Hemispheric Differences in Change Deafness

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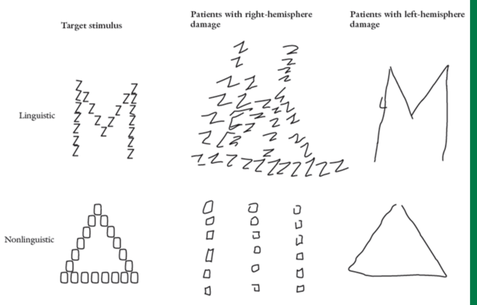
Introduction

It is well-established that the left hemisphere is specialized for processing information in a piecemeal manner, with an emphasis on temporal relationships, while the right hemisphere is specialized for processing information in a holistic manner, with an emphasis on spatial relationships (e.g., Ivry & Robertson, 1998; Robertson & Lamb, 1991).



The purpose of this study was to determine whether the differential hemispheric specialization for processing scenes contributes to perceptual errors.

We examined whether change deafness, the inability to detect changes to auditory scenes, is due to relying on the wrong hemisphere.

A dichotic listening task was utilized to measure hemispheric differences in change detection to both environmental and speech sounds (using both semantic and acoustic changes).

Research Questions

Is change deafness more prevalent when the sounds are presented to the right hemisphere or the left hemisphere?

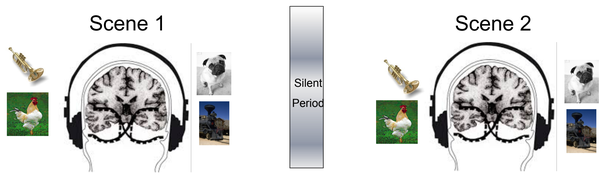
Is change deafness due to global processing or piecemeal processing of scenes? Global processing would be indicated by increased change deafness to changes in the right hemisphere/left ear; piecemeal processing would be indicated by more change deafness to changes in the left hemisphere/right ear.

Experiment 1: Change Deafness with Environmental Stimuli

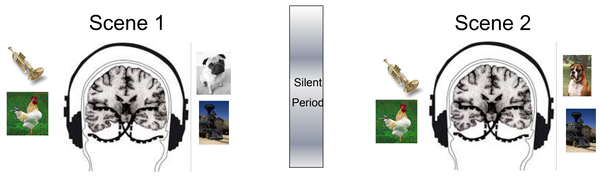
Stimuli: Each auditory scene was composed of 4 one-second environmental sounds.

Procedure: 3 trial types were presented in a Same/Different task

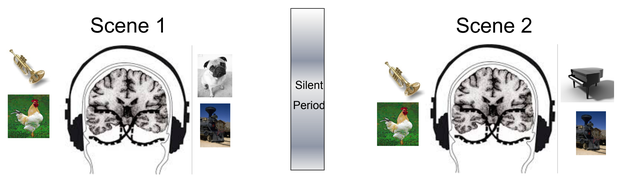
Same scenes: Exactly the same before and after a 350 msec silent period.



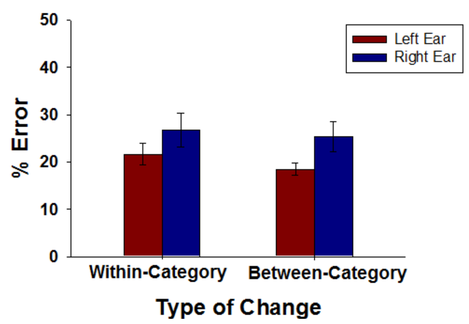
Within-Category Change: One sound changed to a different sound that was acoustically different but semantically the same



Between-Category Change: One sound changed to a different sound that was acoustically and semantically different



Results:



Change deafness rates to within-category and between-category changes were similar. There was no significant effect of Change Type, $F(1,15)=3.09$, $p>.05$.

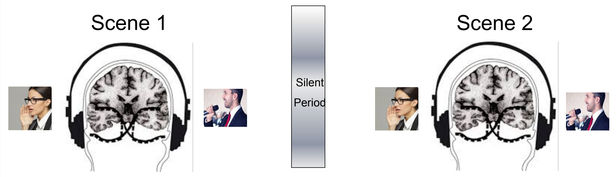
Change deafness rates were higher when the change occurred in the right ear/left hemisphere. There was a left ear/right hemisphere advantage for successfully detecting changes, $F(1,15)=6.76$, $p<.05$.

Experiment 2: Change Deafness with Speech Stimuli

Stimuli: Each auditory scene was composed of 2 one-second verbal speech sounds.

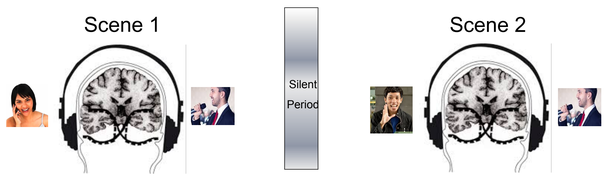
Procedure: 3 trial types were presented in a Same/Different task

Same scenes: Exactly the same before and after a 350 msec silent period.

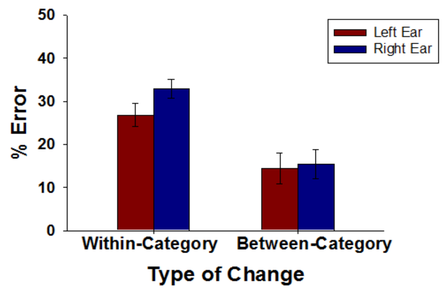


Within-Category Change: One sound changed to a different sound that was acoustically different but semantically the same

Between-Category Change: One sound changed to a different sound that was acoustically and semantically different



Results:



Change deafness occurred more often to within-category changes. There was a significant effect of Change Type, $F(1,12)=49.57$, $p<.05$.

Change deafness rates were higher when the change occurred in the right ear/left hemisphere. This trend was only significant for within-category changes, $F(1,12)=6.95$, $p<.05$.

Conclusions

Change deafness occurs more often when the change is presented to the right ear/left hemisphere. Conversely, listeners were more successful at detecting changes when the sound change was processed by the right hemisphere.

The right hemisphere advantage in detecting changes to environmental and speech sounds suggests a hemispheric specialization for change detection.

This finding suggests that relying on the left hemisphere, which is specialized for processing the details of scenes, increases perceptual errors, such as change deafness.

The right hemisphere advantage for successfully detecting changes suggests that a strategy based on the global representation of the auditory scene is more effective for successful change detection.

The results of the present study suggest that processing the details leads to more perceptual errors than processing the global acoustic gist. In other words, to avoid perceptual errors, hearing the forest is better than hearing the trees.

References

Ivry, R. B., & Robertson, L. C. (1998). *The two sides of perception*. Cambridge, MA: MIT Press.

Robertson, L. C., & Lamb, M. R. (1991). Neuropsychological contributions to theories of part/whole organization. *Cognitive Psychology*, *23*(2), 299-330.