**Auditory Distance Perception and DRR-ILD Cues Weighting**

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**Introduction**

The estimates of auditory distance are typically dominated by the overall received stimulus intensity. However, distance processing can also be guided by intensity-independent cues. Specifically, the *interaural level differences* (ILDs) provide distance information for lateral stimuli and, in reverberant space, the *direct-to-reverberant energy ratio* (DRR) cue provides distance information for sources from all directions. In the absence of the intensity cue, listeners use these cues to estimate nearby-source distance [Kopčo et al. (2012) PNAS, 109, 11019-11024]. In the current study, we examined how the ILD and DRR cues are combined and weighted to create an auditory distance percept, and how previous experience influences this weighting.

**Methods**

We performeda series of behavioral experiments in a virtual reverberant environment in which we simulated sound sources presented at a varying distance (15-100 cm) from directly in front or to the side of the listener. To explore the listeners’ weighting of the cues, we manipulated the availability and congruency of the cues. Specifically, we compared performance with the ILD or DRR eliminated, presented congruently, or presented incongruently. Stimuli were either binaural, monaural, or diotic. We also examined the effect of the preceding listening experience on cue weighting.

**Results**

Incongruent DRR-ILD stimulation caused a weaker distance percept (inaccurate estimates of source distance) compared to the congruent presentation. Individual cue weighting critically depended on previous experience. Very low weight was put on DRR after the subject was exposed to stimuli with congruent ILD and intensity cues. On the contrary, after stimulation with DRR-based performance, DRR weighting increased dramatically. Finally, diotic DRR-based performance was found to be better than monaural DRR-based performance even though the directional percept was more consistent with a realistic listening situation in the latter condition.

**Conclusions**

The weighting of ILD and DRR cues in judging distance of nearby sources is strongly adaptive, depending the previous room exposure. This result is consistent with the hypothesis that the brain dynamically updates its model of the acoustic environment, preferring the most reliable cue combination in each room. Future studies will need to examine the properties of this process and the underlying neural mechanisms.

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