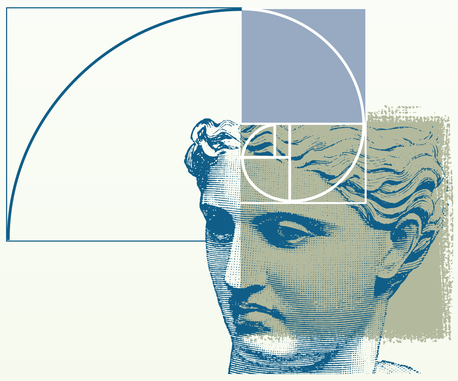
Cross-modal recruitment of auditory and visual cortices following brief exposure to bimodal stimuli



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Introduction

Recent neuromagnetic recording and functional neuroimaging evidence from silent reading of written text or musical notes suggest that exposure to only the visual component of words and musical notes can lead to the activation of auditory areas. Conversely, voices of familiar individuals have been shown to cause activation in the FFA.

Purpose

To test the hypothesis that cross-modal recruitement of auditory and visual cortical areas would only occur when stimuli had been pre-associated.

Methods

Stimuli

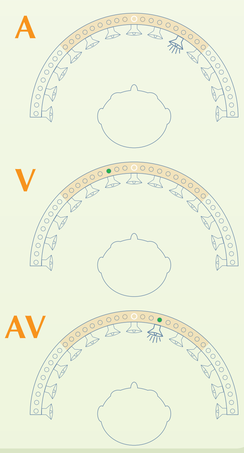
- Simultaneous or separate sequences of white-noise bursts and/or LED flashes (see above).

Experimental design

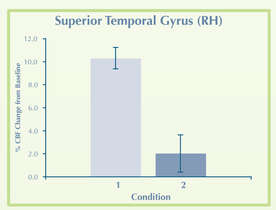
- Condition 1: Scanned while exposed to either the auditory (**A**) or the visual (**V**) components of the bimodal stimuli.
- Condition 2: Pre-exposed to the bimodal stimuli (**AV**); subsequently, same as Condition 1.

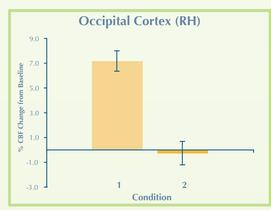
Participants and apparatus

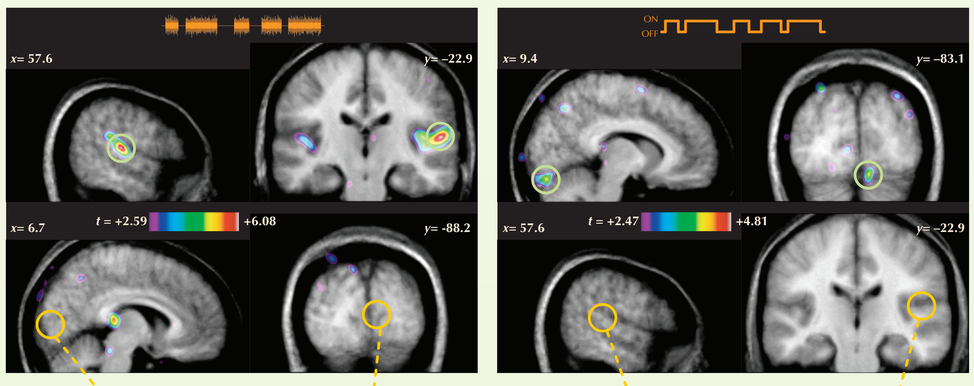
- For Condition 1, 12 (6 female) and for Condition 2, 13 (6 female) young, healthy right-handed individuals were recruited.
- Stimuli were presented using a circular array (radius 24 cm) containing mini speakers and LEDs positioned 15˚ and 5˚ apart, respectively.
- Cerebral blood flow was measured with a Siemens HR+ scanner and the H_2O^{15} bolus method.

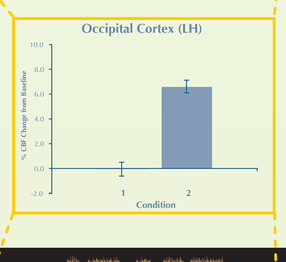


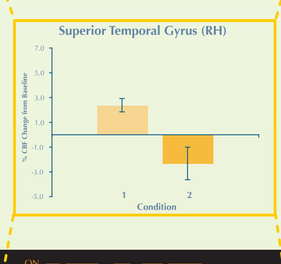
Cross-modal Recruitment (Stimulus – Fixation)

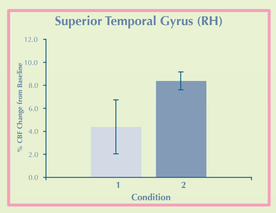


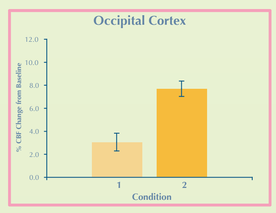




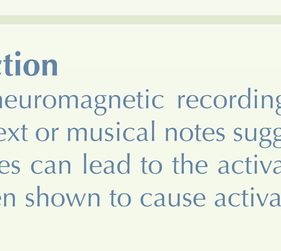


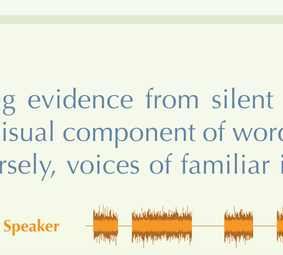


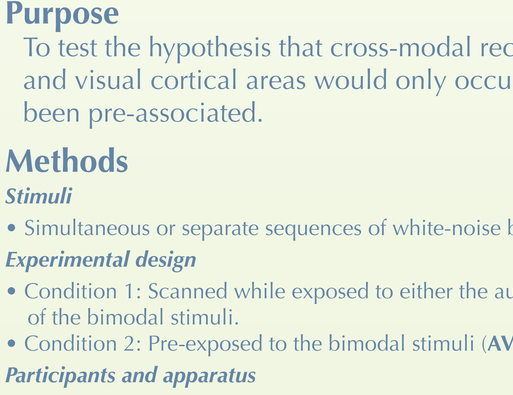


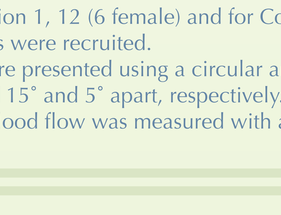


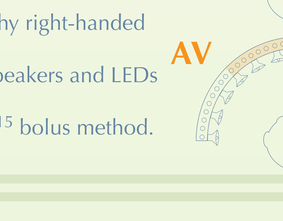
Contrast Analyses



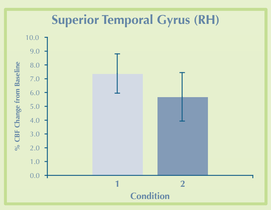


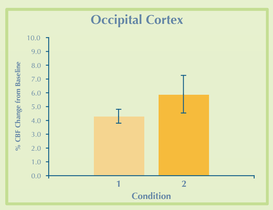


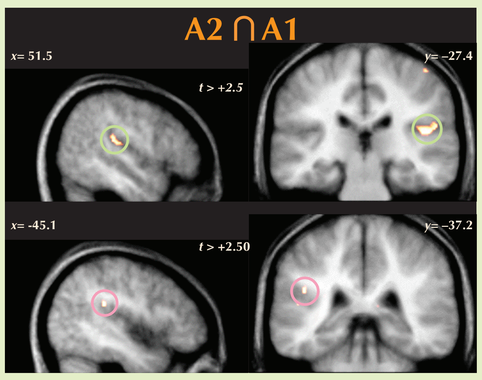


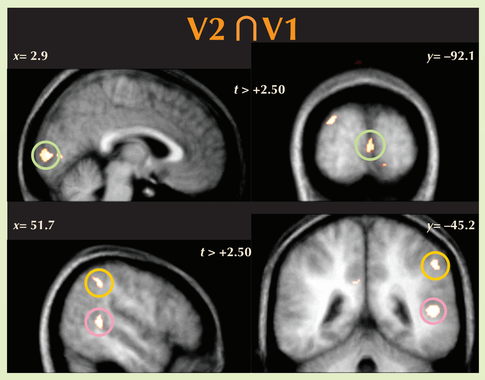


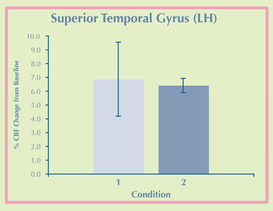
Conjunction Analyses

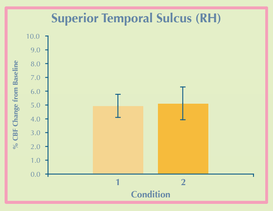


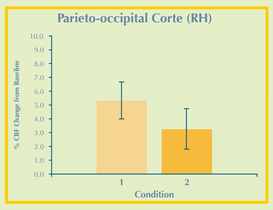




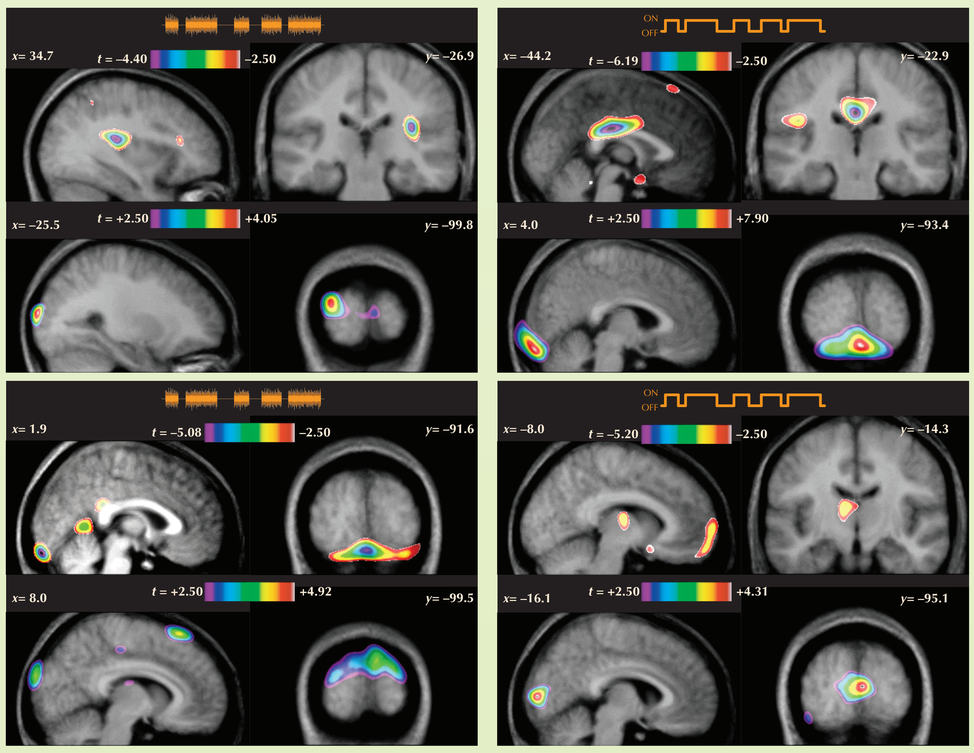








Functional Connectivity Analyses



Summary/Conclusions

- With pre-exposure to the pairing of auditory and visual stimuli, one observes an asymmetic cross-modal recruitment of sensory cotices by way of activation of the visual cortex by the acoustic components of the bimodal stimuli.
- Contrast analyses reveal that the recruitment of the visual cortex by acoustic signals may be linked to the associative nature of the bimodal stimuli during paired presentations, as in the naïve subjects, the visual cortex appears to be deactivated by the same auditory stimuli.
- Conjunction analyses provide further support for the dependence of this phenomenon on pre-association of auditory and visual stimuli, by the virtue of having no voxels of cross-modal cortices being shared in the intersection of the two conditions.
- Functional connectivity analyses provide further support for the asymmetric recruitment of cross-modal sensory cortices in favour of acoustic stimuli.

Acknowledgements

This work was supported by a research grant from the Canadian Institutes of Health Research (CIHR) to RZ and a Postdoctoral Fellowship from CIHR to SZ. We thank Pierre Ahad and Marc Boufard for technical assistance with the testing apparatus and data analysis, respectively. We are especially grateful to Elham Sadoughi-Yazdi for her timely assistance with the experimental setup.