Abstract of journal publication 2013

Title: Remediation of spatial processing deficits in hearing-impaired children and adults

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Journal: Journal of the American Academy of Audiology

Abstract:

Background: The ability to use interaural cues to segregate target speech from competing signals allows people with normal hearing to understand speech at significantly poorer signal-to-noise ratios. This ability, referred to as spatial processing ability or spatial release from masking, has been shown to be deficient in people with a sensorineural hearing loss even after amplification is applied. Spatial processing deficits in a population of children with auditory processing deficits have been found to be remediable through the use of a deficit-specific auditory training program called the LiSN & Learn.

Purpose: The aim of the present study was to determine whether LiSN & Learn auditory training could improve the spatial processing ability of hearing-impaired adults and children. In addition, the research investigated whether the age of the participant would affect the efficacy of the training program.

Research Design: In a repeated measures design, participants’ spatial processing ability was assessed pre- and post-training using the Listening in Spatialized Noise – Sentences Test (LiSN-S). Questionnaire responses were also collected from participants pre- and post-training to provide a subjective measure of real-life listening difficulty. Between the two assessment periods participants were asked to train with the LiSN & Learn for 15 minutes per day, 5 days per week for 60 training sessions.

Study Sample: Participants were five children (aged 6 – 11 years) and five adults (aged 60 – 74 years) with up to a moderate sensorineural hearing loss.

Intervention: The LiSN & Learn auditory training software incorporates five computer games in which target sentences, processed with head-related transfer functions are perceived as coming from 0° azimuth, while simultaneous distracting speech streams are perceived as coming from ±90° azimuth. Participants are tasked with identifying a word from the target sentence and selecting the corresponding picture from a selection of four images displayed on the screen. The SNR is adapted based on whether the response given is correct or incorrect.

Results: Despite an average improvement of 10 dB on the LiSN & Learn training program, no significant improvements were seen post-training in either of the spatially separated conditions of the LiSN-S (p ranging from 0.47 to 0.75). A 1.2 dB improvement was found in the baseline condition of the LiSN-S which incorporates no spatial separation between distracter and target stimuli (p < 0.01). Age did not significantly affect training outcomes (p = 0.21). No significant improvements were found post-training on the self-report questionnaires (p = 0.84 and p = 0.20).

Conclusions: This study has demonstrated that LiSN & Learn training does not significantly improve spatial processing deficits in adults or children with a sensorineural hearing loss. As auditory training did not prove to be effective, further research should be directed toward the development of hearing aid processing schemes that will compensate for the degraded interaural time difference and interaural level difference cues which underpin spatial processing.