Canadian Audiologist
The Official Publication of the Canadian Academy of Audiology

# The Audible Contrast Threshold (ACT™) Diagnostic Test to Take on the Number One Challenge with Hearing Loss

Published January 16th, 2024

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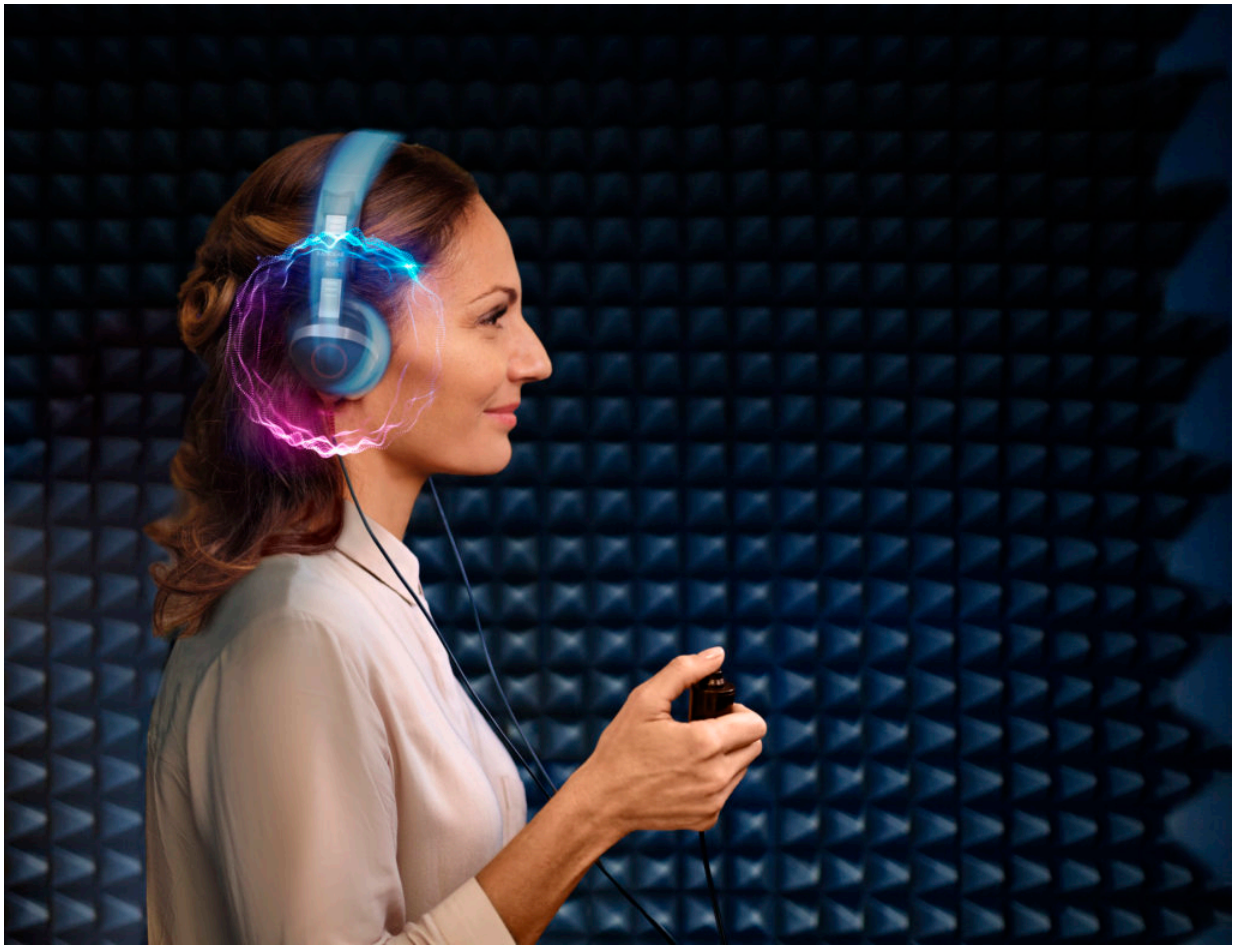
*Editor's Note: CanadianAudiologist.ca had approached the people at Oticon Canada to submit this article on the new Audible Contrast Threshold (ACT™) test which is supported by their most recent incarnation of their software. The ACT test uses modulated noise rather than words, and is therefore language independent.*



For more than 100 years, the only diagnostic measurement used to fit hearing aids was the pure-tone audiogram. The audiogram has served and continues to serve us well in characterizing a

prospective hearing-aid user's ability to hear soft sounds – or the lack of this ability. From the audiogram, the hearing-care professional can adequately address issues related to audibility in the hearing-aid fitting. However, every HCP knows that hearing loss is much more than a lack of audibility. In particular, hearing loss affects the ability to understand speech in the presence of background noise – even when audibility has been properly compensated for (e.g., Lopez-Poveda, 2014).

Audibility loss is well-established and is measured with the audiogram. With the Audible Contrast Threshold test, we are looking at a new phrase- "contrast loss." This refers to the amount of contrast a person needs between the desired speech they want to hear and the undesired background sounds. Thus, if a person has a severe contrast loss, they need a better SNR to perform similarly to someone with a mild contrast loss. Until now, no standard clinical measure for contrast loss has existed. To compensate for hearing-in-noise problems or contrast loss, modern hearing aids use powerful help-in-noise technology (Jensen & Pedersen, 2015; Andersen et al., 2021).

Beginning at this most recent level of technology- Oticon Real- this test is highly adjustable in the fitting software. It is thus, in principle, able to provide different "help levels" in noise for each user. However, there is currently no objective, evidence-based way of selecting the adequate help level for the individual. Therefore, the help-in-noise features are often left in their moderate default settings.

This represents missed opportunities, particularly for those hearing-aid users who really struggle with hearing in noise and who would benefit greatly from the strongest settings available. Similar opportunities exist at the other end of the spectrum, in users with near-normal speech-in-noise ability (once audibility has been taken care of). Such users might be better off with a mild setting of the help-in-noise features to give them a less processed sound scene, also in situations that most other hearing-aid users would find challenging. Thus, an objective diagnostic test that could inform the hearing health care professional of potential prescriptive benefits mentioned above (e.g., prediction of speech-in-noise ability) would also be useful for counselling, setting expectations for the outcome with hearing aids, and for recommending additional help such as assistive listening devices, communication strategies, and auditory training. In a joint effort, the audiometric equipment manufacturer Interacoustics and Oticon have now defined the first evidence-based prescription rule for help-in-noise settings in Oticon hearing aids with the new Audible Contrast Threshold (ACT) diagnostic test.

**What is ACT and How Is It Performed?**

ACT is a test designed solely to predict a hearing-impaired person's speech-in-noise ability. ACT is not a tone test, or a speech test. Instead, it uses modulated noise signals to determine how much 'contrast' a client needs to hear the difference between sounds. In other words, it estimates how well the client will hear speech in noise. The results from the test can be used to directly influence how the adaptive features of a hearing aid, such as noise reduction and directionality, are programmed.

ACT only takes two to three minutes to complete and uses the same equipment as pure tone audiometry: A set of headphones (insert earphones) and a push button. Regarding Interacoustics audiometers, an Affinity Compact is required to perform ACT. Other compatible audiometers include select MedRx Avant models and the GSI Audio Star Pro. Because it does not use speech material, it doesn't matter which language the client speaks. This allows for speech?in?noise

ability to be measured regardless of the language spoken or the individual's language ability.

The test is also automatically adjusted to account for the client's hearing loss. It does this by applying the shape and level of the pure tone audiogram into the sounds they are listening to during the test. This allows for an accurate and personalized measure of speech-in-noise ability.

Once an ACT test has been completed, the tester will be presented with a value. This is known as the ACT value and it is expressed in dB nCL, which stands for 'normalized Contrast Level'. This is a novel scale developed by the research team at the Interacoustics Research Unit. In brief, nCL stands for:

- n – normalized – the scale is normalized based on normative data acquired from young adults with normal hearing. A young adult with normal hearing will thus score 0 dB nCL.
- C – Contrast – clients detect contrast in signal modulation.
- L – Level – this is a dB measure so is denoted as such. This does not refer to the presentation level but instead the amount of contrast / modulation in the signal.

The ACT value will range from -4 dB nCL to +16 dB nCL. It can inform the hearing care professional of how well a hearing-impaired person will hear speech in background noise when wearing hearing aids. The lower the ACT value, the better the client can hear speech in noise. The higher the ACT value, the more difficulty they will have hearing when in background noise; therefore, as the ACT value increases, the client will need more help from their adaptive hearing-aid features.

The Interacoustics Research Unit has identified normative data for the ACT values (Table 1).

| **ACT value** | **Contrast loss** |
|---|---|
| -4 dB nCL to +4 dB nCL | Normal |
| 4 dB nCL to 7 dB nCL | Mild |
| 7 dB nCL to 10 dB nCL | Moderate |
| 10 dB nCL to 16 dB nCL | Severe |

Table 1. Normative Data for the ACT Values

Lastly, the test results can be programmed directly into the client's Oticon hearing aid (Real platform or later) either manually or automatically, providing the hearing-aid user with an objective and personalized fitting based on their hearing?in-noise ability.

Thanks to the introduction of ACT, hearing care professionals will have additional diagnostic information to provide a more personalized solution quickly and easily for specific hearing loss and to optimally fit a hearing aid the first time. Through diagnostic integration, the Oticon Genie 2 fitting software will automatically and immediately calculate the optimal amount of help a client needs in noise. Based on the language-independent ACT test which takes an average of 2 minutes, the software auto-generates personalized help-in-noise settings, providing the correct dose of 'contrast' to better separate speech from noise, based on a person's ACT value. The prescription enables hearing care professionals to fully deploy the advanced capabilities of Oticon hearing aids most effectively. The integration is expected to be available in the next release of the Genie 2

fitting software in 2024.

**Thomas Behrens, Vice President of Audiology, Oticon comments:**

"*At Oticon, we have dedicated decades of research into BrainHearing™, and have demonstrated the considerable effort for hearing aid users to understand speech in complex noise environments. Hearing aids should support a user to tackle this important challenge optimally and with an ACT assessment, hearing care professionals can ensure our advanced hearing aids do that to the best of their ability. Embracing the new ACT diagnostic test, we are challenging the conventions to explore a new way of working with hearing care and improve the benefit of hearing aids for our users from the first fit. ACT redefines how we can compensate for hearing loss, and we are proud to be the first company to make the introduction and make strong contributions to making it a new industry standard.*"

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## References


1. Andersen, A. H., Santurette, S., Pedersen, M. S., Alickovic, E., Fiedler, L., Jensen, J., & Behrens, T. (2021). Creating clarity in noisy environments by using deep learning in hearing aids. Seminars in Hearing 42(3), 260-281.
2. Jensen, J., & Pedersen, M. S. (2015). Analysis of beamformer directed single-channel noise reduction system for hearing aid applications. 2015 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 5728-5732.
3. Lopez-Poveda, E. A. (2014). Why do I hear but not understand? Stochastic undersampling as a model of degraded neural encoding of speech. Front. Neurosci. 8, 348.
4. Santurette, S. & Laugesen, S. (2022). *Audible Contrast Threshold (ACT™)* [White paper]. Oticon.