

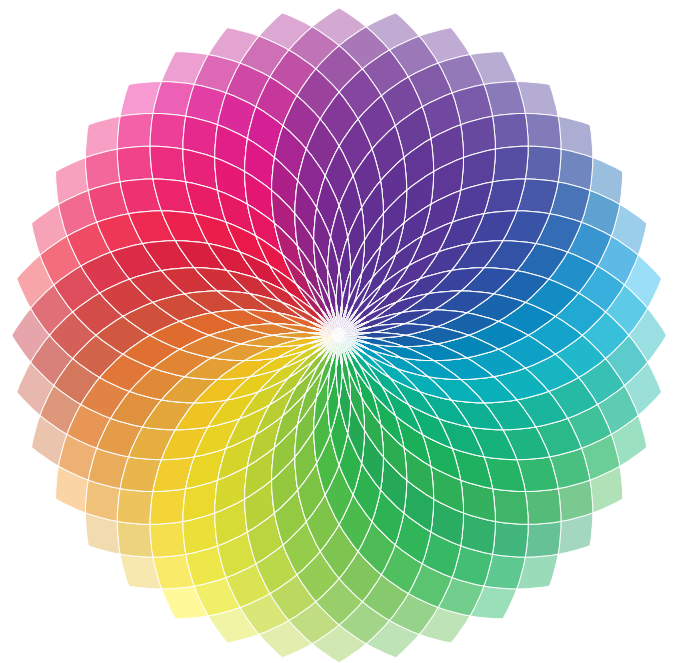


# Unitron research insights: **Our sophisticated classification system and environment blending**

Think about your favourite colour. What's the first thing that pops into your mind? Maybe blue, or yellow? Maybe your favourite colour can't be described in one word. Perhaps it's something like *the orangey-pink of a sunset* or *the deep green-blue of the ocean*.

The same can be said for how we hear. We're not always in only one type of listening environment; it may not be just 'quiet,' or just 'noisy.' Life presents us with a wide array of sounds, and these sounds – whether they're speech or environmental – might happen at the same time. When it comes to hearing instruments, we want a system that can handle the wide variety of acoustic situations life offers, all while striving to make the signal sound as natural as possible. To deliver on these objectives, it requires a sophisticated, accurate classification system. So how do we ensure that our classifier does what it needs to in order to enable optimised performance for the ever-changing soundscape?

Unitron's sophisticated classifier works by analysing the acoustic environment, determining what is speech, noise or music. This enables our system to automatically engage the appropriate features at the right time, strength and in combination with other features so it can adapt in real time for the end user's benefit. Unitron has always been conversation-focused, but that doesn't mean we want to completely omit environmental sounds which would not be a natural way of listening. We also rely on environmental sounds to give us context about a given situation, and to help us understand where we are in space and time. Like all things in life, it's about striking a balance.



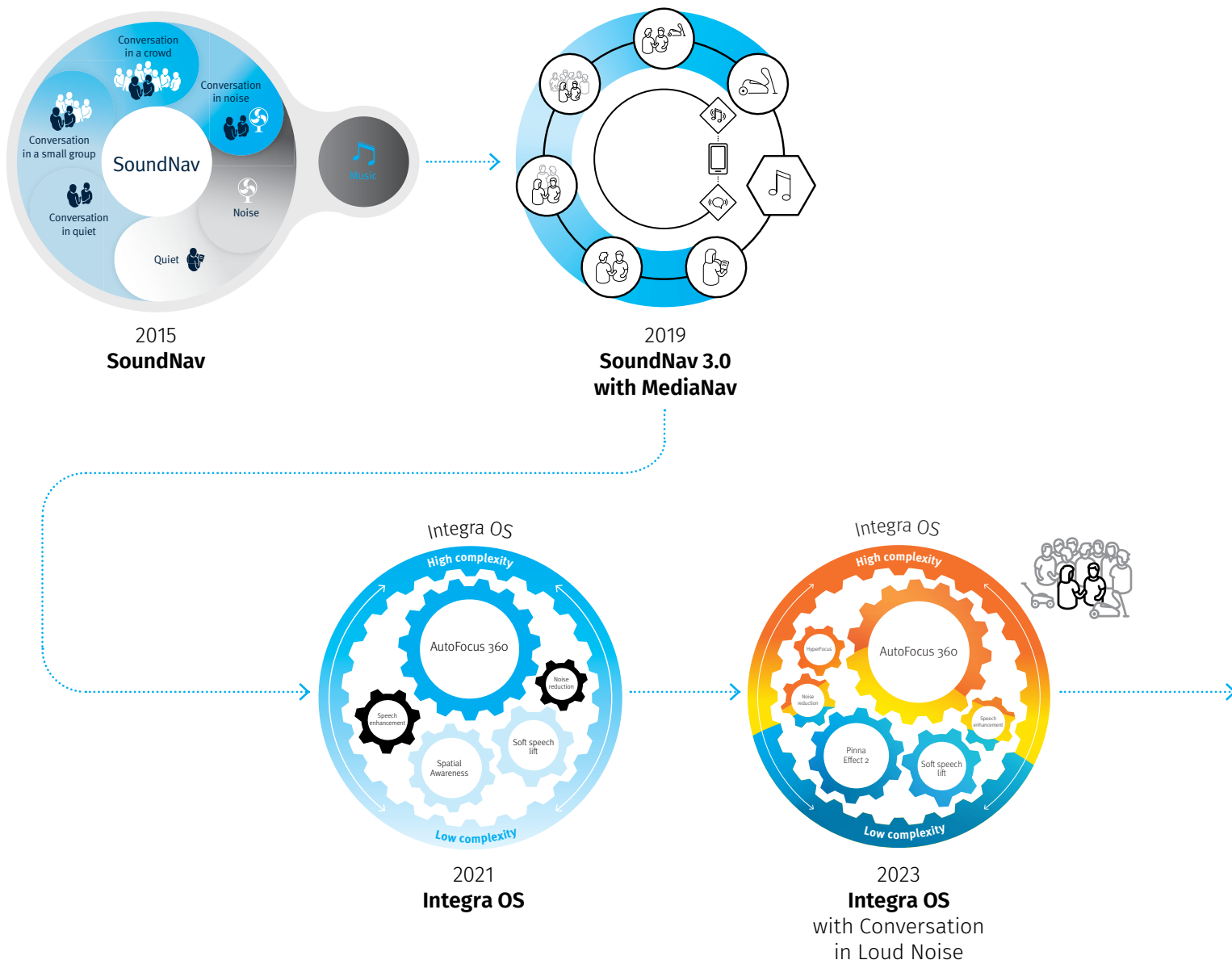
Life isn't just quiet or noisy.  
Just like a favourite colour, it's  
often somewhere in between

# Our history

Unitron's approach to classification has evolved over the years to become the sophisticated system we know today. For two decades, we have used a 'multi-destination' approach in our automatic system, initially using four separate environments. In 2015, we introduced **SoundNav**, which helped to revolutionise how our hearing instruments handled speech in noise. It was the first Unitron operating system to utilise seven distinct environments with a particular focus on improving conversations across a range of noise types and levels. But the work didn't stop there. In 2019 with the Discover platform, SoundNav further evolved to include **MediaNav**, which provided classification of streamed signals through universal Bluetooth™. With the introduction of **Integra OS** in 2021, the environments were

realigned across technology levels, and a streamlined approach was applied to the configuration of the environments within the automatic program. With Vivante in 2023, we introduced an 8th automatic listening environment, **Conversation in Loud Noise**, to help manage the most challenging listening situations.

Ultimately, our goal is to get hearing instrument users back into the conversation, regardless of what that listening environment might be. An accurate and effective classification system is the foundation for delivering a great hearing experience.



# Why does environmental classification matter?

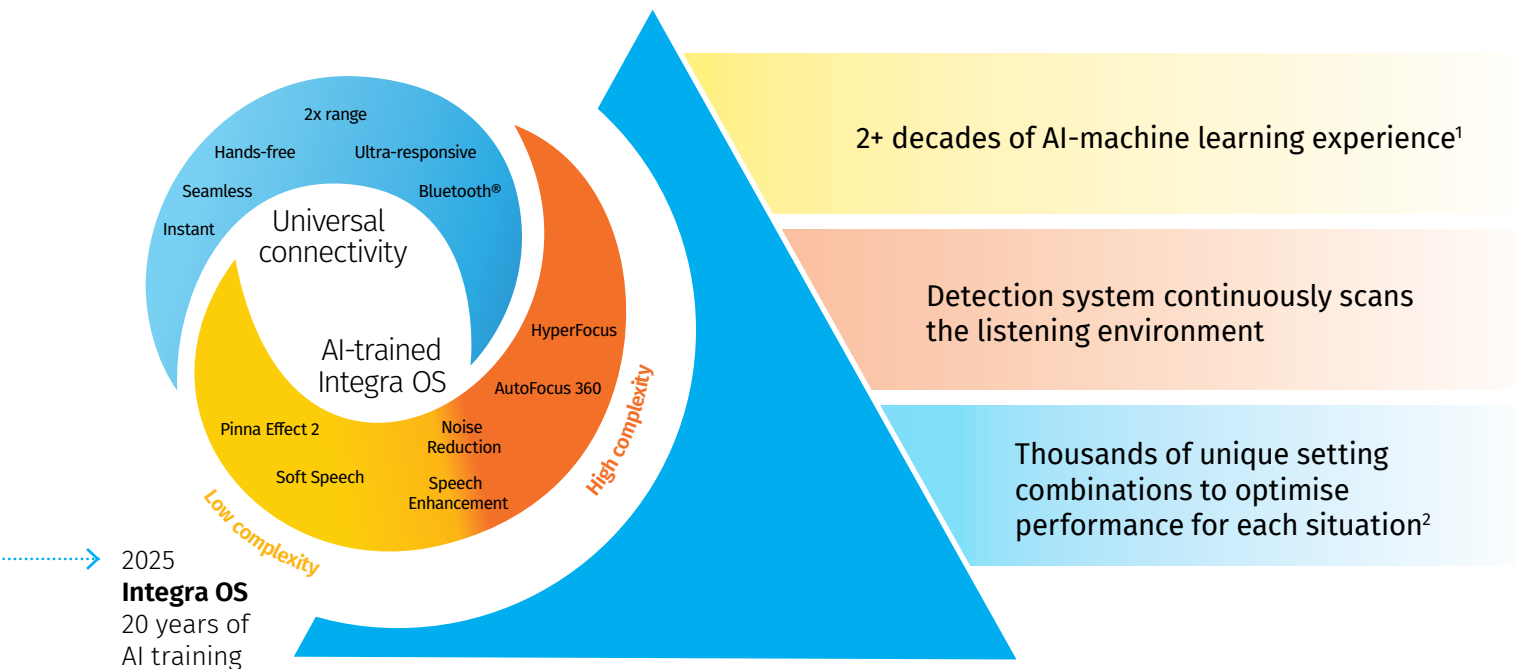
Hearing instrument manufacturers have different approaches to their classification systems. This creates variability among devices on the market, depending on a manufacturer's overall philosophy on what's important to the end-user. Depending on which aspects of the acoustic environment are measured, different decisions are made about the relevance of what is detected. This leads to different conclusions about the acoustic environment itself, and how to adapt parameters to accommodate it.

Our primary objective is to deliver an easy, enjoyable listening experience, regardless of the environment. Using advanced features or aggressive beamformers on their own isn't how we deliver the sound quality our users have come to know and love. If features aren't activating in the

right place at the right time, this could introduce distortion or impact environmental awareness. For example, applying aggressive beamforming in a direction other than the one from which speech is coming, or if there is no speech at all, will have no beneficial effect and could reduce awareness of other relevant sounds. Or applying noise reduction to a music signal will likely degrade, not improve the sound quality. That's why we need an intelligent and accurate classifier, so the right features are enabled as and when they are required.

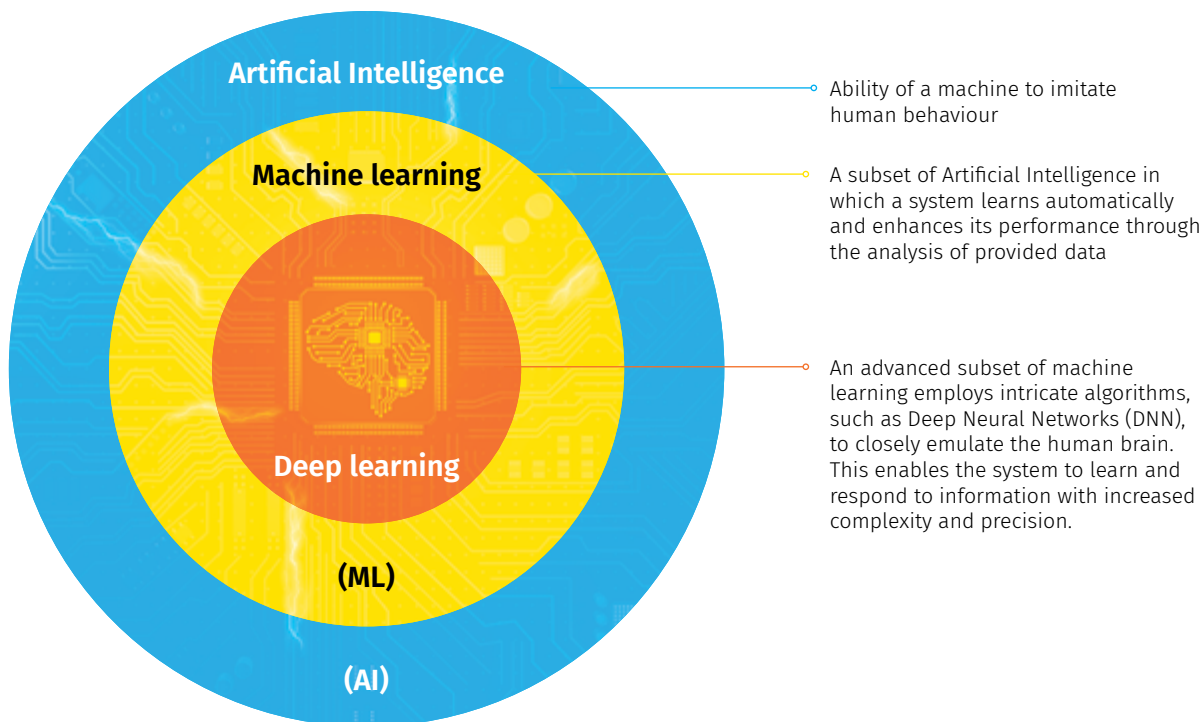
We address this challenge with our operating system, Integra OS, which has been informed by AI-trained classification to enable our automatic system to optimise performance by taking a blended approach.

## Over 2 decades of AI industry experience



<sup>1</sup>24 years as of Jan 2025

<sup>2</sup>Based on automatic environment blending possible at premium level 9



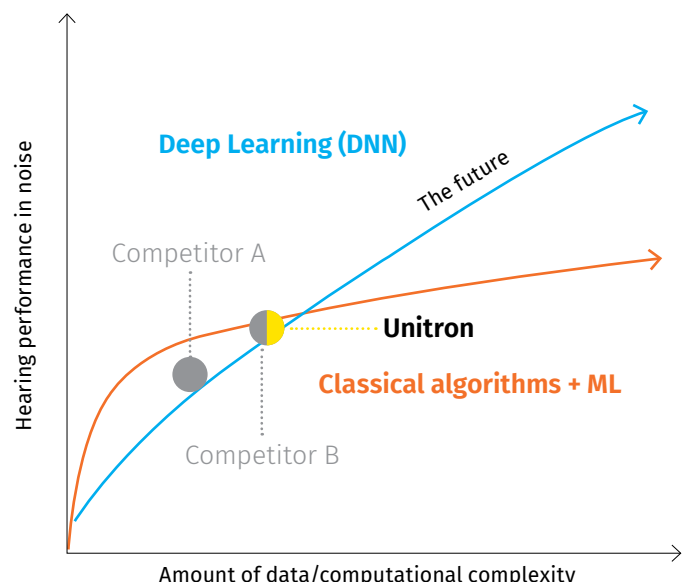
For over 20 years, Unitron has been using machine learning – a form of artificial intelligence – to ensure our classifier is trained to handle any situation a listener encounters. AI and machine learning, and most recently Deep Neural Networks, are certainly hot topics in today’s world of hearing instrument technology, but it can be difficult to understand the actual real world benefits. Some manufacturers have recently incorporated DNN analyses into their classifier training to increase accuracy and then activate automatic features to improve sound performance.

Use of a DNN in this way, which is not actually employing it for real-time sound cleaning or de-noising, can use unstructured data for sound scene identification reducing the need for labour-intensive manual machine learning classifier training. But these small or lightweight DNNs may not achieve better outcomes than classical machine learning. In fact, an effective classical algorithm, combined with AI-trained sound scene classification can still equal or even outperform a small DNN.

The real promise of DNN usage lies in the potential for real-time de-noising to improve signal to noise ratios beyond what current directional microphone and noise reduction systems can achieve. But this requires much more computational capacity than the use of small DNN at this moment in time can deliver.

When we discuss AI-machine learning, we’re referring to the use of thousands of samples from a variety of spoken languages that were used to train our classifier to accurately identify a wide range of listening environments. So how accurate is it?

## Classical algorithms combined with AI can match or outperform small DNNs



# Putting it to the test



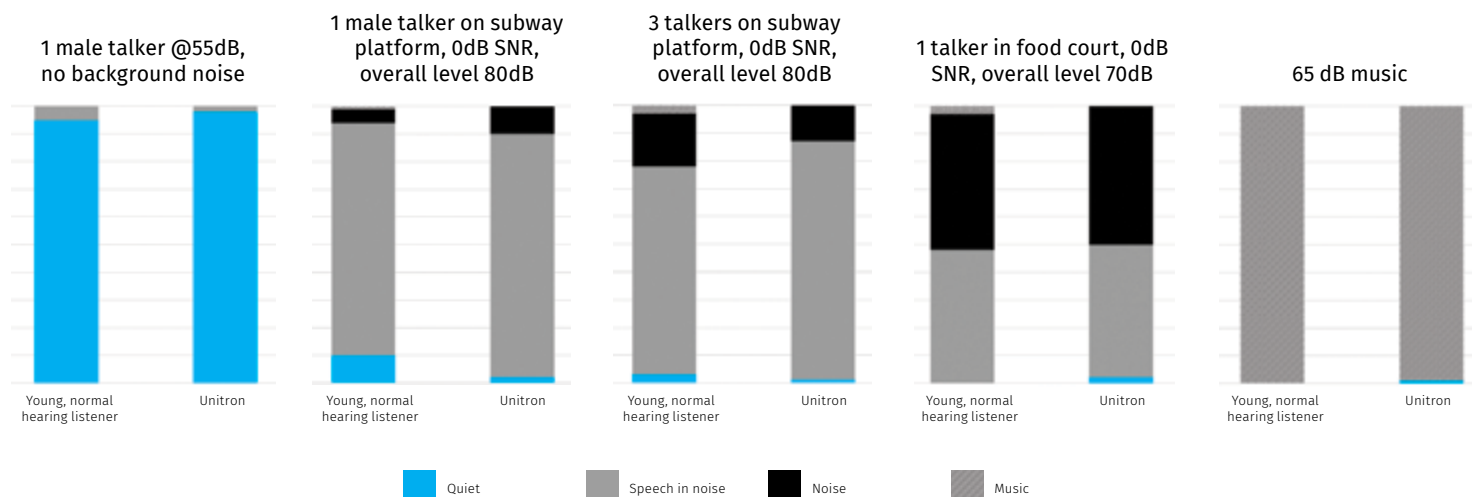
With innovative research done by the University of South Florida, we were able to establish that our classifier is comparable in accuracy to normal hearing young adults. In the study, researchers tested the hearing instruments in multiple different conditions or environments:

1. Quiet listening
2. Quiet conversation
3. Quiet conversation with music
4. Small group conversation with noise
5. Small group conversation with noise/music
6. Large group conversation
7. Larger group conversation with music
8. Television viewing

These listening environments are listed from least complex to most complex. As participants moved through these conditions, they were exposed to between one and three talkers at a time and varying levels of background noise. We also looked at how directionality factors in. The hearing instrument takes a multitude of samples from a listening situation to determine which environments within the classifier are most relevant at a given time.

The outcome of this study shows that we achieved near-human intelligence in our classifier. The charts below show five different situations ranging from very quiet speech without noise, several noisy conversation situations and music. As you see, our AI-trained system really does classify very closely to normal hearing young adults.

And like we mentioned at the beginning, we're rarely in just a 'quiet' or just a 'noisy' environment. For real-life listening situations, we need something that can really handle the complexities of conversation in a wide range of situations. That's where the power of our AI-trained automatic system really shines.



You can find further details about this study here: [Seminars in Hearing/Volume 42, Number 3 2021 # 2021.](#)

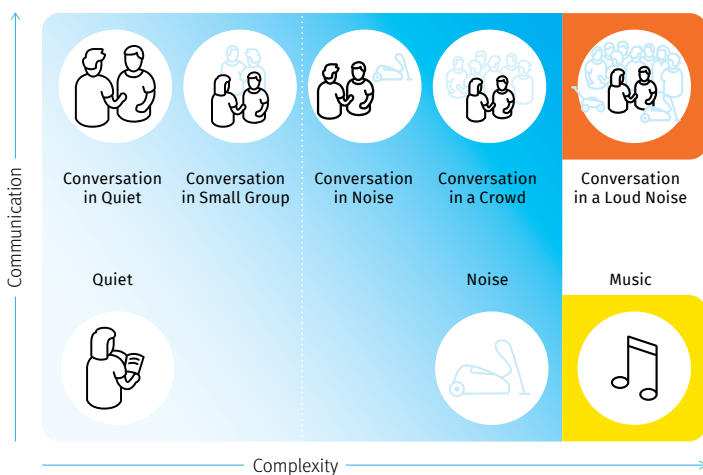
# Program blending – a unique approach to real-time optimisation

Remember the favourite colour analogy at the beginning of this article? To achieve those unique, custom colours, several foundational colours are blended. Unitron's automatic program does something similar by leveraging accurate environmental classification to create custom blends to optimise performance in real-time.

Six environments can be blended. The classifier will prioritise the three environments that are most likely to be present in each listening situation. In other words, the system does not have to just choose from one of the available environments, but rather it can blend environments based on the unique identification of the sound scene.

There are two exceptions: Conversation in Loud Noise and Music environments do not blend as both of these environments require special attention given their complexity and engage fully, when appropriate.

In our premium level technology, the hearing instrument user can be provided with up to 3,713 unique environment combinations, designed to optimise performance for every listening situation.



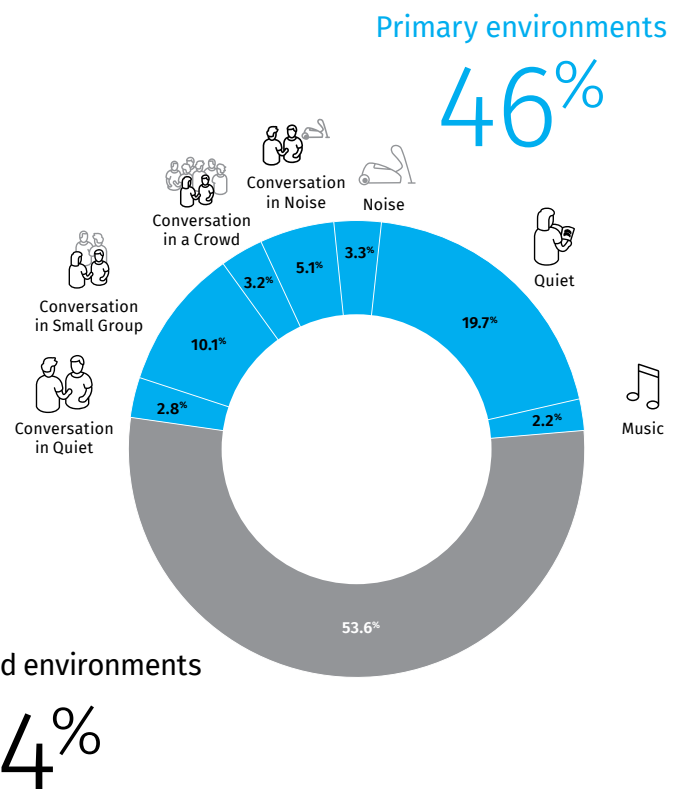
# 3,713

unique environment combinations



The University of Western Ontario investigated environmental blending in hearing instrument systems. Data collection techniques were informed by a collaboration of scientists from Western and Wilfrid Laurier Universities and Unitron. This team brought together experts in the areas of signal processing and aural (re)habilitation, human environment analysis and urban development. Passive and interactive data collection techniques included in this study measured the following dimensions: signal level, physical location, social context and subjective ratings.

Approximately 54% of the time, participants were in listening situations that were complex enough to be classified as a mixed or blended environment. Given that's a little over half of their total listening time, it makes sense to have a blended approach!



# Conclusion

Not all classification systems are the same; they vary based on the priorities of the manufacturers.

For Unitron, our primary objective is to provide an easy listening experience, which means improving conversations across all levels and types of noise. Backed by over 2 decades of AI-machine learning, our technology enables a unique blended approach and allows us to keep conversation at the forefront. Knowing that we have a classification system that's smart enough to do the heavy lifting, and is comparable in accuracy to normal hearing young adult listeners, instils confidence in Unitron technology.

Nobody knows what each new day will bring. We experience quiet one-on-one chats with a friend or loved one – or even those moments without much conversation at all. And of course, there are the very challenging times with multiple conversations and background noise. The sophistication of Integra OS means we don't need to make compromises – we optimise performance across all kinds of soundscapes. By first accurately classifying the ever-changing situation, then blending our base environments, we can then activate the best combination of premium features in the right combinations and at the appropriate strength settings to automatically optimise performance.

Each day brings a listener a host of ever-changing listening environments, and Unitron's AI-trained classifier and automatic system are up for the challenge so everyone can truly love the experience.

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Danielle Glista, Ph.D., Reg CASLPO; Robin O'Hagan, BA; Leonard Cornelisse; Tayyab Shah, Ph.D.; Donald Hayes, Ph.D.; Sean Doherty, Ph.D.; Jason Gilliland, Ph.D.; Susan Scollie, Ph.D.; Combining Passive and Interactive Techniques in Tracking Auditory Ecology in Hearing Aid Use Canadian Audiologist; Vol. 12 • Issue 4 • 2025