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.

Attentional enhancement

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

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?²,³

Next Steps

Auditory Hallucinations

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

Schizophrenia patients

- Perceptual hypervigilance enhances biases, producing a higher likelihood of accepting false signal as real⁹ ➔ more AH.
- More vigilant ➔ more attentive ➔ greater enhancement?

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References