Contextual Plasticity in Sound Localization Induced by Passive Exposure to Transient Sounds

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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 distractor-target trials in which the distractor was at a fixed location while the target location varied. The observed bias is always away from the contextual distractor location, even though the distractor is not present on the experiment-tal trials. Here, two experiments were performed. Exp. 1 examined whether this phenomenon is dependent on engagement of the subject in an active localization task on the contextual trials, as used in previous studies. Here, instead, contextual trials only contained the distractor without any targets, and the listener's task was to passively listen to the context. It was hypothesized that if CP is mainly caused by adaptation to the distractors, then it would be observed also in this condition. Exp. 2 examined whether CP is also observed in virtual environments, both reverberant and anechoic. It used a setup similar to Exp. 1 and it was hypothesized that the observed CP might be stronger than in Exp. 1, in particular in anechoic virtual space, as no real-world anchoring to stimuli in real world is available. In both experiments, distractor locations were varying from block to block while the target range was fixed across blocks, to examine how CP depends on the distractor location.

Methods: In both experiments, the target stimulus was a 2-ms noise burst (click), while the distractor 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. Distractor 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 distractors. 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.

Results: In Exp. 1, repulsive contextual biases of up to 5° were induced by the lateral distractors, while a bias of up to 3° was induced by the central distractor. In Exp. 2, the patterns were similar, but the effect was much stronger, reaching up to 19° in the virtual anechoic condition and approximately 17° in the virtual reverberant condition. The effects were strongest near the distractor and decreased with target separation from distractor.

Conclusions: These results confirm that contextual plasticity is a general localization aftereffect phenomenon that does not require active engagement in a localization task.

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