Contextual Plasticity in Sound Localization vs. Source Separation

Stanislava Linková, Gabriela Andrejková, Norbert Kopčo
Institute of Computer Science, P. J. Šafárik University

Background: Contextual plasticity (CP) is a localization aftereffect occurring on the time scale of seconds to minutes. It has been observed as a bias in horizontal sound localization of click target stimuli presented alone, when interleaved with contextual adaptor-target trials in which the adaptor was at a fixed location while the target location varied. The observed bias is always away from the contextual adaptor location, even though the adaptor is not present on the experimental trials. In a previous study [Linkova et al. (2021) ARO Abstract #W30], two experiments examined whether this phenomenon is dependent on engagement of the subject in an active localization task on the contextual trials (Exp. 1), and whether CP is also observed in virtual environments, both reverberant and anechoic (Exp. 2). Here, we examine two hypotheses: 1) that CP is a consequence of the auditory spatial representation adapting to improve source separation at the cost of introducing biases in localization, and 2) that CP is caused by adaptation that aims to utilize the whole spatial representation range for localization when stimuli are presented from a limited range.

Methods: In both experiments, the target stimulus was a 2-ms noise burst (click), while the adaptor was a click train consisting of 12 such clicks. Six target locations were used, ±33, ±22, ±11° in Exp 1 and ±30, ±20, ±10° in Exp. 2. Adaptor locations were fixed across block at 0, ±45, or ±90° in Exp. 1 and 0 or ±50° in Exp. 2. In addition, baseline blocks contained no adaptors. Subjects responded by using a numerical keypad while seated with their heads supported by a headrest. Virtual environments in Exp. 2 were simulated by using non-individualized HRTFs and BRIRs. For hypothesis #1, response variance and stimulus-response correlation were analyzed. For hypothesis #2, the direction and size of drifts in responses over time were correlated with stimulus distribution.

Results: Variances tended to increase near the adaptor location, not consistent with hypothesis #1. Drifts in responses depended not only on the distribution of the stimuli, but also on the relative location of individual targets re. the adaptor, partially consistent with hypothesis #2.

Conclusions: These results suggest that CP adaptation is caused by a mechanism aimed more at improving source localization than improving source separation.

[Work supported by VEGA 1/0355/20 and APVV DS-FR-19-0025].