

Multisensory object-perception: Audio-visual binding studied with fMRI

Bischoff, M., Blecker, C.R., Walter, B., Vaitl, D., Sammer, G.
Bender Institute of Neuroimaging, University of Giessen, Germany

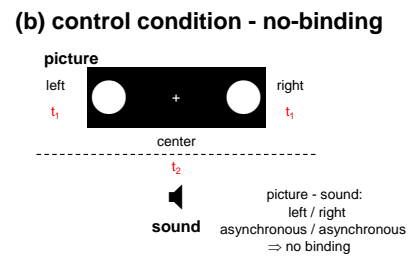
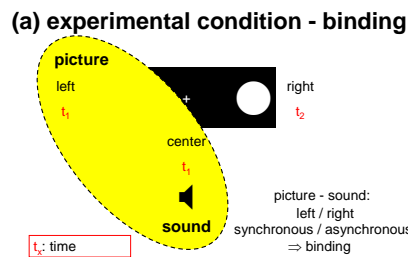
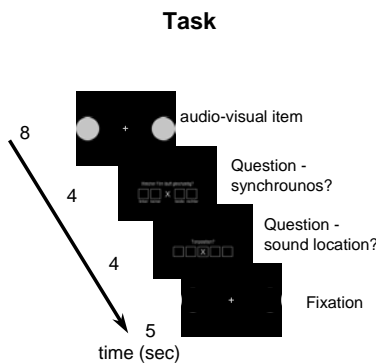
INTRODUCTION

Audio-visual binding - as subset of crossmodal integration - describes the combination of information across both these senses to the subjective unified perception of a bound object. Simultaneous auditory-visual stimulation biases the perceived localization of an auditory stimulus towards a visual one, if the visual stimulus offers higher spatial precision. This is known as ventriloquism-effect. We investigated audio-visual binding by using this bias-effect to act as an indicator for perceived binding. We thereby consider that trials, in which participants reported a ventriloquism-effect, represent consciousness-related object-binding (perceived bound objects).

AIM

Aiming at consciousness-related binding the study focuses on the comparison of a "bound" object with "unbound" object-features. Brain-physiological correlates of audio-visual object perception were examined under the aspect of crossmodal integration. fMRI was recorded during task performance (n = 19 subjects) in order to reveal activation in areas discussed to be involved in multisensory processing in the literature.

TASK



(a) In the experimental condition two synchronous stimuli (disc and beep) alternating with a single visual stimulus (disc) were presented. Localization bias towards the disc signaled consciousness-related binding.

(b) The control (no-binding) condition was formed by asynchronously presented stimuli (no localization bias).

DATAACQUISITION

- Angle of vision: 11° vertical, 18° horizontal
- Sound: 440 Hz sinus
- MR-compatible electrodynamic high quality sound stereo headphones
- fMRI-Scanner: 1,5 T - Siemens Symphony, 30 slices, 4 mm thickness, 1 mm Gap
- TR = 3000 ms, TE = 59 ms, flip angle = 90°, FOV = 192, 64 x 64 pixels.

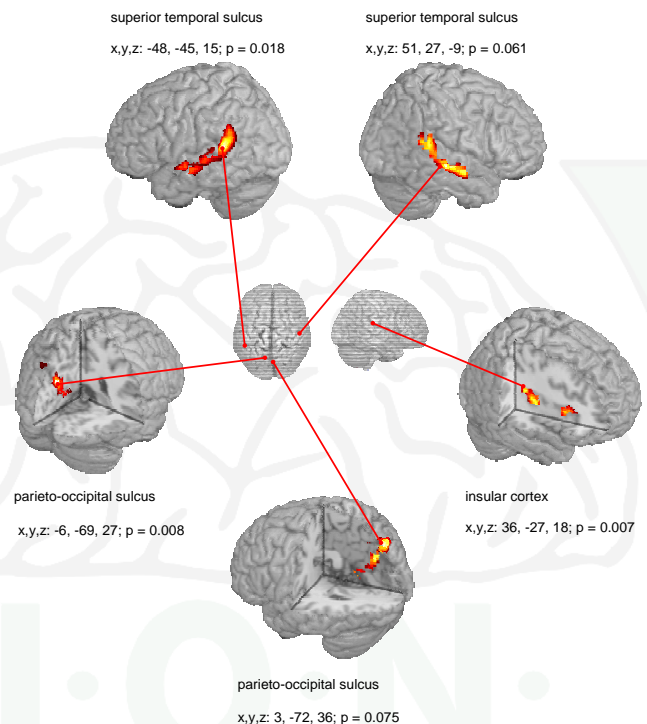
RESULTS

Contrasting trials with reported ventriloquism-effect vs. the no-binding condition revealed activation in the right insula, left superior temporal sulcus and left parieto-occipital sulcus (ROI-analysis, FWE-corrected at p = 0.05). Right superior temporal sulcus and right parieto-occipital sulcus showed a tendency (ROI-analysis, FWE-corrected at p = 0.1).

DISCUSSION

We consider these activations to result from the consciousness-related feature-binding of a bound object. The same areas showed no significant activation when trials, in which participants did not perceive binding, were contrasted. The results correspond to recent findings, suggesting the insula and superior temporal sulcus to be sensitive to the shared temporal onset of stimuli. Implementing the ventriloquism-effect allows us to relate these activations to consciousness-related processes, which probably are different from stimulus-driven multi-sensory integration in subcortical areas.

ROI-Analysis results
contrast: binding vs. no-binding



n = 19 subjects; p-values FWE-corrected