Effect of attention on neural correlates of auditory perception in schizophrenia

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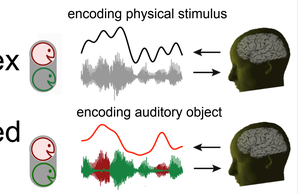
Background

Auditory hallucinations: a hallmark symptom of schizophrenia.

Mechanisms?
- Bottom-up: misprocessing of external input.
- Top-down: misattribution of internal content.

Anatomy
- Structural and functional abnormalities in the left temporal lobe.[1]
- Disrupted left-right asymmetry, e.g. Right Ear Advantage.[1,2]

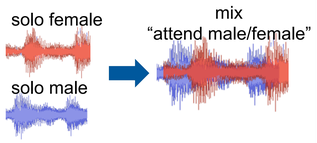
Attention and auditory perception: "cocktail party" paradigm.
- Encoding discrete auditory objects within a complex environment.
- Perceptual enhancement of attended vs unattended stimuli.[3]



Methods

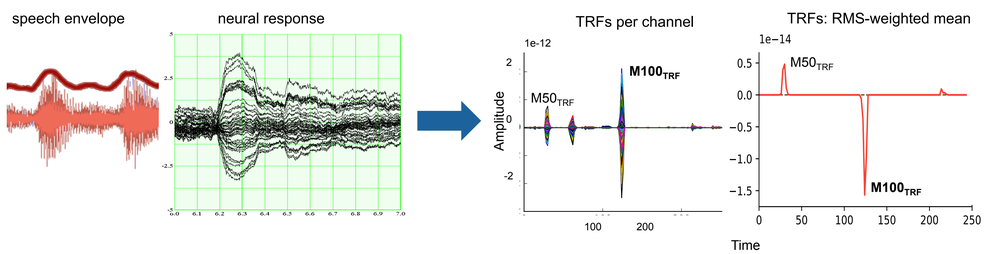
Participants
- 22 patients with schizophrenia (SZ; 7 female).
- 27 healthy controls (HC; 8 female).
- Matched for age, handedness, smoking status.

Stimuli
- 60s audiobook segments.
- Male/female narration.
- Counterbalanced for target gender.
- Mixed into single channel, presented binaurally.



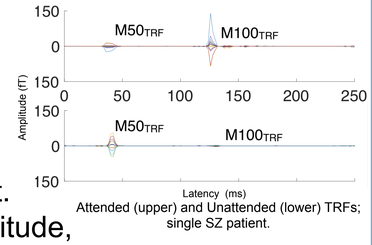
MEG Recording
- 157 channel KIT/Eagle MEG Scanner; 1 kHz sampling frequency.
- Denoised by Time-Shift PCA (TSPCA).[4]
- Denoising Source Separation (DSS)[5,6] enhances response reliability over trials (*D*=6).

Temporal Response Functions (TRFs)
- Deconvolves neural activity evoked by continuous speech envelope, using envelope to model neural response.
- TRF components follow features of envelope at fixed latency: **M100$_{TRF}$.**

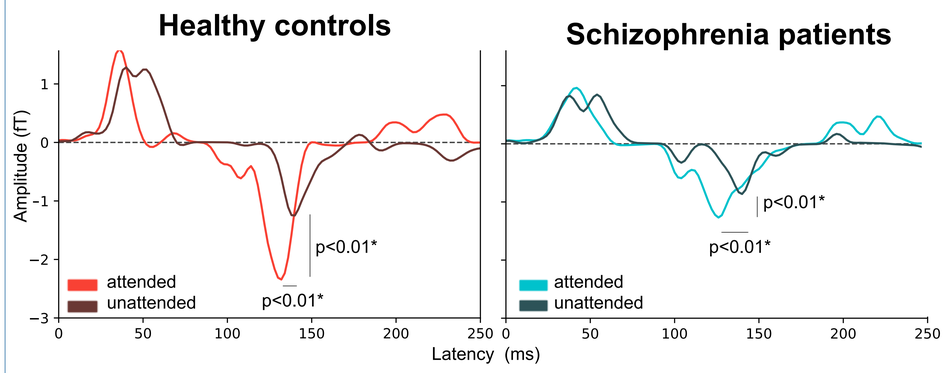


Results

Attended vs Unattended speech
- Separate TRFs calculated for attended and unattended speech.
- Component of interest: M100$_{TRF}$.
- M50$_{TRF}$ likely too early for attention; typically shows less (if any) enhancement.
- Measures of interest: M100$_{TRF}$ peak amplitude, latency of peak.
- Response to attended vs unattended speech is stronger and faster for both groups.

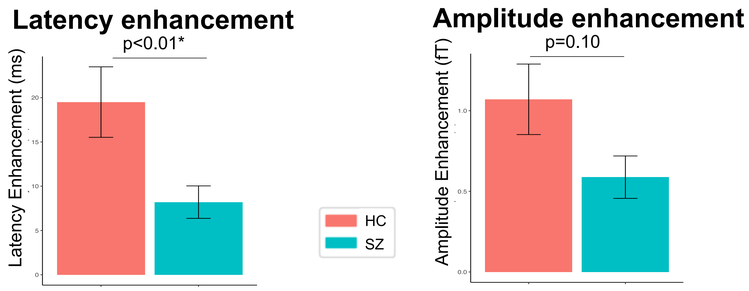


Attended (upper) and Unattended (lower) TRFs; single SZ patient.



Linear mixed effects models: M100$_{TRF}$ latency/amplitude ~ Condition (Att/Unatt) + Age + Sex + Handedness + (1 | Subject)

Attentional enhancement
- Difference between TRF$_{Attended}$ and TRF$_{Unattended}$ latency/amplitude.
- HC show greater enhancement than SZ, especially for latency.



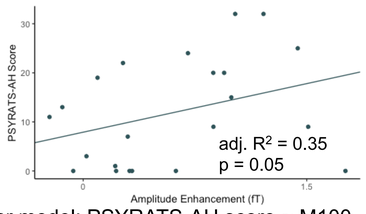
Linear models: M100$_{TRF}$ Enhancement ~ Diagnosis (SZ/HC) + Age + Sex + Handedness

Discussion
- Enhancement happens for SZ and NC both.
- Less enhancement for SZ:
  - impaired top-down control?
- Latency differs most between SZ and HC: Right Ear Advantage diminished/absent in SZ[1,2]?

Next Steps

Auditory Hallucinations
- AH contributing factor: perceptual hypervigilance.[7,8]
- AH valuated with PSYRATS – AH
  - Higher score = more hallucinations.
- Higher AH score ~ greater amplitude enhancement for SZ.

Schizophrenia patients



Linear model: PSYRATS-AH score ~ M100$_{TRF}$ amplitude enhancement + Age + Sex + Handedness
- Perceptual hypervigilance enhances biases, producing a higher likelihood of accepting false signal as real[8] ➔ more AH.
- More vigilant ➔ more attentive ➔ greater enhancement?

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