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Title

Visual calibration of auditory distance perception

Background

Ventriloquism effect (VE) occurs when a sound is perceived to originate from the location of a nearby visual stimulus. Ventriloquism aftereffect (VA) occurs if the shift in the perceived sound location persists even after the visual stimulus is removed. A recent study showed both these effects in the distance dimension [Hladek et al., (2013), Ventriloquism effect and aftereffect in the distance dimension, ICA Montreal, POMA Volume 19, pp. 050042]. A complex pattern of effects was observed, however, the baseline performance with no AV disparity was not measured in that study.

Methods

Two experiments were performed in a small reverberant room, similar to the previous study. Both experiments consisted of 2 sessions. In Experiment 1, listeners localized a 300-ms broadband noise (A-only trials) coming from one of 8 loudspeakers placed in front of the listeners. On interleaved audio-visual (AV) trials, sounds were paired with visual signals (LEDs) that were aligned (AV-Aligned baseline) or displaced closer (AV-Closer condition) or farther (AV-Farther) from the sounds by 30%. The AV condition was kept constant throughout a session. In Experiment 2, subjects localized A-only stimuli without any interleaved AV trials.

Results

In Experiment 1, A-only performance differed from the AV performance even in baseline AV-Aligned sessions. As in previous study, VE was stronger in AV-Closer than AV-Farther condition, independent of the baseline used. However, VAs were very similar for both AV-Farther and AV-Closer conditions. Relative to AV-Aligned baseline, distance-dependence of the effects was smaller than in the previous study. In Experiment 2, learning effects were observed even without any visual stimulation.

Conclusions

The differences in the strength of VA and VE for AV-Closer vs. AV-Further conditions are in part due to differences in the baseline AV and A-only performances. However, given that the differences in relative effect sizes for VA-Closer vs. VA-Further conditions were observed even relative to the measured baselines, it is likely that different neural mechanisms underlie VE and VA in distance. In addition, when visual calibration of auditory distance occurs in reverberant space, spontaneous room learning occurs which is likely to interact with the effects of visually guided learning.

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