WHITE PAPER – MARCH 2015

Evidence on Soft Speech Booster

ABSTRACT

Evidence collected at two independent sites shows that Soft Speech Booster (SSB) improves speech understanding by 7% on average. More specifically:

- The extra fixed soft gain of SSB improves soft speech understanding by 7% on average.
  This improvement raises to 13% with the personalisation of SSB, with some test persons showing a 20% improvement.

- On average, SSB improves conversational speech understanding by 8%.

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Introduction

With the launch of Alta2 and Nera2 we introduce Soft Speech Booster (SSB), a feature that enhances the delivery of soft gain in two ways. On the one hand, SSB benefits from the improvement of the feedback system (Inium Feedback Shield) and the compression rationale (VAC+), and provides an extra 3 dB of soft gain above 1.5 kHz. In addition to this fixed extra soft gain, with the new Soft Sound Perception (SSP) control in Genie, SSB provides an extra amount of soft gain that is prescribed to fit personal preferences. See Le Goff (2015) for more information on SSB. This white paper discusses the relevance of SSB and presents the evidence of its benefits.

Relevance

SSB improves amplification in hearing instruments by enhancing soft gain delivery. Here, we discuss why soft gain and SSB are relevant for understanding speech in quiet moments as well as in daily conversations.

A rule of thumb is that soft gain amplifies sounds that have a level of 50 dB SPL or less. It is therefore intuitive that SSB enhances the understanding of speech in quiet environments where speech is soft, typically around 50 dB SPL.

In daily conversations, the level of speech is moderate, i.e. between 60 and 70 dB SPL. This figure is, however, an average value and such moderate speech actually contains many soft sounds. As shown in the left panel of ***Fig. 1***, in 65 dB SPL speech, the sounds above 1 kHz are actually below 45 dB SPL. In addition, as shown in the right panel, the level of speech varies rapidly in time by 20 to 30 dB. The combination of these two properties means that, 80% of the sounds above 1 kHz of 65 dB SPL speech are actually amplified by soft gain and therefore enhanced by SSB.

To get a picture of the relevance of SSB for the daily life of hearing aid users, we analysed the sort of sound levels and environments that users experience. We collected the Activity Analyser (Memory) records from 103 patients using Alta or Alta Pro in the United States. On average, those patients were using their devices for over 11 hours per day. The average overall level, categorised by signal type (as determined by our TriState Noise Management system) is shown in ***Fig. 2***.

Based on overall level alone, over 75% of the time is spent in environments of up to 70 dB SPL. If analysed based on the total amount of time that speech is present (that would include speech in quiet (dark blue) and speech in noise (light blue)), over 75% of the time that speech is present, it is present at levels of 70 dB SPL or lower.

The combination of these field measurements and the analysis of speech shows that SSB will enhance the understanding of speech in 75% of all conversations experienced by hearing aid users.

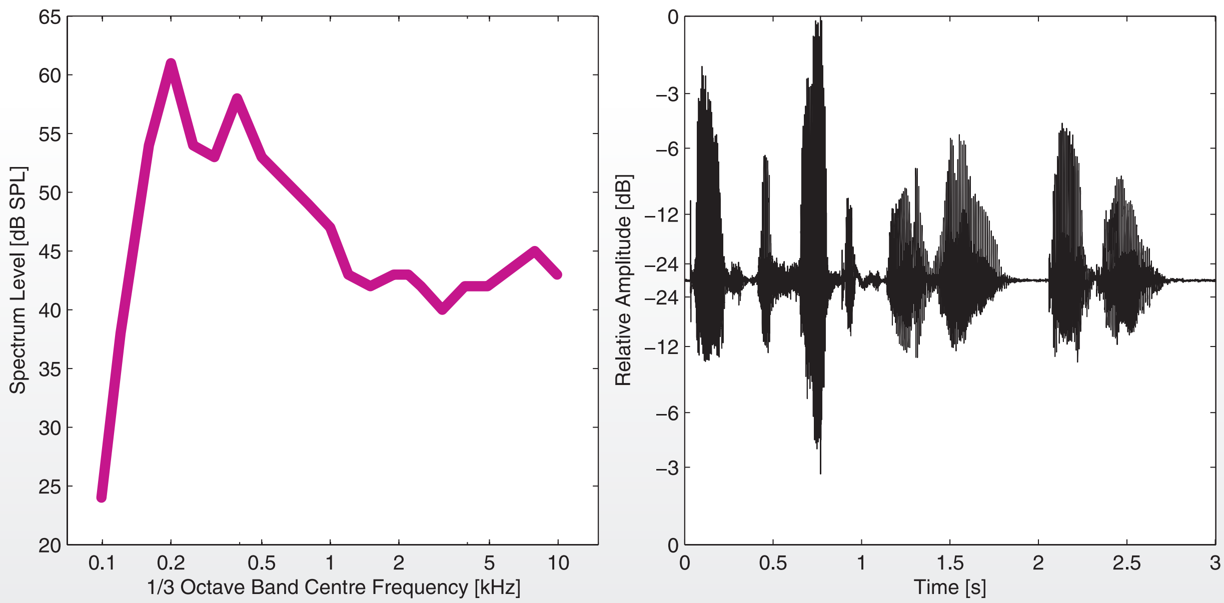

Figure 1: Left: Long-term spectrum of a 65 dB SPL speech (after Laugesen et al. 2010). Right: Time representation of 3 seconds of speech.

Benefit

In order to evaluate the benefits in speech understanding provided by SSB, three clinical tests were conducted at two independent sites: the Oticon headquarters (DK site) and the Hörzentrum in Oldenburg (DE site). Data were collected between October 2014 and February 2015.

Soft Speech

The benefit of SSB on the understanding of soft speech was evaluated by measuring speech understanding in quiet environments. At the two test sites, the task of the test persons was to understand monosyllabic words presented in quiet environments.

34 test persons participated in the test at the DK site and 30 test persons participated in the test at the DE site. At the DE site, all test persons had a moderate hearing loss and were using a RITE instrument with 85 receivers. At the DK site, test persons also had a moderate hearing loss but they were wearing a variety of instrument styles (RITE, BTE, ITC, and ITE) and receivers (60, 75, 85, and 90).

At the two sites, the speech material was presented with a loudspeaker standing in front of the test person in a room with moderate reverberation. Dantale I speech material was used at the DK site and WAKO speech material was used at the DE site. The reference performance was the speech understanding with Alta devices (VAC). The presentation level to measure this reference performance was adjusted for an individual target understanding of 50% (DK) or 70% (DE). The directionality of the instruments was always set to omnidirectional.

The performance obtained with the SSP control in the middle position shows the benefit of SSB that is related to the fixed 3 dB increase in soft gain above 1.5 kHz. In this case, the increase in soft speech understanding was 4% at the DE site and 9% at the DK site. This difference was statistically significant (2-sided T-test, $p<0.001$) at the DK site but not at the DE site ($p=0.64$). Weighted by the number of test persons, the average improvement is 7%. The better performance at the DK site compared to the DE sites is likely due to two factors. At the DK site, VAC+ and VAC were implemented in the same device, which eliminated possible differences in fitting of independent Alta and Alta2 devices at the DE site. In addition, while at the DK sites, all test persons were daily users of Alta instruments, and thus familiar with VAC, test persons at the DE sites were daily users of a wide variety of instruments, making the sound of Alta or Alta2 instruments new to them.

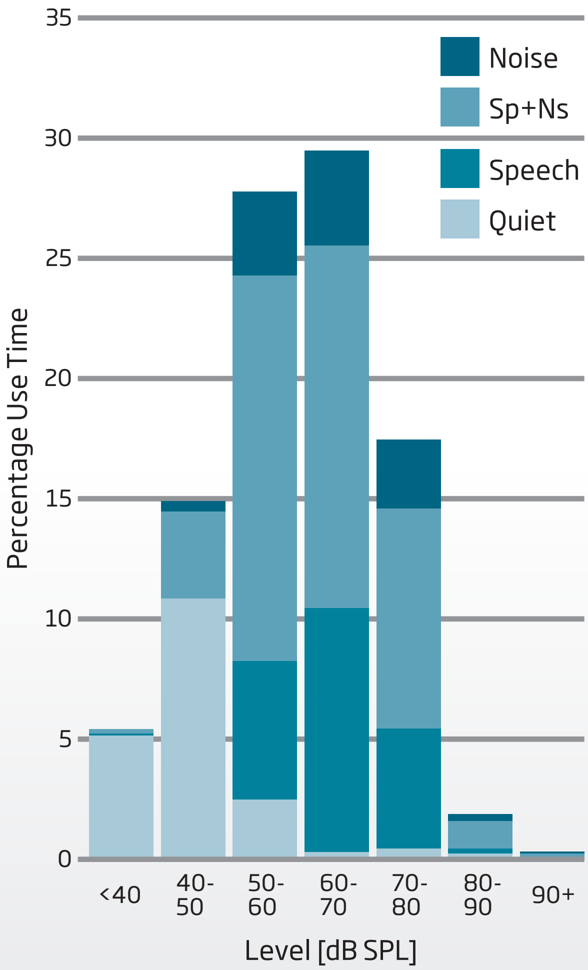

Figure 2: Categorisation of sound levels by signal types.

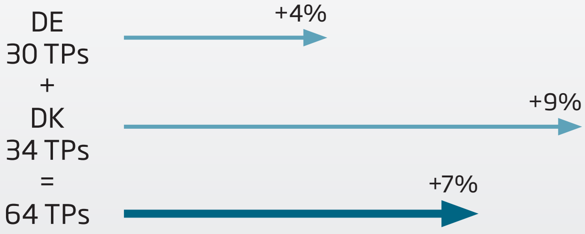

Figure 3: Improvement in Soft Speech understanding due to the extra 3 dB of soft gain above 1.5 kHz measured.

Personalisation

The benefit of the personalisation was measured at the two sites by measuring the soft speech understanding with the SSP control at two additional positions: “comfort” and “detail”. About 20% of the test persons had their best understanding with the control in “comfort”, 50% when it was in “detail” and 30% when it was in the middle position. On average, choosing the best position of the SSP control for individual test persons increased the performance by 6%, raising the total benefit of SSB for soft speech understanding to 13% compared to the reference condition measured with Alta (VAC) devices.

Conversational speech

The benefit of SSB on the understanding of daily conversations was measured using a speech-in-noise test at the DK site. Speech reception thresholds (SRTs) were measured with Dantale II speech material in a continuous background noise that had a level of 65 dB SPL. The performance was measured with 30 test persons that were wearing devices in which both VAC and VAC+ was implemented, hence evaluating the benefit of the fixed extra soft gain of SSB, (no personalisation of the SSP control). The average SRT improvement was 0.7 dB, which translates in a percentage of word-recognition of about 8% (Wagener et al. 2003). This difference was statistically significant (2-sided T-test, $p<0.05$).

Figure 4: Benefit of SSB on soft speech understanding.

References

1. Laugesen, S., Neher, T., Johannesson, R. B., Jensen, N. S, and Behrens, T. (2010), "Pinna cue-preserving hearing aid fittings: Audibility considerations", *Poster presented at IHCON*.
2. Le Goff, N. (2015), "Amplifying soft sounds – a personal matter", *Oticon – White paper.*
3. Wagener, K., Josvassen, J. L., and Ardenkjear, R. (2003), "Design, optimization and evaluation of a Danish sentence test in noise", in *International Journal of Audiology, vol 42,* pages 10-17.

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