

Putting the focus on conversations

A three-part whitepaper series

Moving to a new technology platform presents hearing instrument manufacturers with opportunities to make changes that positively impact patients. The introduction of the powerful new North platform has enabled Unitron to go above and beyond helping patients hear speech in noise to really focus on conversations. It's not surprising that many other hearing instrument manufacturers share Unitron's goal. However, meeting each patient's listening goals while still maintaining natural sound is a significant challenge and not all solutions are up to the task.

Part 2: Sound Conductor

This whitepaper is the second in a series designed to explain how Unitron leverages the combined strength of three signature features to help patients experience comfort with awareness in noise, enjoy music and focus on conversations like never before. In the pages that follow you will learn about Sound Conductor, the Unitron signature feature that helps to meet patient listening goals by intelligently balancing adaptive features based on environment classification provided by the SoundNav automatic program.

Author

Tina Howard, Au.D., CCC-A, FAAA
Senior Validation Specialist
Favorite sound: wind chimes

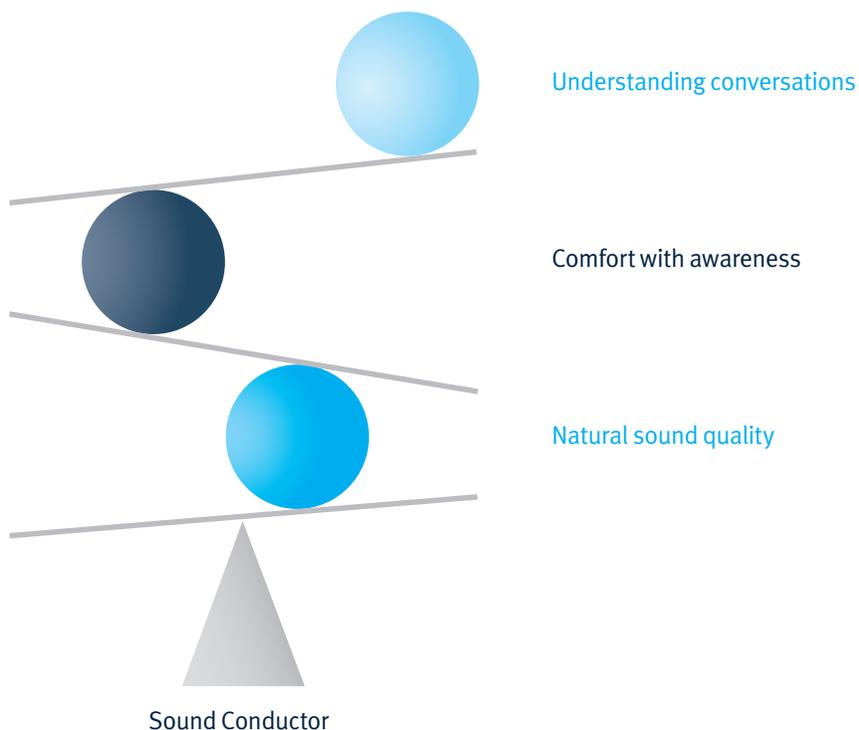
Natural sound and beyond

Delivering natural sound quality is a primary goal of Unitron's North platform. While natural sound is very important to patients, we also need to successfully address their variety of listening goals in order to achieve long-term acceptance of hearing instruments:

- Help patients understand conversations in noise – their number one complaint¹
- Provide comfortable listening with awareness in noise
- Preserve the pure, beautiful quality of music

This raises the question of how to best meet different listening goals while staying true to North's natural sound. The answer is Sound Conductor.

Sound Conductor dynamically balances the appropriate adaptive features to address each unique listening scenario while maintaining natural sound quality.



Setting the stage

Unitron has always been strongly committed to providing speech intelligibility. Although we had a successful strategy in the past, which was proven to provide 16% improvement in speech understanding in noise, this strategy was designed for a single destination approach to speech in noise. Sound Conductor takes over this role on the new North platform, combining the best of our proven strategy with a philosophy that breaks speech in noise into different levels of background noise so patients can focus more on conversations.

Sound Conductor was developed in parallel with SoundNav. Before Sound Conductor can make an impact, the classifier in the SoundNav automatic program needs to indicate which of the seven environments best identifies the patient's current listening realities. These seven environments are categorized into three groups based on similarity of listening goals, and whether target speech is present or the signal is melodic. SoundNav sets the stage for Sound Conductor to make intelligent adjustments to relevant adaptive features in order to achieve the listening goals for the conditions in that environment.

When **speech** is present the listening goal is understanding conversations, no matter what level or type of background noise is present.

When **no speech** is present, the listening goal is comfort with awareness, ensuring that the patient is not distracted or annoyed by low-level or high-level ambient noise.

When the signal is **music**, the listening goal is to enjoy its natural quality without the distortion that can be caused by an adaptive feature, such as noise reduction.

The first whitepaper in this series – Classifier and SoundNav – goes into great detail on how SoundNav classifies listening into seven distinct environments.

Balancing listening goals

Once SoundNav has laid the classification groundwork, Sound Conductor doesn't simply apply industry-standard solutions to address individual listening challenges. Instead, each adaptive feature is set to a strength that provides benefit. Sound Conductor can manage the different features dynamically, keeping up with changing listening environments so that the hearing instrument is always providing the acoustic response that the wearer needs in the moment.

Works harmoniously – The adaptive features are optimized so that when they are active, the setting that is most effective for each of them in a particular listening environment is also optimized to work harmoniously with the other features. This not only avoids sound quality artifacts that can occur when these algorithms are simultaneously engaged, but also yields a natural acoustic response.

Executes an intelligent strategy – Since Sound Conductor works within SoundNav, it is operating from information that the classifier has gathered about the acoustic environment. This allows Sound Conductor to know when each feature should be engaged and the strength at which it should be applied. It also knows when it makes sense for a particular feature to be turned off completely.

Preserves natural sound quality – The Sound Conductor strategy meets a patient's listening goals without sacrificing the amazing natural sound quality advancements of the North platform.

How Sound Conductor works

Within each SoundNav environment, Sound Conductor manages speech enhancement, noise reduction and directionality.

Speech enhancement is an adaptive feature that detects when speech is present. It then increases the amplitude of the speech signal. Speech enhancement can provide listeners with clarity but not comfort.

Noise reduction is an adaptive feature that detects the parts of the signal that are consistent with the characteristics of noise. It then decreases that part of the signal. Noise reduction can provide listeners with comfort but not clarity.

Speech enhancement and **noise reduction** work together, along with the appropriate **microphone strategy**, to effectively maximize separation between speech and noise, thereby improving signal to noise ratio. This results in better speech understanding for the wearer.

Let's take a closer look at how Sound Conductor intelligently adjusts these adaptive features to meet the listening goals in each SoundNav environment.

Listening goal: understanding conversations

We know that traditionally speech in noise is the environment that gives patients the most difficulty. However, we don't tend to focus on the details of what makes up the background noise. For example, speech babble has far more spectral and temporal fluctuations than mechanical noise, which is steady across the frequency spectrum.

The Sound Conductor strategy supports the reality that not all conversations are created equal. Background noise is a continuum and the challenges differ as you move from one end of the scale to the other. A conversation between two friends in a small café is very different than a conversation on a busy street with lots of traffic noise. This is why SoundNav doesn't classify all speech in noise into one environment. Having four unique subclasses dedicated to conversations allows us to take a slightly different approach for each type of background noise to achieve the universal goal of understanding speech.

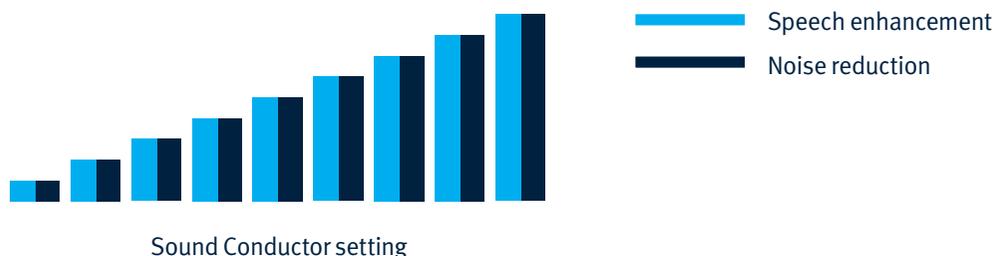
In order for a listening environment to be classified as a conversation, speech must be present. The only thing that changes across classes is the type and level of background noise. The speech enhancement and noise reduction features are both present in the conversation environments. Even though the functions of the speech enhancement and noise reduction are oppositional by nature, driving the gain model in opposite directions, Sound Conductor manages them dynamically to achieve the best result for the listener.

Speech enhancement (active) – This adaptive feature works to amplify speech and is active whenever speech is present.

Noise reduction (active) – This adaptive feature works to reduce the background noise and is active in the presence of noise.

Directionality – Different directional microphone strategies may be appropriate to support the audibility needs of different conversation environments.

Fig. 1 – Understanding conversations



The graphs in Fig. 1, 2 and 3 show that the available range and strength of each of these parameters is based on listening needs as they relate to the seven SoundNav environments.

Listening goal: comfort with awareness

Lack of speech clarity is one of the most common complaints that hearing healthcare professionals hear from patients. Discomfort in noise is a primary reason for wearer dissatisfaction.² New hearing instrument wearers are the most likely to be annoyed by background noise after being fit with hearing instruments³

How well the technology works overall is an important contributor to a patient's holistic listening experience and their success with amplification. We need to take into account every environment where a patient wears their hearing instruments and treat each one appropriately, including those where no target speech is present. When these environments are not handled effectively, it can deter patients from wearing their hearing instruments or promote selective wearing, where patients only wear their hearing instruments when they are going to be away from home or around people.

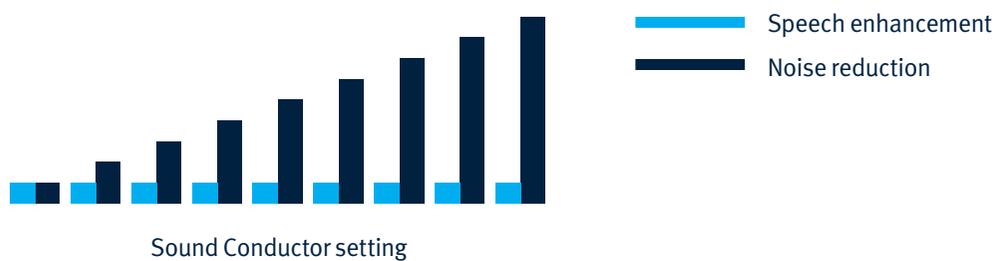
Within SoundNav, there are two “no-speech” environments: Quiet and Noise. When Sound Conductor encounters a no-speech environment, it begins balancing features to make listening comfortable and natural.

Speech enhancement (inactive) – As the name would suggest, speech enhancement is not available in the no-speech environments.

Noise reduction (active) – In Quiet, noise reduction is set to maintain comfort by not overamplifying those soft noises. In Noise, it is set to minimize moderate-to-loud environments to achieve listening comfort.

Directionality – This feature is set to provide awareness without undermining comfort. For Quiet, this is achieved through Pinna Effect. For Noise, a fixed directionality strategy supports comfort by picking up less of the environmental noise but still allowing for awareness.

Fig. 2 – Comfort with awareness



Listening goal: enjoying music

Although Music is also a non-speech environment it represents a very special case, both in signal type and treatment. The reality with this environment is that less is more. The less you manipulate the signal with processing and adaptive features, the better the outcome.

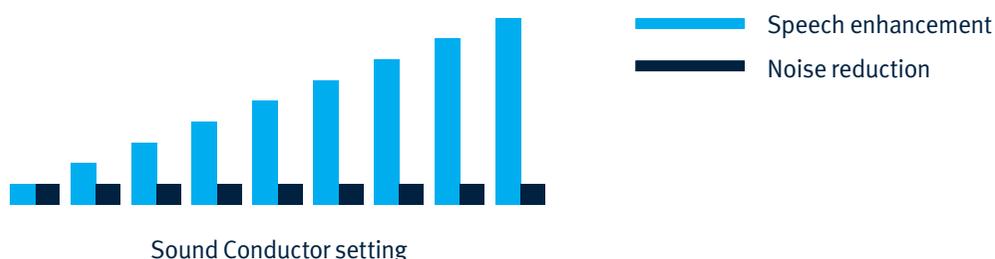
When the signal is speech, Sound Conductor adapts the features to make it sound sharper and clearer. When the signal is noise, with or without speech, Sound Conductor minimizes its impact. However, when the signal is music, the goal is amplification without change. Taking the wrong approach means that any benefits provided by Sound Conductor will have an adverse impact on the sound of the music. To prevent this from happening, the precise classifier in SoundNav detects music and puts it in its own dedicated environment. This allows for execution of a Sound Conductor strategy that supports music.

Speech enhancement (active) – Since some music includes vocals, which are considered a speech signal, it makes sense that speech enhancement works to bring the vocals out to provide benefit to the listener.

Noise reduction (inactive) – Noise reduction has a negative impact on music so it is not applied in the Music environment of SoundNav.

Directionality – The most suitable microphone strategy for music is Pinna Effect as it provides the most natural sound quality.

Fig. 3 – Enjoying music



Flexibility to customize

Once SoundNav has classified the environment, the listening goals are predefined. The graphs in Fig. 1, 2 and 3 show that the defaults set in the software are based on achieving the listening goals of each environment. Fitters can feel confident that the quick fit setting in Unitron TrueFit™ fitting software will provide patients with highly satisfying listening. For fitters who prefer to make some adjustments, it's easy and intuitive to further customize speech enhancement, noise reduction and microphone strategy for each SoundNav environment. No matter what adjustments a fitter makes, they can't compromise the fitting because any adjustments take place within the safety of the parameters that support the overall listening goals of that specific environment.

Part of a team

Sound Conductor is a signature feature in Unitron's approach to helping patients hear speech in conversations – their most challenging listening environment. Once the SoundNav automatic program has classified a signal into one of seven environments, Sound Conductor goes to work intelligently adjusting the adaptive features to address the predefined listening goals for the environment – understanding conversations, comfort with awareness or enjoying music – all without compromising the natural sound quality of the North platform.

The third signature feature in Unitron's technology team is SpeechZone™ 2. SpeechZone 2 takes focusing on conversations to the next level in the most challenging listening situations. This feature automatically activates within the “Conversation in a crowd” and “Conversation in noise” listening environments in SoundNav to let patients clearly hear speech coming from any direction.

You can learn more about SpeechZone 2 in the third whitepaper of our three-part “Putting the focus on conversations” series.

References:

1. Kochkin S. MarkeTrak VIII: The key influencing factors in hearing aid purchase intent. *Hearing Review*. 2012; 19(3):12-25.
2. Alexander, Joshua M., PhD. (2014). Hearing Aid Solutions for the Speech-in-Noise Problem. (Audiology Online course). Retrieved from <http://www.audiologyonline.com/audiology-ceus/course/hearing-aid-solutions-for-speech-24917>.
3. Palmer C. et. al. Amplification With Digital Noise Reduction and the Perception of Annoying and Aversive Sounds. *Trends Amplif*. 2006;2:95-104.

At Unitron, we care deeply about people with hearing loss. We work closely with hearing healthcare professionals to provide hearing solutions that improve lives in meaningful ways. Because hearing matters.

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