A model of the reference frame of the ventriloquism aftereffect considering saccade biases

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Background: The ventriloquism aftereffect (VAE), observed as a shift in the perceived locations of sounds after audio-visual stimulation, requires reference frame (RF) alignment since hearing and vision encode space in different frames (head-centered vs. eye-centered). Previous experimental studies observed inconsistent results: a mixture of head-centered and eye-centered frames for the VAE induced in the central region vs. a predominantly head-centered frame for the VAE induced in the periphery. A previous model proposed to describe these data required different parameter fits to predict the central vs. peripheral data. Here, a new version of the model is introduced to provide a unified prediction of both data sets considering that saccade responses used to measure VAE might also introduce biases.

Methods: The model has two additively combined components: a saccade-related component and an auditory space representation component. The former component characterizes biases in auditory saccade responses in eye-centered RF. The latter is adapted by ventriloquism signals in a combination of head-centered and eye-centered frames.

Results: The updated version of the model provides a unified prediction for both central and peripheral aftereffect data, even if only head-centered RF is considered in the auditory space representation.

Conclusion: The results suggest that purely head-centered RF is used for adaptation of auditory spatial representation in the ventriloquism aftereffect, and that the apparently mixed eye-and-head centered RF observed experimentally is most probably due to saccade-related biases that are eye-centered. However, additional simulations need to be performed to determine whether eye-centered ventriloquism signals further improve the model predictions.