Interactions between visual salience and synchrony on auditory detectability in adults

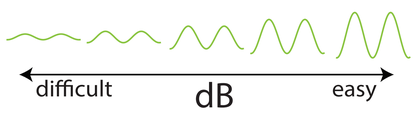
Danielle Briggs, Hiu-Mei Chow, Vivian M. Ciaramitaro
Psychology Department, University of Massachusetts Boston

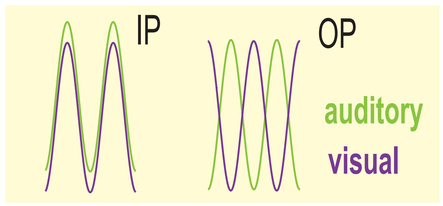
BACKGROUND

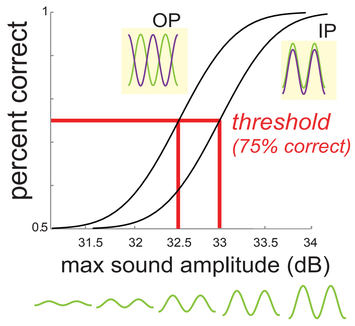
Visual information can influence auditory detectability and increase perceptual reliability (Sumby & Pollack, 1954). Such multisensory interactions have been shown to be most enhanced, benefit most, when stimuli in different modalities are synchronized in time, spatially co-localized and follow the law of inverse effectiveness (Meredith & Stein, 1986).

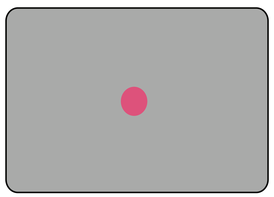
Here we examine the interaction between temporal synchrony and visual salience. We predict enhanced auditory detection for visual stimuli presented: 1) in-phase with the auditory stimulus relative to out-of-phase and 2) for a weaker visual salience level over a high salience level.

METHOD

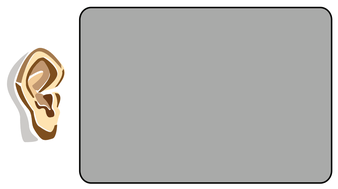




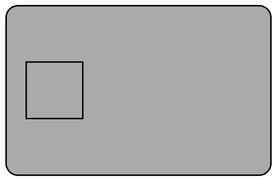




Fixation



Test Display



Gaze-contingent Reward

Auditory Stimulus
A white noise sound modulated at 1 Hz at five loudness levels was presented to the left or right of center against a constant white noise background.

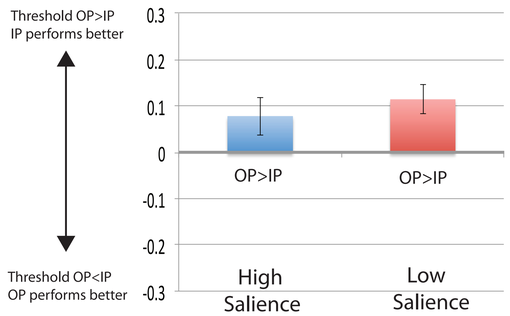
Visual Stimulus
Monitor brightness was either at high or low saliency modulated at 1 Hz in-phase (IP) or out-of-phase (OP) with the auditory stimulus.

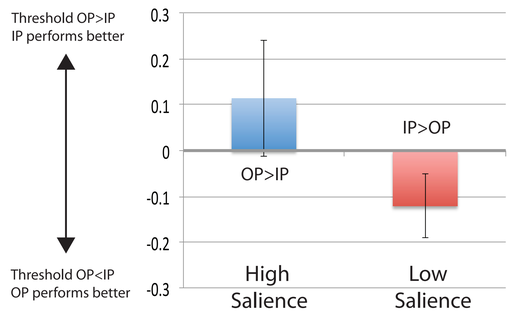
Reward Video
A short cartoon was shown if participants looked to correct side of monitor, if not, an empty box was shown on correct side.

RESULTS

Threshold Difference

Average Threshold Difference (dB) = OP − IP



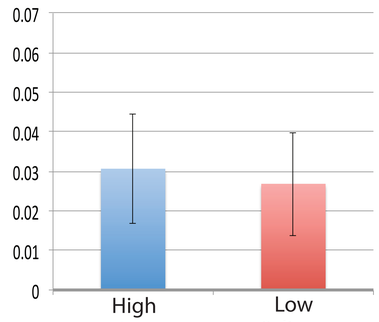


Reaction Time Difference

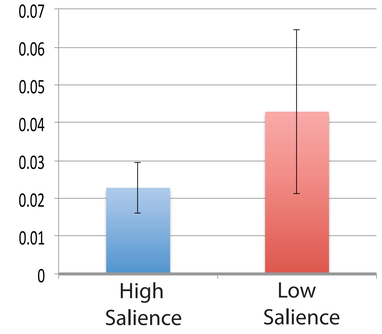
Average Reaction Time Difference (sec)
= (OP - IP) / (OP + IP)

Salience Order

Low to **High**
(n = 8)



High to **Low**
(n = 7)



CONCLUSION

Here we found improved auditory threshold for in-phase to out-of-phase stimuli for high visual salience. For low visual salience, decreased effects were seen when conditions were run in the order of low salience first, high salience second. For that same condition, average reaction time difference increased substantially, taking longer for participants to make a decision. These results suggest that the effect of synchrony on crossmodal integration is critically dependent on salience. It would be interesting to look further into the factors involved in this order effect and how these threshold differences compare to a baseline measure of the auditory detectability without a visual stimulus.

References

Sumby W.H. & Pollack I. (1954). Visual contribution to speech intelligibility in noise. *J. Acoust. Soc. Am,* 26(2). 212-215.

Meredith M.A. & Stein B.E. (1986). Visual, auditory, and somatosensory convergence on cells in superior colliculus results in multisensory integration. *Journal of Neurophysiology,* 56(3), 640-662.

Research funded by: UMass Boston Proposal Developmental Grant