Trial-to-trial Contextual Adaptation in Sound Localization

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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 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. This was confirmed for both real and virtual environments, for 1-click target sounds presented from different azimuths and interleaved with a 12-click adaptor presented from a fixed position [Linková et al. (2022) KUŽ].
In the current study, we investigated the short-term dynamics of the adaptation by analyzing the effect of the stimulus immediately preceding a given target in the Linková et al. data. Thus, we investigated the differences between adaptor-target (AT) and target-target (TT) trial pairs both in terms of the bias and standard deviation in responses to the second target in the pair. Because the adaptor is in a fixed position and contains more energy than a target, it was expected to induce stronger biases. On the other hand, it can act as an anchor, reducing the standard deviation in response to the following target.

Methods: In two prepared 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.

Results: The results showed that the adaptor affected the localization even in the short term and the deviations increased. However, this effect was only observed in a virtual environment. This could be caused by the subjects' uncertainty in the localization of the stimuli in the virtual environment, and thus they responded mainly with respect to the adaptor which acted as an anchor.

Conclusions: The adaptor has a fast-acting effect on the CP observable on the time scale of several seconds. These results support an idea that CP is likely caused at least partially by suppression in spatial representation.