AURICAL®

RoomTune™
What is it and why is it important?

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Introduction

Acoustics is a complex matter. Many parameters play a role making it difficult to predict and control an acoustical environment. For this reason, several audiological procedures, such as audiometry, immittance and probe microphone measurements, routinely employ various types of calibration or compensation to ensure the acoustical conditions adhere to standards and other performance requirements. This paper examines an area that is not currently covered by sound field conditioning standards – demonstration of hearing instruments using sound libraries from fitting modules, and how room size can influence the signal spectrum played from a loudspeaker. In this connection, this paper also explains how RoomTune™ – a new feature in the OTOsuite® fitting software for AURICAL® – acts as a sound card in AURICAL Aud and can improve the accuracy of the measured signal for a more reliable and consistent sound for the fitting modules.

Background

The wide availability of various types of domes allows for a broad use of demonstrating different hearing instruments on the client's ear in realistic conditions. This step is not only appropriate, but also very important. This is where the expectations are set, and counseling and selling take place. For the sake of reliability, ease of use and customer satisfaction, various factors come into play. The acoustical environment is one of them.

When considering fitting rooms in a broader perspective, the situation is somewhat unclear. Rooms are different sizes, with different furniture and often using different client and loudspeaker positioning. To make things even more variable, multiple people may be present in the fitting rooms during the fitting sessions. Overall, we are dealing with a diverse acoustic environment.

When it comes to presenting the sounds in the fitting software, in most cases, these are played back using a dedicated amplifier/speaker system where the only adjustment of the sound is the overall level.

Considering this from the hearing instrument perspective, the advanced adaptive algorithms are designed to detect various properties of the sound that comes into the hearing instrument through the microphones. The processing depends not only on the overall level of the sound, but also on the spectrum of the sound. In addition to other factors, this information is used to detect speech and noise in order to apply the appropriate processing. The purpose is to give the client the best sound as originally intended by the designers of the hearing instrument.

Considering all these factors, how can the hearing instrument manufacturer, the fitter and the client expect the hearing instruments to perform at their best? All three stakeholders are relying on a predictable and consistent hearing instrument performance, yet very little control is in place to ensure a better and more uniform acoustical environment for this step of the fitting process. Related procedures already employ various steps, such as chirp calibration of stimuli for probe microphone measurements and sound field calibration for audiometry to compensate for the variations in the room acoustics and other factors. Nevertheless, the counseling, demonstration and sales phase of the fitting process has received little help in this area so far.

The acoustical environment

We investigated various elements of this issue during the development of RoomTune. This document focuses on the influence of room size on the signal spectrum played from a loudspeaker.

The graph below shows the variation of an uncompensated sound:

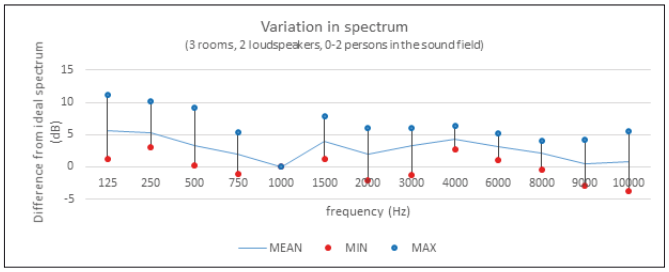

Fig. 1 The variation of the signal spectrum measured acoustically in 3 rooms, using 2 different loudspeakers and with 0, 1 and 2 persons in the room. All curves were normalized at 1 kHz.

Note: On a global scale, the variability of rooms and the sound systems is most likely to be even greater than shown in the above examples.

Looking at Figure 1, deviations are found in the entire frequency range. This suggests that the lack of signal compensation is likely to have an impact on noise reduction and speech recognition, which are the essential functions of a hearing instrument.

From that, we can conclude that the practical acoustical environment, when untreated, is likely to make hearing instruments perform less optimally, displaying a lower benefit to the client. This can inherently lower the value perception of the hearing instruments and consequently skew the cost-benefit balance.

RoomTune functionality

Simply put, RoomTune is about measuring how a known sound presents in a given room and applying an equalizer/frequency compensation during the subsequent playback of sounds. This functionality is available to any software outside OTOsuite – including fitting modules - as AURICAL Aud becomes selectable as a Windows® sound card. Based on this, fitters can now use their AURICAL Aud and the connected sound field speakers as the compensated sound system with their fitting modules. The fitting modules do not have to be modified in any way to make use of RoomTune.

The RoomTune measurement procedure itself is automated and can be carried out by any fitter by following simple on-screen instructions. Apart from these simple instructions, RoomTune is as easy to use as any other sound card.

RoomTune is available with OTOsuite version 4.75 and requires the updated RoomTune/Talk back microphone, which is available as an accessory.

What difference does RoomTune make?

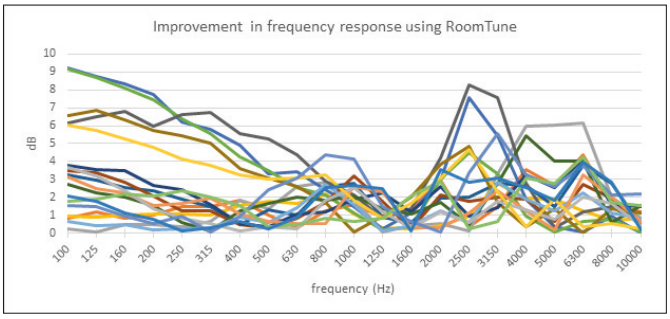

Fig. 2 The graph shows how many dB RoomTune improved the accuracy of the presented signal i 3 different rooms using 4 different speaker systems (3 stereo and 1 mono).

Figure 2 shows RoomTune yields an improvement of up to 9 dB depending on room, speaker system used and frequency. This is well above the size of adjustments that fitters apply when adjusting the output of a hearing instrument in the fitting process, and demonstrates just how significant the RoomTune compensation is.

Conclusion

The improvement from RoomTune does not just provide a more consistent sound field for the sake of uniformity. It also provides reliability as to the performance of the hearing instruments when exposed to a sound field that is intended to reflect a realistic and yet controlled sound environment.

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