The Emergence of Early Sound Categorical Responses in the Human Brain

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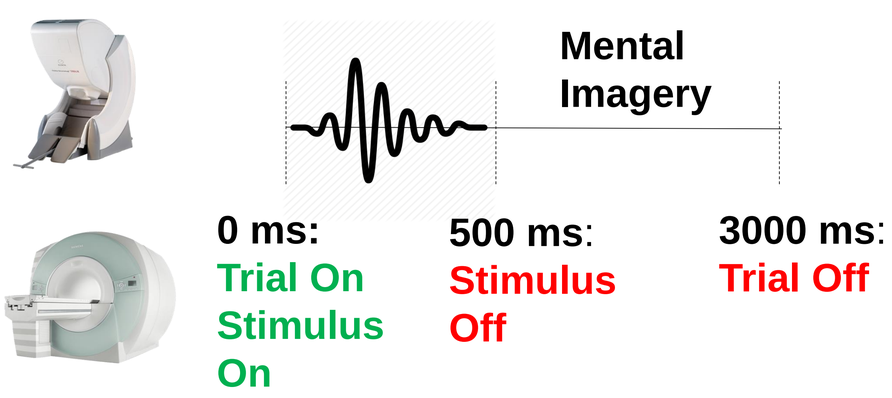
Introduction

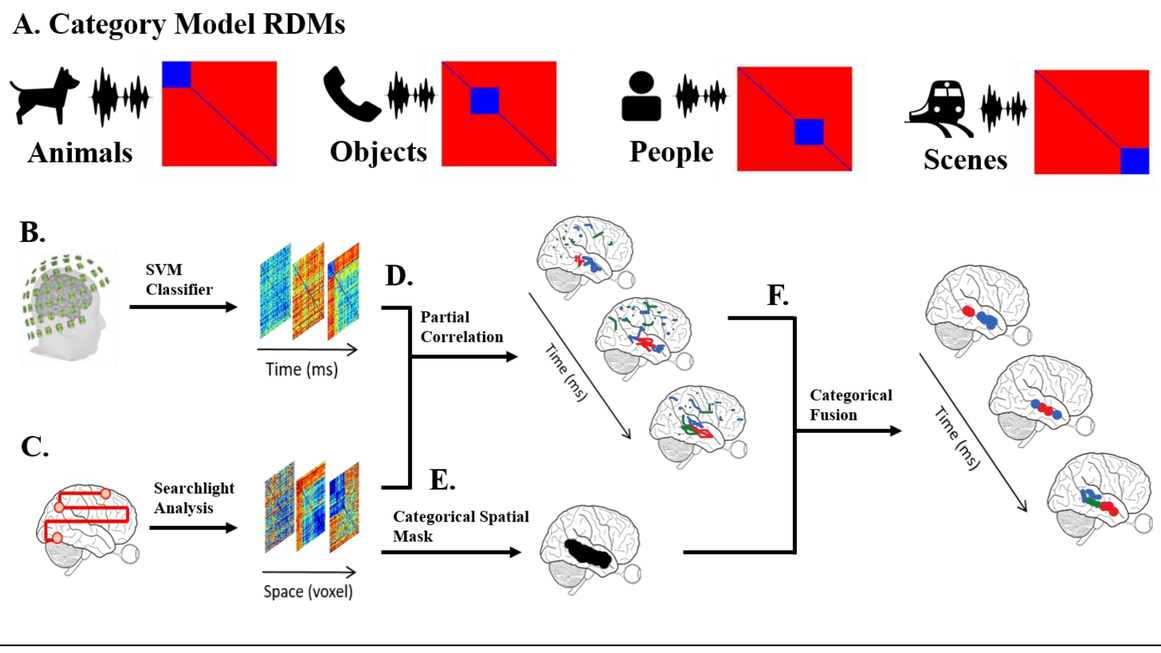
- Humans can rapidly and efficiently identify environmental sounds (e.g. a dog barking or a phone ringing), but the underlying neural mechanisms of this categorization are largely unknown.
- We extend the fMRI-MEG fusion approach of Cichy and collaborators [1] to investigate the spatial and temporal dynamics of human sound perception as a function of sound category (people, animals, objects, scenes).
- Understanding the brain's quick and robust approach to sound categorization could benefit current computational models of audition.

Experimental Design



80 unique sounds across 4 categories

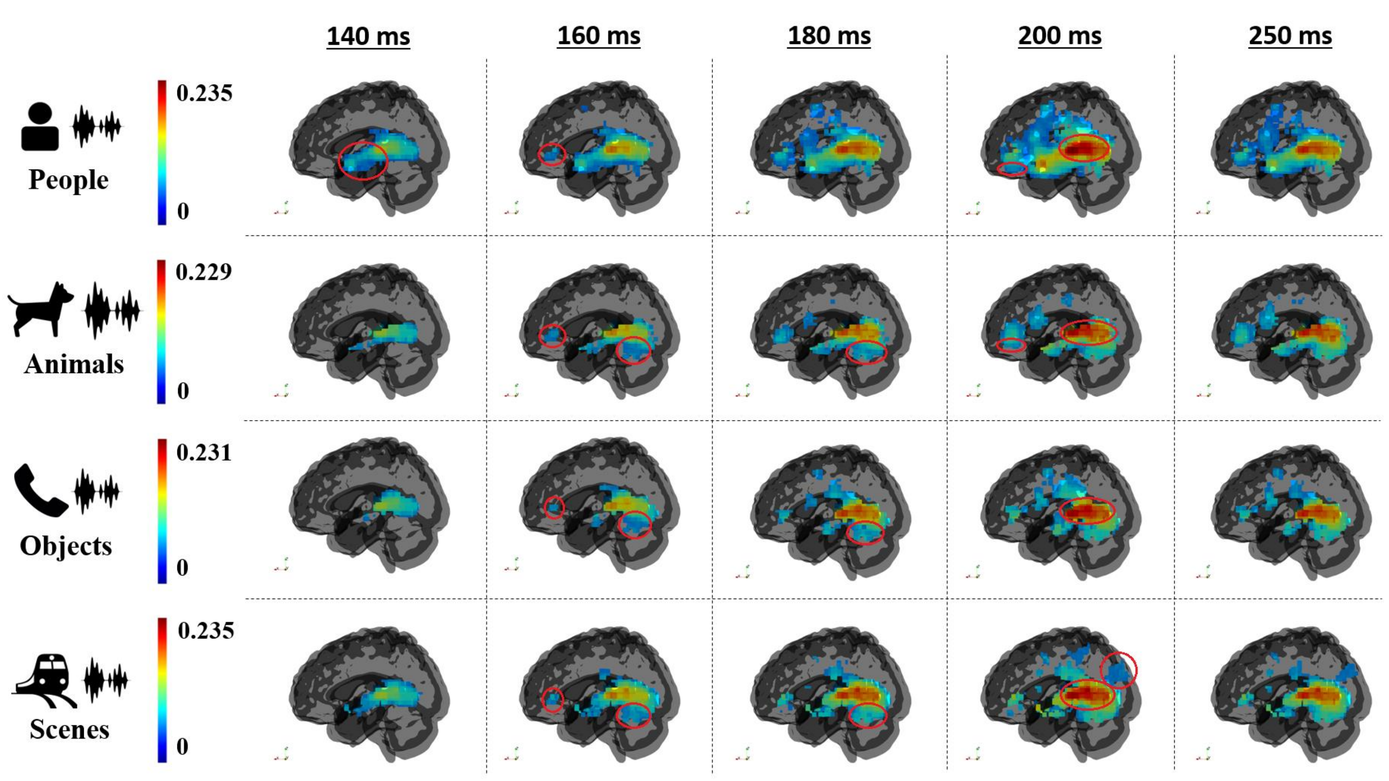
Method



Conclusion

- The human brain seems to process all sounds similarly before distributing the responses to various brain regions according to sound category.
- This method of sound categorization may be responsible for the remarkable robustness and efficiency of the human auditory system. Implementing a brain-inspired architecture in artificial networks may increase their performance.
- Future work should investigate the neural dynamics of brain regions responsible for processing specific categories of sound.

Results



- Brain responses begin to diverge to higher level cortical areas at around 150 ms with respect to sound category.
- The TVA [2], IT cortex, occipital inferior cortex, the orbital part of the LIFG, and the occipital middle gyrus [3] show category specific responses.

References

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[2] Cyril R Pernet et al. "The human voice areas: Spatial organization and inter-individual variability in temporal and extra-temporal cortices". In: *Neuroimage* 119 (2015), pp. 164–174.

[3] Edmund T Rolls, Marc Joliot, and Nathalie Tzourio-Mazoyer. "Implementation of a new parcellation of the orbitofrontal cortex in the automated anatomical labeling atlas". In: *Neuroimage* 122 (2015), pp. 1–5.

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