

Field Study News

Phonak TVLink – wireless TV solution

The impact of sound delay

Abstract

Modern hearing system technology provides accessories which help to improve audibility of alternative input signals in the daily routine. The new Phonak TVLink base station in combination with an iCom offers a very convenient way to link any Phonak wireless hearing instrument to the TV via Bluetooth. The smallest possible transmission delay is the key to user satisfaction and an enjoyable TV experience. At a distance of three meters from the TV, Phonak TVLink wirelessly streams data with a minuscule transmission delay of 40 milliseconds (ms), measured between TV sound outlet and the eardrum. The impact of four different transmission delays (13 ms, 33 ms, 45 ms and 113 ms) on audibility and spontaneous acceptance were investigated. The participants were asked to subjectively compare three different television (TV) sequences with each delay. The results showed that delays of 13 ms and 33 ms were accepted by all test subjects across hearing loss configurations and TV sequences. A 45 ms delay was accepted by 80% of test subject across hearing loss configuration. The acceptance of the 113ms delay depended on the used TV sequence.

Introduction

People with hearing loss often face problems when watching TV, even in quiet and in particular in noisy environments. Typically, the TV is placed at some distance, often several meters from the listener. This distance causes specific problems that decrease the performance of hearing instruments (HI). The higher frequencies of a signal transmitted through air lose their energy faster than the low frequencies resulting in a less favourable input signal at the HI microphones. Background noises that are introduced can easily mask the remaining speech cues and lead to very poor speech understanding. Often the HI wearer would overcome this issue by using traditional headphones or special headphones with amplification. However such TV solutions are not optimal for wearers of hearing instruments. They either do not provide enough amplification, do not consider the individual hearing loss configuration or they make it impossible to communicate with a significant other while wearing the headphones.

With iCom (Field Study News, July 2009), Phonak introduced a modern communication interface solution for a wide range of entertainment and communication devices, including mobile phones, landline phones, computers, mp3 players, GPS- and HiFi systems, using standard Bluetooth protocols. The new TVLink base station was specifically developed to provide a stable, fast and high quality Bluetooth signal transmission for optimal TV enjoyment. Thanks to Bluetooth technology, the communication link between the TVLink base station and iCom is wireless up to an amazing distance of 30 m. iCom transmits the received Bluetooth signal wirelessly, in real time to wireless enabled Phonak hearing instruments. Thus, HI wearers can receive signals from the TV directly via their HI with unique StereoSound quality and benefit from a hearing solution that provides improved audibility, intelligibility and listening pleasure. A very important point to consider is the time delay that is introduced between the audio output from the TV and the eardrum. Bluetooth Audio Transmitters create a certain delay due to the fact that the input signal needs to be translated and compressed with a Bluetooth Codec in order to be sent. Those delays can cause problems such as an echo effect in open fittings or a lack of synchronization between sound and lip movement. In this study, the impact on audibility and acceptance of four different transmission delays, 13 ms, 33 ms, 45 ms and 113 ms was evaluated with three different TV sequences.

Set-up of the study

To investigate the acceptance of the 4 delays, a special test setup was used. Samples of 3 different TV scenes were presented. The first sequence was taken from a news broadcast, featuring a clear male voice without any background noise. The second sequence was part of a report of a sporting event with various male and female voices and with varying background noises. The last sequence was taken from a movie and contained several male and female speakers with fast and slow spoken parts, with and without background noise. All sequences used were taken from TV programs in the native language of the participants.

In order to change and control the sound delay at ear level, the audio was muted on the TV and presented with an external soundcard and audio authoring software instead. The loudspeaker representing the TV speaker was positioned in front of the test subject at 0° azimuth and 3.4 m in distance. This distance creates a natural delay of 10 ms until the sound from the loudspeaker reaches the eardrum. The delayed sounds were introduced via a wired connection from the sound card to the iCom.

Test subjects and devices

Thirteen test subjects participated in the study. The hearing loss configurations were separated into three different categories: The mild and the moderate hearing loss categories included four subjects each. The severe hearing loss category included five test subjects. The age of the test subjects ranged from 53 to 80 years, with an average age of 67 years. Exélia Art HIs fitted with the Phonak Adaptive Digital formula and the appropriate acoustic couplings were used for all subjects. The subjects without earmolds were fitted with slim tubes and SDS 2.0 domes. The experience level was set individually, so that the loudness of own and fitters' voice were well accepted. The hearing instrument microphones were not attenuated for this test; all external input signals were transmitted at original presentation levels.

Results

Data of the three different TV sequences was collected for the three hearing loss configurations and the percentages of acceptance for the four different TVLink delays were evaluated.

Acceptance of the three shortest delays was high for all sequences.

The acceptance of the "News" sequence was 100% with a delay of 13 ms and 33 ms for all hearing loss configurations. Just one test subject with a moderate hearing loss did not accept a delay of 45 ms. However, the longest delay of 113 ms was accepted only by 40% of the subjects in the "severe" group.

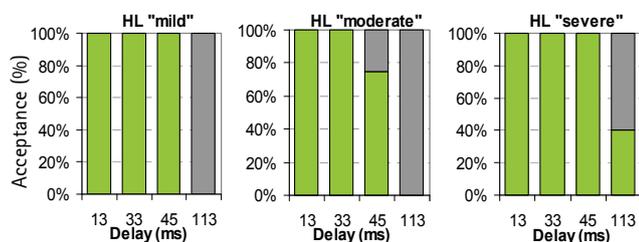


Figure 1: Percentage of acceptance of the TV sequence "news" for the 4 different delays. Acceptance is shown in green, non-acceptance in grey.

The acceptance of the "sport" sequence was highest with a delay of 13 ms and 33ms. A slight decrease of acceptance was seen with a 45ms delay in moderate and severe hearing losses. The acceptance of the "movie" sequence was again highest with the 13 ms and 33 ms delays. A delay of 45 ms was still accepted by almost 80% of test subjects.

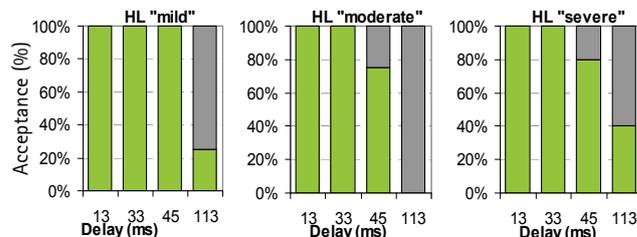


Figure 2: Percentage of acceptance of the TV sequence "sport" for the 4 different delays. Acceptance is shown in green, non-acceptance in grey.

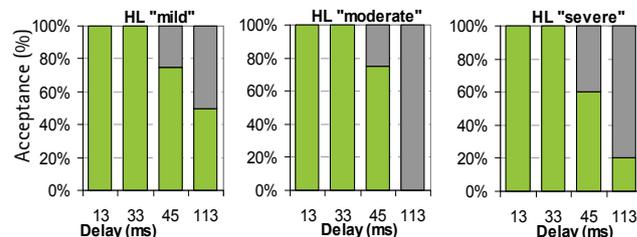


Figure 3: Percentage of acceptance of the TV sequence "movie" for the 4 different delays. Acceptance is shown in green, non-acceptance in grey.

Average acceptance of the delays for all hearing loss configurations and sequences combined can be seen in figure 4. As one would expect, acceptance decreased as transmission delay increased. Delays of 13 and 33 ms were accepted by all subjects. Over 80% of the test subjects still accepted a delay of 45 ms, whereas only 20% accepted a delay of 113 ms.

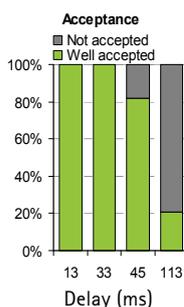


Figure 4: Percentage of acceptance of all TV sequences averaged over all hearing loss configurations. Acceptance is shown in green, no acceptance in grey.

Conclusion

Data for subjects of all hearing loss configurations showed that over 82% of subjects would accept a delay of 45 ms. It can therefore be concluded that in order to be accepted and to provide a satisfying TV experience, transmission delay should be below 45 ms.

Phonak has found the optimal way to balance best StereoSound quality and long range with low transmission delay. Phonak TVLink is a modern Bluetooth audio streaming solution which offers an unprecedented real stereo sound over an unrivalled distance of up to 30 meters, even without direct line of sight. At the same time the transmission delay of only 40 ms at a distance of 3m makes it the ideal solution for even the most demanding Hearing instrument wearers.

References

Field Study News, July 2009: iCom – Significant benefits of speech intelligibility in combination with mobile phones

For more information, please contact: Myriel.Nyffeler@phonak.com