in Loud Noise	Fixed directional, SSC 7

Table 1: Manual programs used in HINT-C and AB comparison testing.

The first lab session included fitting of the hearing aids, speech-in-noise testing, and subjective ratings during the speech-in-noise testing. Subjective ratings will be shared in a future publication.

All laboratory tasks were completed in a moderately-reverberant room with 68 dBA cafeteria noise.
The speech-in-noise task involved sentence repetition of HINT-C materials with the talker originating from the front (0°), front side (300°), or side back (150°) as seen in Figure 1. The signal-to-noise ratio was fixed during testing and

individually set prior to testing to target ~50% accuracy for RES and speech from the front.

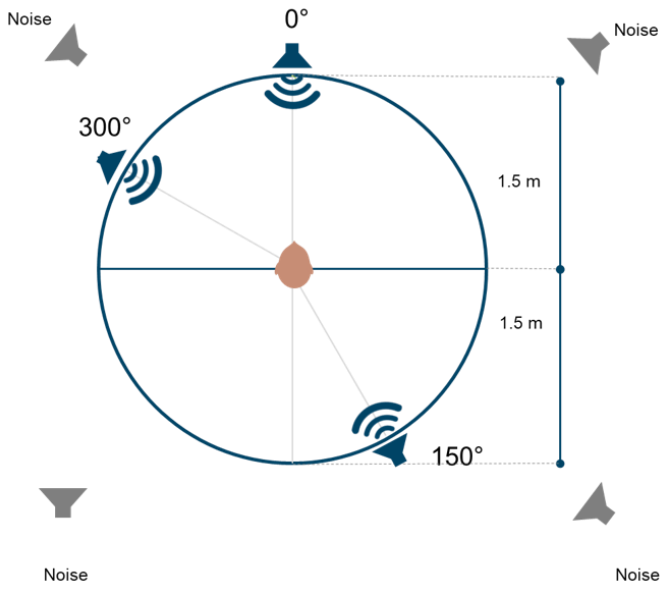

Figure 1. Lab set up for HINT-C sentence and preference testing. Note, for preference testing the speech came from the front speaker only.

Two tasks were undertaken in the second lab session to determine the adolescents' SSC preferences. For both tasks speech was presented from the front and at a 0dB SNR (see Figure 1).

The first task was a paired-comparison task to find out which of the five manual programs listed above was preferred by each participant. Two options from the 5 manual programs (blinded) were presented and the participant was asked to pick which of the two programs (blinded) was "easiest to listen to". This process was repeated until all five manual programs listed above had been compared against each other twice. The analysis of the preference was based on which program the participant chose the most often.

Second was a slider setting task where participants were asked to self-adjust the SSC (Noise reduction) slider while in a manual Spheric Speech in Loud Noise (SSiLN) program in myPhonak. A section of running speech was played and the participant was asked to move the slider to a position that made listening to speech the "easiest" (their favorite setting), and then to a position that made listening to speech the "most difficult" (their least favorite setting).

Finally, preference was determined during a field trial when participants and a guardian went to a noisy place (e.g., a family arcade), where the participant listened with two programs (SZ2.0, SSC5). They rated their ability to hear in that environment with both programs and chose their favorite program.

Results

Speech in noise performance with HINT-C

Figure 2 displays sentence recognition in noise performance for all 3 loudspeaker conditions and 5 hearing aid settings. Analysis revealed significant and similar benefits with SSC 1, 5 & 7 and SZ2.0 for the front loudspeakers compared to RES. For the back loudspeaker, performance with the SSC programs was significantly better than with the SZ 2.0 program. These results indicate the SSC program is the one that maximizes the speech recognition performance from all three loudspeaker locations.

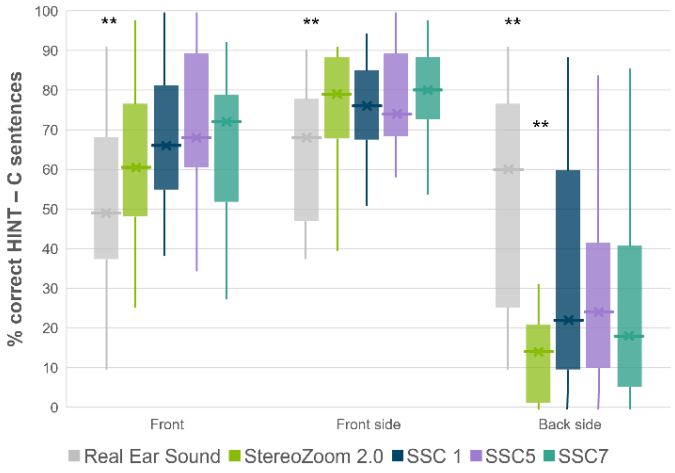

Figure 2. HINT-C sentence test results for each noise management strategy.

Laboratory Preference Tasks

Figure 3 shows the results from the blinded AB comparison. The 5 different noise management strategies can be seen on the x-axis. The number of participants who chose a particular noise management strategy is shown on the y-axis. Analysis revealed that SSC7 was chosen more than any other program and RES was chosen less than any other program. When comparing the SSC options SSC1 was chosen the least.

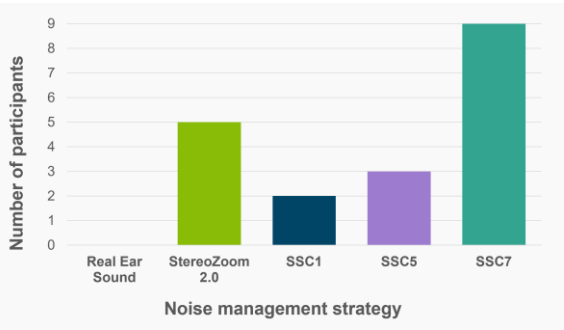

Figure 3. Number of participants who chose each noise management strategy most often in the AB comparisons.

In the second task to determine participants' preference they were asked to adjust the noise reduction slider in SSPiLN in myPhonak to their setting that made it easiest to listen to running speech. The noise reduction slider is equivalent to the Spheric Speech Clarity slider in Target and therefore influences the DNN strength. During the slider setting task none of the participants preferred SSC1 or SSC2. Instead, most participants set the slider on SSC 5, 6, or 7 as their preferred setting to make listening the easiest (see Figure 4).

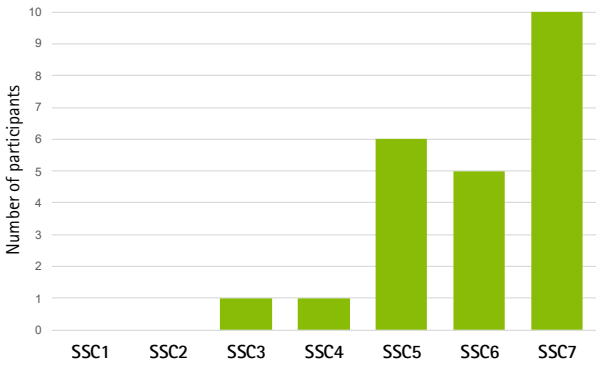

Figure 4. Indicates the position of the Noise Reduction slider (equivalent to the SSC setting) selected by the participants as their favorite.

Across the two measures, preference was seen for SSC in the range of slider position 5 – 7. It is well documented that preference for noise management varies amongst people with hearing loss and therefore it is not surprising that a range of settings was preferred highlighting the importance of giving the adolescent the option of making adjustments through the app. As there were only a small number of participants with open and power domes, it was not possible to determine if these preferences were related to acoustics. However, it is interesting to note that the adolescent's preferences were similar to those seen in the adults (Cox et al. 2024).

Field Trial Preference

Not all participants successfully completed the field trial due to time constraints. During the field trial, most participants (67%, 12 of 18 – see figure 5) preferred the SSC5 instead of the SZ2.0 program.

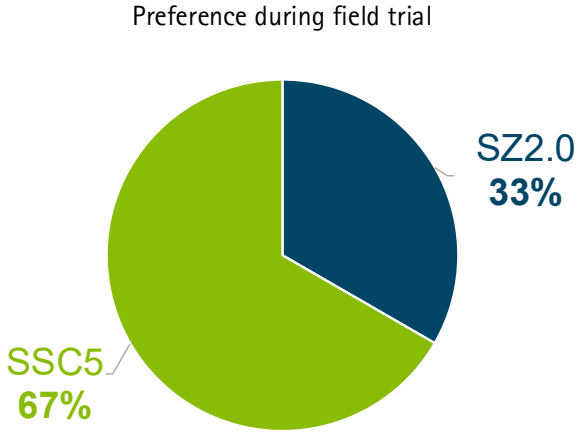

Figure 5. Preference for SSC5 or SZ2.0 during the field trial in a challenging listening situation.

In their free response comments, some participants provided the following justifications for preferring SSC5:

"It sounded better and wasn't so hard to hear my mom"

"I could tell when the noise cancelling turned on – makes a noticeable improvement."

"I liked how easy I was to hear and make out what the person in front of me was saying."

Fitting recommendations

Based on these findings, Sphere fittings with adolescents can be optimized with the following guidance.

- Set SSC in the Spheric Speech in Loud Noise program on position 5 regardless of the acoustics to take advantage of the benefits and preferences demonstrated in the study.
- Support growing independence by providing suitable adolescents with a manual Spheric Speech in Loud Noise program. When appropriate, guide them to actively adjust the noise reduction slider in complex listening situations and save customized programs in the app with meaningful names that reflect their real-world environments.
- Review their saved manual setting together, letting the adolescent share real-life feedback, and foster ownership of how SSC could be set in AutoSense. Involving the adolescent creates more personalized settings, supporting their confidence in the technology and supports consistent device use.

Conclusion

Across laboratory and field studies, SSC provides meaningful improvements in speech understanding in noise for adults, particularly when speech comes from off-axis directions or in diffuse, multi-talker environments. Studies also conclude that SSC reduces listening effort and cognitive load.

In the study at Vanderbilt University with adolescents, the large DNN-based Spheric Speech Clarity (SSC) was evaluated to determine whether it improves intelligibility and whether adolescents prefer DNN processing in lab and field settings.

For intelligibility, SSC yielded benefits in challenging listening conditions, notably when speech came from the back loudspeaker, where SSC outperformed SZ2.0, while front-facing speech performance was comparable to SZ2.0. There were no adverse effects of using the SSC in noise.

In terms of preference, adolescents consistently favored SSC processing over SZ2.0 in both lab and field contexts. They also consistently preferred an SSC setting that is stronger than the current Junior mode default.

Overall, the findings indicate that SSC can improve intelligibility in certain noisy, dynamically spatial listening situations for adolescents and is strongly preferred by this group in real-world settings.

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Erin is an associate professor in the Department of Hearing and Speech Sciences. She is an experienced researcher, conducting hearing aid studies that focus on the benefits and limitations of technologies in laboratory and real-world situations. She is especially interested in how technologies can help children and adolescents communicate easily in their diverse and complex listening environments.

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Jodie is a highly experienced Senior Audiologist with extensive expertise in managing hearing loss across both pediatric and adult populations. As the Pediatric Audiology Manager at Phonak, she is dedicated to delivering the highest quality hearing solutions for children with diverse hearing needs. Driven by the belief that "every child matters", Jodie combines her deep clinical experience with her active participation in clinical research.

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Stacey has spent the last 17 years at Phonak in various audiology and training roles with a special interest in pediatrics. She currently leads the Audiology Thought Leadership & Education team at Phonak HQ in Switzerland and lives in North Carolina. Before becoming an audiologist, she worked as an American Sign Language interpreter.

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One-page summary

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Nelson, J., Picou, E., Rich, S. May 2026.

Key highlights

- Speech understanding with SSC in challenging listening situations was equal (or slightly better) with speech from the front, and significantly better when speech came from behind the listener compared than with StereoZoom 2.0.
- Adolescents preferred SSC over another noise-management option, including in laboratory and real-world field testing.
- When given the option for the strength of SCC, adolescents consistently preferred stronger SSC settings than the current default.

Considerations for practice

- Set SSC in the Spheric Speech in Loud Noise program on position 5.
- When appropriate, provide an adolescent with a manual Spheric Speech in Loud Noise program so they can personalize their SSC setting with the noise reduction slider in this program. The customized program can be named and saved.
- Use this customized program to optimize the SSC slider position in the AutoSense program.