— WHITE PAPER

Beyond the lab: Signia IX with RealTime Conversation Enhancement significantly improves real-world busy group conversations

In a peer-reviewed study conducted by researchers at Western University (Ontario, Canada), 20 participants were fitted with Signia Integrated Xperience (IX) hearing aids and asked to assess their conversational experience while attending a real-world group conversation in a busy food court in a mall. In the single-blinded study, the participants assessed the conversation with RealTime Conversation Enhancement (RTCE) turned on and off. An absolute assessment of the two programs as well as a relative (preference) assessment was made while participating in a conversation. Both types of assessments yielded the same overall result in favor of RTCE. Activation of RTCE resulted in significantly better absolute ratings of speech understanding, clarity of conversation partners, listening effort, ability to focus on the conversation, and the level of background noise. When directly comparing the programs, a statistically significant preference for RTCE was observed, with an impressive 80% of participants stating an overall preference for the RTCE program. The study shows that Signia IX with RTCE significantly improves the group conversation experience in real-world noisy environments.

Niels Søgaard Jensen, Barinder Samra, Homayoun Kamkar Parsi, Brian Taylor
FEBRUARY 2025

Take-away messages

- This study shows that activation of RealTime Conversation Enhancement (RTCE) in Signia IX provides a significant improvement of the conversational experience in a challenging real-life scenario.
- 80% of the participants stated an overall preference for RTCE.
- Benefits provided by RTCE were observed within the domains of speech understanding, clarity of conversation partners, listening effort, and the ability to focus on the conversation.
- The study confirms that the perceptual and technical RTCE benefits observed in various lab studies transfer directly to the real world.

Introduction

The ability to actively participate in and contribute to conversations with others is essential for a fulfilling and connected life. Not surprisingly, when investigating what it takes to make a conversation successful, Nicoras et al. (2023) found that both normal hearing people and people with hearing loss rated the ability to listen easily as the most important factor for conversation success, especially in group conversations. This ability is typically reduced for people with hearing loss who often struggle when trying to participate in noisy group conversations.

Accordingly, this type of communication environment is among the listening situations with the lowest percentage of people with hearing loss reporting satisfaction with their hearing ability, even when using hearing aids (Picou, 2022). Traditional hearing aids often fall short when it comes to providing a sufficient level of support in group conversations in noise. In a survey of 15,000 people, where the vast majority had a self-reported hearing loss, the most desirable hearing aid attribute was "hearing friends and family in noise" (Manchaiah et al., 2021). As every hearing care professional (HCP) knows, there is a pressing need to address the challenges of participating in noisy group conversations and to help hearing aid wearers perform more effectively in these situations.

With our unique innovation, Signia Integrated Xperience (IX) with RealTime Conversation Enhancement (RTCE), Signia has taken a major leap forward when it comes to addressing the problems associated with participating in noisy group conversations. Rather than simply improving the speech understanding ability in a static acoustic scene in which the hearing aid wearer is facing one talker of interest, advancements in real-time analysis and processing of group conversation scenarios mean we are now able to improve the entire wearer experience in dynamic group conversations in background noise. This advanced scene analysis happens on top of Signia's unique split processing technology that allows separate processing of speech and noise. The result is the new multi-stream architecture of RTCE, which can track and enhance multiple speakers at the same time, allowing the wearer to fully participate in and contribute to the conversation while remaining immersed in the environment. For a more detailed description of split processing and RTCE, see Jensen et al. (2021) and Jensen et al. (2023b), respectively.

Since the introduction of Signia IX, a variety of studies have been conducted to assess the performance of RTCE. These studies have clearly demonstrated the perceptual benefits provided in noisy group conversations, both in comparisons to reference settings with RTCE deactivated (Jensen et al., 2023a; Korhonen & Slugocki, 2024; Slugocki et al., 2024) and in comparisons to competitor hearing aids (Jensen et al., 2024b; Jensen et al., 2024a; Korhonen et al., 2025).

All the studies referred to above have been conducted in test setups where conversation scenarios were simulated in lab environments. A major benefit of this type of research is that it allows testing to be done with a high level of experimental validity. By setting up an acoustically relevant and realistic listening situation that can be controlled and replicated for the different hearing aid settings we want to compare, we can effectively reduce the variance created by factors other than those we want to study.

However, hearing aids are engineered to be used in the real world. Even though advanced test methods can replicate real-life scenarios in the lab and yield valuable results with a high level of ecological validity, lab testing should not stand alone. Testing in the real world is also necessary to assess the performance of the hearing aids and the wearer experience.

When taking research from the lab into the real world, the ecological validity will increase, but at the same time, the level of control will typically drop. To make the results of real-world research valid and useful, it is necessary to find an appropriate compromise between ecological validity and control. Assessing hearing aids in a real-world location where the

acoustical conditions change from day to day, such that different study participants are subjected to very different test conditions, may not provide very useful results. This is one example of the considerations made when preparing the study presented in this white paper.

To test Signia IX in a real-world study and investigate the perceptual benefits of RTCE in a challenging group conversation scenario, Signia collaborated with Susan Scollie and Paula Folkeard at Western University in Canada. A familiar and relevant real-world test location was chosen for the study: a food court in a busy mall.

The results of the study have already been published and discussed in detail in a peer-reviewed article (Folkeard et al., 2024). In this white paper, we will summarize the most important results from the study and discuss what we learned and how the outcome aligns with the findings from other studies done on Signia IX and RTCE.

Participants and hearing aids

Twenty people (11 female, 9 male) with a bilateral sensorineural hearing loss participated in the study. Their average age was 74 years (range: 61-84 years), and they were all experienced hearing aid wearers. The study was approved by Western University's Human Research Ethics board, and the participants signed a letter of informed consent.

The participants were fitted with Signia Pure C&G IX equipped with M-receivers and power sleeves. The hearing aids were fitted according to the IXFit rationale, and a real-ear measurement (REM) was done to verify the gain against a NAL-NL2 rationale. The gain was adjusted if the measured insertion gain fell more than 5 dB below the NAL-NL2 target.

The adjusted gain setting was copied to a second program where RTCE was turned off. Thus, the fitted hearing aids included two programs: One with RTCE activated (RTCE ON), and one with RTCE deactivated (RTCE OFF). All other settings of the hearing aids were kept the same in the two programs. The hearing aids were connected to the Signia App installed on an iPhone, which allowed easy switching between the programs. The switching was always done by the experimenter to keep the participants blinded to the program identity.

Real-world test location

The purpose of the study was to test Signia IX in the exact type of communication situation that RTCE was developed to address: A group conversation in a noisy place in the real world.

The study was conducted at the Cherry Hill Village Mall in London, Ontario, Canada. The availability of a busy and noisy food court made this a highly suitable place for establishing a conversation situation and conducting the testing. The main requirement for using this setting was that the sound scene was stable across different days, so different participants were tested under similar conditions. Testing was conducted only during times of the day when the number of occupants was expected to be similar across different days, aiming to achieve comparable background noise levels across measurements.

To verify that the sound scene was stable across time, a series of acoustical measurements were conducted on different days prior to the actual testing. The results showed that the average background noise level remained within a range of 3dB, between 69.5 dBA and 73.4 dBA. Furthermore, the spectral shape of the background noise was quite similar across days. These findings indicated that the food court offered a sound environment suitable for the study purpose, as the measured variance of 3dB was low. In an additional measurement, the reverberation time (T30), averaged across 500 Hz and 1 kHz), was estimated to be 0.9 s, which is a common value for this type of environment.

Assessing the conversational experience

To conduct this study, a conversation scenario was established at one of the tables in the food court (a specific table in the middle of the food court was used for all testing). Two researchers (one male and one female) acted as conversation partners. The researchers and the participant were seated around the table, facing each other at approximately 1 m distance (see FIGURE 1).

Participants were asked to subjectively rate their conversational experience when listening to the two researchers having a conversation. To ensure the conversations were similar across the participants, a series of scripts were created on a variety of familiar topics such as, for example, food, travel, pets, weather, and weekend activities. The scripts were structured so that the male and female talkers had an equal amount of dialogue during the turn-taking. The dialogue on any given topic lasted between approximately 35-45 s.

FIGURE 1 Sketch of conversation setup. Male talker/tester (left), female talker/tester (mid), and participant (right) sitting around the round table.

The specific task of the participants was to rate different aspects of their conversational experience provided by the two hearing aid programs, RTCE ON and RTCE OFF. Two different assessment approaches were used: 1) an absolute assessment where the participant used the same program throughout the conversation and rated the experience on an absolute scale, and 2) a relative assessment which included switching back and forth between the two programs and where the participant stated their level of preference for one program compared to the other.

Absolute assessment

After listening to the conversation with one of the programs, the participants were asked to rate their conversational experience by stating their level of agreement with the following 10 statements:

1. I can understand what is being said in the conversation.
2. I hear my conversation partners clearly.
3. The volume of my conversation partners is just right.
4. I don't have to work hard to follow the conversation.
5. I can focus on the conversation in front of me.
6. I find the sound of my conversation partners pleasant.
7. The voices I am listening to are coming from the correct direction.
8. The background noise I hear is at an appropriate level for communicating.
9. The overall loudness is just right.
10. I am satisfied with the overall sound.

For each item, the level of agreement was rated using a 7-point Likert scale, going from "strongly disagree" through "neither agree nor disagree" to "strongly agree". If the participants needed more time to assess the program, they were given the opportunity to listen to an additional conversation.

When the ratings were done for one program, the task was performed again with the other program. The order of the two programs was counterbalanced across the participants, and the participants were blinded to the identity of the program.

Relative assessment (preference)

Following the absolute assessment, the participants listened to a third scripted conversation where the female talker changed the programs back and forth between RTCE ON and RTCE OFF, indicating with one or two fingers which program the participant listened to at a given time. This A-B comparison approach has the advantage of allowing detection of more subtle differences between different hearing aid programs compared to the absolute approach, in which it can be difficult to remember the perception of the first program while evaluating the second.

Based on the conversation with the A-B switching, the participants were asked to state their preference by answering these questions:

1. Which program do you prefer for overall sound quality?
2. Which program do you prefer for speech clarity?
3. Which program do you prefer for understanding both the male and the female conversation partners?
4. Which program do you prefer for making the conversation partners more prominent against the background noise?
5. Which program do you prefer for reducing background noise?
6. Which program do you prefer for reducing the work it takes to follow the conversation?
7. Which program do you prefer overall?

For each item, the preference was stated using a 7-point Likert scale, going from "strongly prefer program 1" through "no preference" to "strongly prefer program 2". Similar to the absolute assessment, the participants were given the opportunity to listen to an additional conversation if they needed more time to complete the assessment.

The order of programs was also counterbalanced across participants in the relative assessment, so the first program the participant listened to in the A-B comparison was not necessarily the same as the first program used in the absolute assessment.

The perceived effects of RealTime Conversation Enhancement

The ratings on the 7-point Likert scale used in the absolute assessment were converted into a numeric scale ranging from -3 (strongly disagree) to +3 (strongly agree), with 0 representing neutrality (neither agree nor disagree). The spider plot in FIGURE 2 illustrates the mean ratings across participants for the two hearing aid programs on each of the 10 items. A rating above 0 (outside the bold black line on the spider plot) reflects some degree of agreement with the statement, indicating a positive experience.

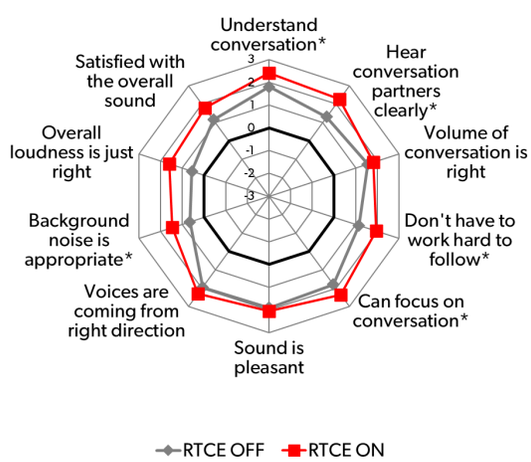

FIGURE 2 Mean ratings provided on the 7-point Likert scale in the absolute assessment of the two hearing aid programs (RTCE OFF and RTCE ON), for each of the 10 items. Positive ratings (outside the black line) indicate agreement with the statement indicated. Items with a significant difference between programs ($p < .05$) are indicated with an asterisk.

Several noteworthy observations emerge from the plot in FIGURE 2. Most strikingly, the mean ratings are consistently higher for RTCE ON compared to RTCE OFF, indicating improved performance with RTCE activated. For half of the items, this difference

was statistically significant ($p < .05$, marked with asterisks in the plot) based on Wilcoxon rank-sum tests. The differences on these items reflect enhanced conversation understanding, clearer perception of conversation partners, reduced listening effort, better focus on the conversation, and a more appropriate background noise level. In all instances, the improvements can be directly attributed to the effect of RTCE.

For the other half of the items, the difference was not statistically significant, and in some cases, the difference was quite subtle, as indicated by mean values almost overlapping in the plot, most prominently for the items related to volume of the conversation and the pleasantness of the sound. These latter observations are not surprising, since RTCE was designed to maintain these characteristics of the conversation partners' speech. Thus, RTCE does not change the volume of the speech, but it makes it easier for the wearer to focus on the speech and follow the conversation, as seen in the other ratings.

Another striking observation in FIGURE 2 is that all mean ratings – for both programs – are positive. That is, on average, the participants were satisfied with both programs in all the different perceptual domains. This is a clear testament to the performance of the baseline Signia signal processing available in the RTCE OFF program, and particularly the split processing, which is the foundation on which RTCE is built. That is, the program without RTCE already offered a high level of wearer satisfaction – but nevertheless, the satisfaction was even higher with activation of RTCE.

The data from the relative assessment were analyzed and plotted in the same way as the absolute ratings. The preference ratings were transformed into a numeric scale from -3 (strong preference for RTCE OFF) through 0 (no preference) to +3 (strong preference for RTCE ON). The mean ratings across the participants are shown in the spider plot in FIGURE 3. Mean ratings outside the bold black line in the spider plot indicate a preference for RTCE ON.

The results displayed in FIGURE 3 are quite clear. For all seven items, there was a substantial preference for RTCE. In all cases, the preference was statistically significant (all $p < .05$) when comparing the preference ratings to zero (no preference), according to Wilcoxon rank-sum tests.

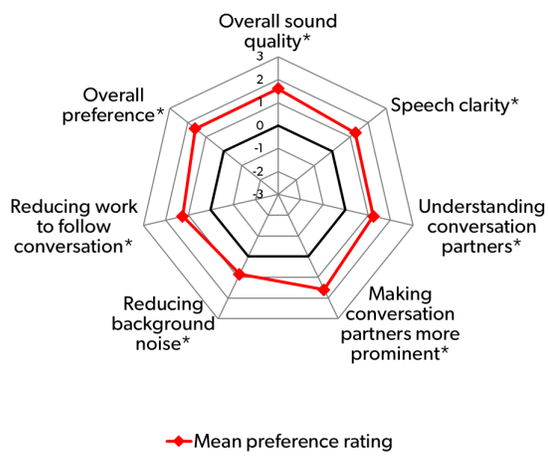

FIGURE 3 Mean preference ratings provided on the 7-point Likert scale in the relative assessment of the two hearing aid programs (RTCE OFF and RTCE ON), for each of the seven items. The bold line at 0 indicates no preference. Positive ratings (outside the bold line) indicate a preference for the RTCE ON program. Items with a significant preference ($p < .05$) are indicated with an asterisk.

The relative preference ratings correspond well with the absolute ratings. Besides asking about the general preference, the preference items addressed different aspects of the conversational experience. These included speech understanding, speech clarity, sound quality, listening effort, reduction of background noise, and making the conversation partners more prominent against the background noise. Thus, the significant preference for RTCE ON observed for all the items provide strong evidence for the benefit perceived by the wearer during a noisy conversation when RTCE is activated.

The individual preference ratings showed that 16 of the 20 participants (80%) stated an overall preference for the program with RTCE activated, and the same share of participants preferred the overall sound quality with RTCE.

More details about the data analysis are provided by Folkeard et al. (2024).

What we learned

The main finding of this study is not that RTCE can provide benefits for the wearer in a group conversation in background noise. We knew that already from several other studies conducted in the lab showing how activation of RTCE benefits the wearer in (simulated) group conversations in noise.

The key finding of this study is that the benefits observed in controlled lab settings fully transfer to actual conversations experienced in noisy, dynamic real-world environments – in this case a busy food court in a mall. The study results clearly show that the benefits of RTCE are perceived by wearers in a real-world setting where many wearers of traditional hearing aids often struggle to participate in group conversations. The alignment between lab and real-life findings shows the importance of a multi-modal research approach where studies are done both in the lab and in the real world, using different methods and outcome measures.

As mentioned in the results section, the relative assessment of the two test programs shows the same overall trend as the absolute assessment. Both data sets clearly show that speech clarity and understanding are significantly improved by RTCE, making it easier for the wearer to focus on their conversation partners. Both data sets also indicate that the listening effort is markedly reduced by RTCE, making it easier and less stressful to participate in a group conversation. Thus, the results of this study are closely aligned with existing evidence on the benefits of RTCE in noisy group conversations. In particular, this study indicates that RTCE can significantly improve the conversational experience in a noisy real-world setting, e.g., when dining with a group in a busy food court.

On an individual level, an overwhelming 80% of participants preferred the program with RTCE activated, both for overall performance and sound quality. This indicates that the benefits of RTCE are not limited to a small subset of wearers but are broadly experienced by the majority. These findings provide HCPs with strong evidence to recommend RTCE as a solution that delivers consistent and meaningful improvements for hearing aid wearers and empowers wearers to actively engage in challenging conversation settings where traditional hearing aids often fall short.

Conclusions

The absolute assessment of the two test hearing aid programs, with and without activation of RTCE, showed that both programs were perceived positively by the participants. This finding reiterates the excellent performance offered by Signia's split processing. However, in all 10 outcome domains, the program with RTCE was rated highest – with statistically significant differences observed for the items on speech understanding, speech clarity, listening effort, ability to focus on the conversation, and background noise level.

The relative assessment showed a strong preference for RTCE. On all seven preference items, the preference for RTCE was statistically significant. On the items about overall preference and overall sound quality, respectively, 80% of the participants stated a preference for the program with RTCE activated.

In conclusion, this study – conducted in a busy mall food court in London, Ontario, Canada – showed that activation of RealTime Conversation Enhancement in Signia IX hearing aids resulted in significant improvements in the conversational experience of the participants in a busy food court. These results confirm and align with our lab data showing the effectiveness of RTCE in improving busy group conversations, highlighting the importance of having multi-modal data in verifying new technology.

Acknowledgements

We would like to thank Susan Scollie, Paula Folkeard and Barah Mohammad Ali Ahmad for their contributions to the preparation and conduction of the study and the publication of the peer-reviewed paper in American Journal of Audiology.

References

Folkeard P., Jensen N.S., Kamkar Parsi H., Bilert S. & Scollie S. 2024. Hearing at the Mall: Multibeam Processing Technology Improves Hearing Group Conversations in a Real-World Food Court Environment. American Journal of Audiology, 33, 782-792.

Jensen N.S., Høydal E.H., Branda E. & Weber J. 2021. Improving speech understanding with Signia AX and Augmented Focus. Signia White Paper. Retrieved from www.signia-library.com.

Jensen N.S., Mohnlein-Gilbert K., Wilson C., Berwick N., Kamkar Parsi H., et al. 2024a. Signia IX with pioneering multi-stream technology delivers 22% better speech understanding in noisy group conversation than a competitor with an AI co-processor-driven platform. Signia White Paper. Retrieved from www.signia-library.com.

Jensen N.S., Samra B., Kamkar Parsi H., Bilert S. & Taylor B. 2023a. Multi-Stream Architecture for Improved Conversation Performance. Hearing Review, 30(10), 20-23.

Jensen N.S., Samra B., Kamkar Parsi H., Bilert S. & Taylor B. 2023b. Power the conversation with Signia Integrated Xperience and RealTime Conversation Enhancement. Signia White Paper. Retrieved from www.signia-library.com.

Jensen N.S., Wilson C., Kamkar Parsi H., Samra B., Hain J., Best S. & Taylor B. 2024b. Signia IX delivers more than twice the speech enhancement benefit in a noisy group conversation than the closest competitors. Signia White Paper. Retrieved from www.signia-library.com.

Korhonen P., Kuk F., Slugocki C. & Peeters H. 2025. Conversations in Noise: Multi-Stream Architecture vs. Deep Neural Network Approach to Hearing Aids. Hearing Review, 32(1), 18-21.

Korhonen P. & Slugocki C. 2024. Augmenting Split Processing with a Multi-Stream Architecture Algorithm. Hearing Review, 31(5), 20-23.

Manchaiah V., Picou E.M., Bailey A. & Rodrigo H. 2021. Consumer Ratings of the Most Desirable Hearing Aid Attributes. Journal of the American Academy of Audiology, 32(8), 537-546.

Nicoras R., Gotowiec S., Hadley L.V., Smeds K. & Naylor G. 2023. Conversation success in one-to-one and group conversation: a group concept mapping study of adults with normal and impaired hearing. International Journal of Audiology, 62(9), 868-876.

Picou E.M. 2022. Hearing aid benefit and satisfaction results from the MarkeTrak 2022 survey: Importance of features and hearing care professionals. Seminars in Hearing, 43(4), 301-316.

Slugocki C., Kuk F. & Korhonen P. 2024. Using Alpha-Band Power to Evaluate Hearing Aid Directionality Based on Multistream Architecture. American Journal of Audiology, Early Online, 1-12.