Multisensory Research

The Effect of Irrelevant Environmental Noise on the Performance of Visual-to-Auditory Sensory Substitution Devices Used by Blind Adults

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Abstract

Visual-to-auditory Sensory Substitution Devices (SSDs) are a family of non-invasive devices for visual rehabilitation aiming at conveying whole-scene visual information through the intact auditory modality. Although proven effective in lab environments, the use of SSDs has yet to be systematically tested in real-life situations. To start filling this gap, in the present work we tested the ability of expert

SSD users to filter out irrelevant background noise while focusing on the relevant audio information. Specifically, nine blind expert users of the EyeMusic visual-to-auditory SSD performed a series of identification tasks via SSDs (i.e., shape, color, and conjunction of the two features). Their performance was compared in two separate conditions: silent baseline, and with irrelevant background sounds from real-life situations, using the same stimuli in a pseudo-random balanced design. Although the participants described the background noise as disturbing, no significant performance differences emerged between the two conditions (i.e., noisy; silent) for any of the tasks. In the conjunction task (shape and color) we found a non-significant trend for a disturbing effect of the background noise on performance. These findings suggest that visual-to-auditory SSDs can indeed be successfully used in noisy environments and that users can still focus on relevant auditory information while inhibiting irrelevant sounds. Our findings take a step towards the actual use of SSDs in real-life situations while potentially impacting rehabilitation of sensory deprived individuals.

Keywords

Blindness; sensory substitution; sensory loss; background noise; environmental sounds, cocktail party

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Supplementary material

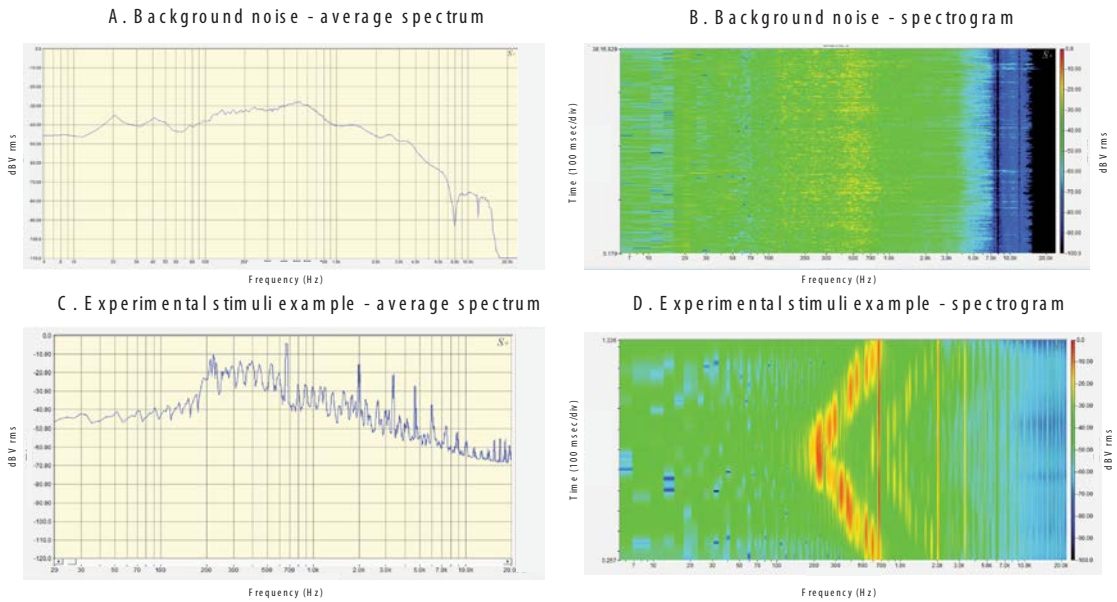

Figure S1. Audio file properties: (A) Background noise average spectrum graph presenting the intensity of the various frequencies in the background noise recording. (B) Background noise spectrogram presenting the intensity of the various frequencies in the background noise recording. (C) Experimental stimuli example. Average spectrum presenting the intensity of the various frequency in one of the experimental stimuli (note that all experimental stimuli span the same frequency range). (D) Experimental stimuli example spectrogram presenting the intensity of the various frequencies in the experimental stimulus recordings.