

WHAT YOU HEAR IS WHAT YOU SEE:

Visual information can hinder auditory detectability early in development Hiu Mei Chow & Vivian M. Ciaramitaro

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Threshold



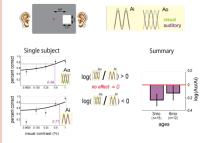
INTRODUCTION

Whereas a great deal of research in adults has examined how simple visual stimuli, providing no lateralized spatial information, can influence the detectability of a sound (e.g. Bolognini et al., 2005; Lovelace, et al., 2003; Odgaard et al., 2004), little is known about similar influences on low level auditory detectability early in development.

In a similar experiment, examining the influence of auditory stimuli, providing no spatial information, on low level visual detectability, Ciaramitaro & Dobkins found that a task-irrelevant sound could infleunce visual contrast sensitivity, in 3- and 6-month olds.

Here we examine whether task-irrelevant (non-spatial) visual information helps or hinders adults and 3- to 8-month old infants' ability to localize near-threshold auditory stimuli.

Previous findings (Ciaramitaro & Dobkins):



Visual thresholds were lower, more sensitive, for out-of-phase (Ao) compared to in-phase (Ai) stimuli.

MFTHODS

Subjects' gaze behavior was assessed using two-alternative forced choice preferential looking as measured by a Tobii TX 300 eyetracker.

Fixation



(viewing distance ~60cm).

Test display Auditory Stimulus White noise, presented to left or right of monitor, fluctuated in olume at 1 Hz. There were 5 max sound amplitude levels (38 - 81dB)

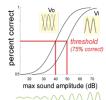
Visual Stimulus Entire background fluctuated in orightness at 1 Hz in phase (Vi) or out of phase (Vo) with the sound.



Gaze-contingent Reward (operant conditioning)

Reinforce babies for looking to the side where the auditory stimulus was presented with a short cartoon movie. A box with no movie was show en babies looked to the incorrect side.

Analysis & Expected results:



If visual influences on auditory processing are complementary to auditory influences found on visual processing, as observed by

Ciaramitaro & Dobkins, then we expect thresholds to be lower in the Vo condition. $\log(M) / M > 0$

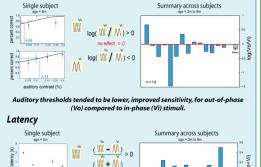
Data inclusion criteria: - more than 80 trials

good dynamic performance

Weibull functions were fit to each subject's accuracy performance for sound localization, to obtain threshold performance (75% accuracy) for the Vo and Vi conditions.



RESULTS: INFANTS

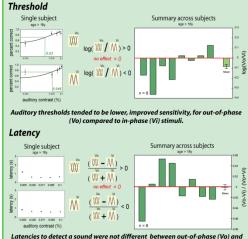


Latencies to detect a sound tended to be slower, less sensitive, for out-of-phase (Vo) compared to in-phase (Vi) stimuli.

(WX - M)

(M + M)

RESULTS: ADULTS



DISCUSSION

General effect of non-spatial visual information:

- Our results thus far suggest a trend of smaller threshold for out-of-phase (Vo) stimuli, than in-phase (Vi) stimuli, consistent with our previous results of auditory influences on visual processing (Ciaramitaro & Dobkins, 2013), implying a complementary interaction between visual and auditory processing in infants.

- The results from adults observers were similar to that from infants, awaiting for more data to confirm whether the interaction between vision and audition remains symmetric with development.

Future Research:

Using pupillometry to further our understanding of the limitation or enhancement of auditory processing induced by non-spatial visual information.

in-phase (Vi) stimuli.

Bolognini et al, (2005). "Acoustical vision" of below threshold stimuli: interaction among spatially converging audivisual inputs. Exp Brain Res., 160(3), 273-82.

Ciaramitaro, V.M., & Dobkins, K.B. (May 2013). The development of cross-modal attention: When can a sound help visual detection. J Vis., 13(9), article 887

Odgaard, E.C., Arieh, Y., Marks, L.E. (2004). Brighter noise: sensory enhancement of perceived loudness by concurrent visual stimulation. Coan Affect Behav Neurosci., 4(2), 127-32.

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