

Psychosis is Associated with Attenuated Early Alpha Synchronization and Normative Late Alpha Desynchronization During Auditory Processing

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Background

- Schizophrenia is a heterogeneous disorder often associated with impaired selective attention.¹
- There is a well established literature linking alpha power modulation to selective attention during visual and auditory perception.^{2,3,4}
- A previous study from our group reported attenuated auditory N1 component amplitudes, elicited during a dichotic listening task, in patients with schizophrenia.⁵
- Given the duration of the auditory N1 (~90-110ms or ~100ms), it's possible that alpha wave synchronization (8-12hz) contributes group differences in N1 amplitude (10hz = 100ms per cycle) which may provide insight into the functional significance of the N1 component.⁶

Objectives

- Can diminished selective attention, as indexed by alpha modulation, help explain perceptual deficits in schizophrenia?
- Is aberrant auditory processing specific to schizophrenia as compared to first degree relatives of patients with schizophrenia and patients with bipolar disorder?

Demographics

Table 1. Participant Demographic Characteristics and Symptom Ratings

Index	SCZ (n=60)	BP (n=34)	CON (n=50)	SREL (n=37)	Statistics
Age	40.6 (11.4)	47.4 (10.2) ^a	45.6 (10.2)	46.1 (9)	$F_{(3,175)} = 3.9, p = .01$
Percent Female	27%	24%	50%	60% ^b	$\chi^2_{(3)} = 16.2, p = .001$
Education	14 (2.2)	14.4 (2.4)	15.1 (1.9) ^c	14.7 (1.9)	$F_{(3,175)} = 2.9, p = .05$
Estimated IQ (WAIS-III)	98.8 (15.3) ^d	101 (12.9)	109.1 (14.9)	109.2 (15.8)	$F_{(3,175)} = 39.6, p < .001$
Schizotypal Characteristics (SPQ Total Score)	33 (14.9) ^e	18 (12.7) ^e	10.4 (9.1)	9.7 (8.9)	$F_{(3,175)} = 6.2, p < .001$

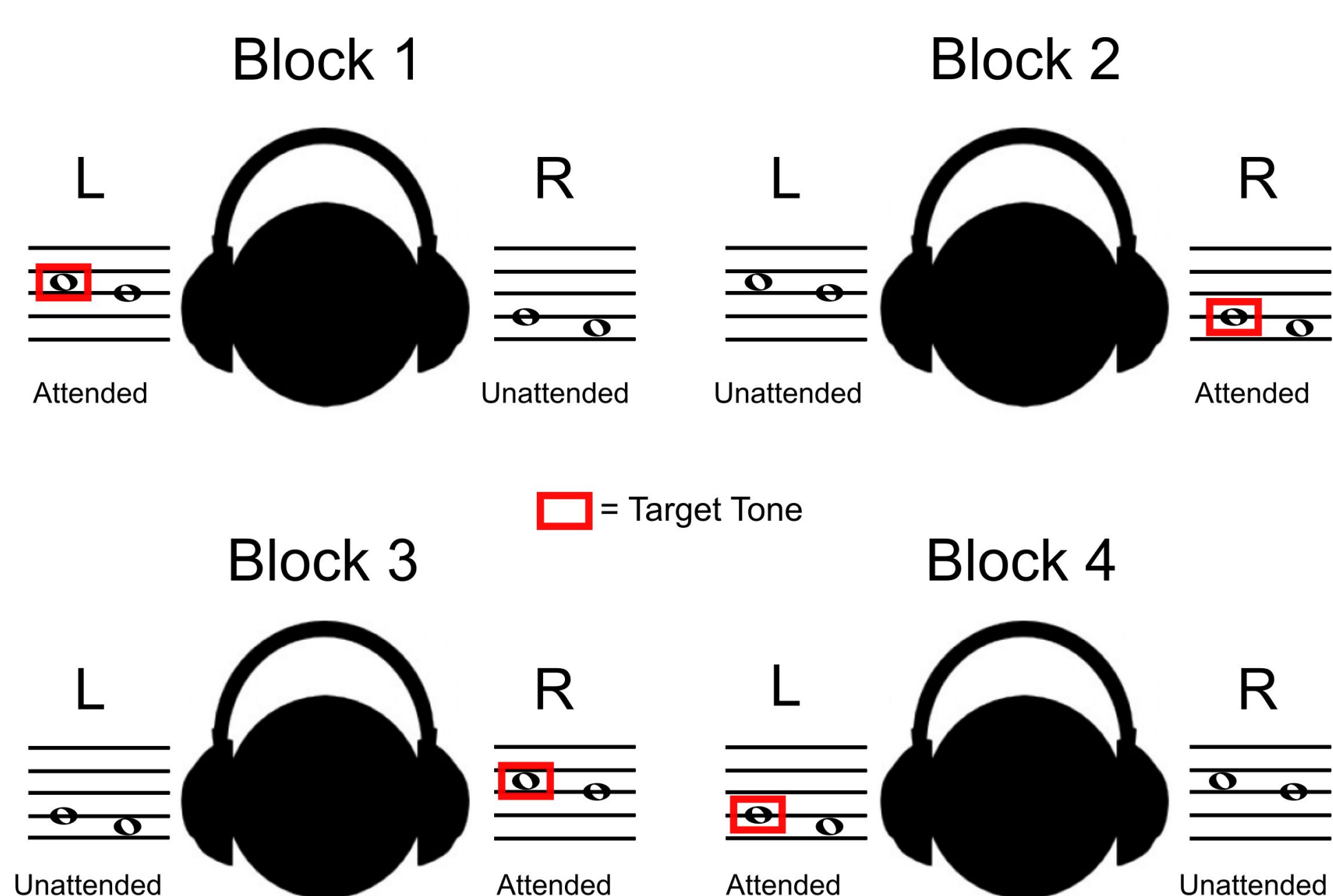
All data are presented as Mean (Standard Deviation), unless otherwise noted. All posthoc analyses corrected for multiple comparisons via Tukey's HSD.

a. Significant difference in age between BP and SCZ, $p = .02$.
 b. Ratio of males to females was significantly different between SREL and both SCZ and BP, $ps < .01$.
 c. Significant difference in years of education between CON and SCZ, $ps < .03$.
 d. Estimated IQ was lower in SCZ compared to CON and SREL, $ps < .007$.
 e. Both SCZ and BP exhibited higher schizotypal characteristics compared to CON and SREL, $ps < .03$.

Methods

- A four tone dichotic listening task was administered to patients with schizophrenia (SCZ), patients with bipolar disorder (BP), first degree relatives of patients with schizophrenia (SREL) and controls (CON) as part of a family study of severe psychopathology at the Minneapolis VA Medical Center.

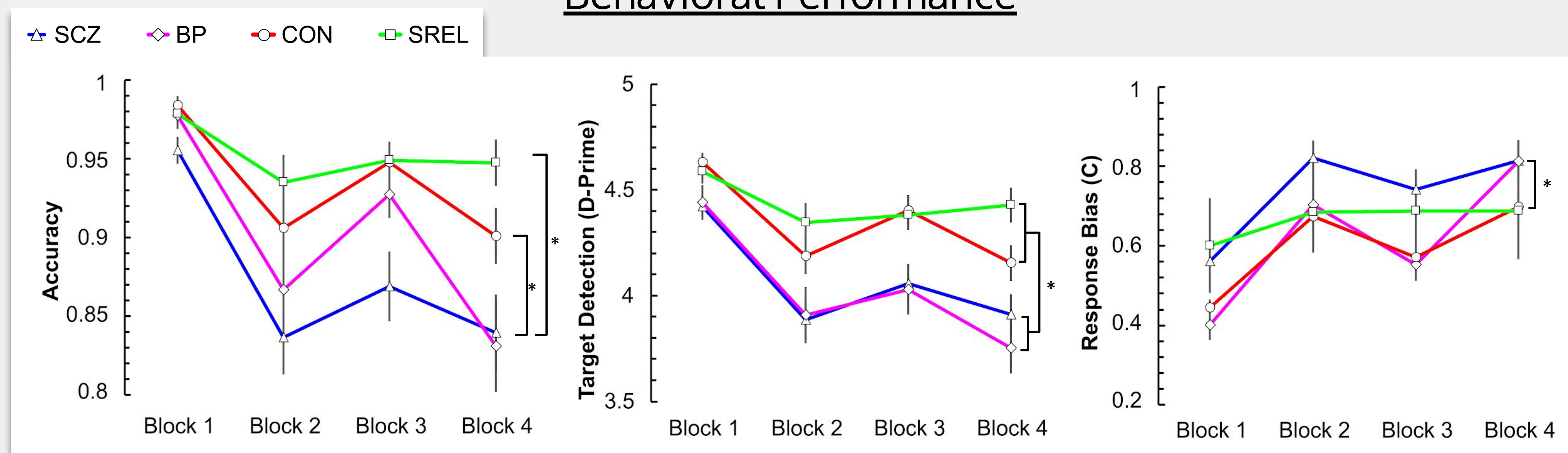
Four-Tone Dichotic Listening Task



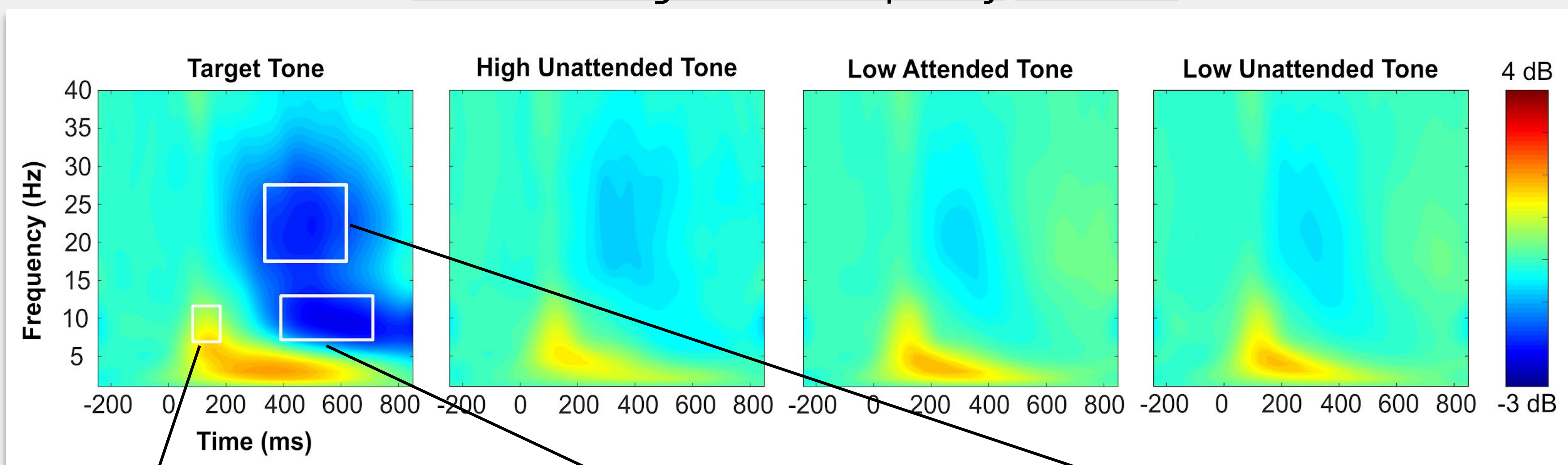
If you are interested in the EEG methods used here (system specifications, preprocessing and time-frequency analysis information) follow this QR code to see my supplemental materials. Or you can just ask me!

Results

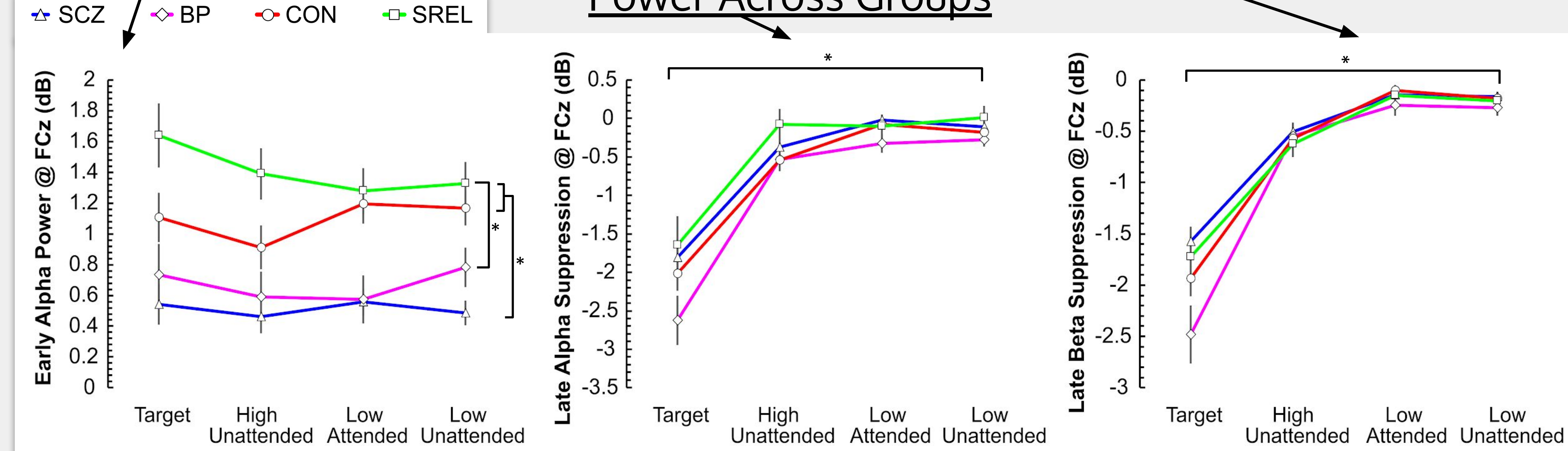
Behavioral Performance



Grand Average Time Frequency Surfaces



Power Across Groups



Findings

Behavioral:

- SCZ exhibited decremented accuracy and more conservative response biases (indexed by more positive C scores) across conditions compared to CON and SREL.
- BP and SCZ both exhibited worse target discrimination (indexed by d-prime) compared to CON and SREL.

EEG:

- SCZ exhibited attenuated early alpha synchronization (80-175ms post-stimulus) compared to both SREL and CON while BP significantly differed from SREL only.
- Although, there was an effect of condition on all groups' late alpha (400-700ms) and beta (375-600) desynchronization, there were no significant differences between groups.
- Correlations between task performance indices and early alpha synchronization were run, but did not reach significance.

Note: test statistic values can be found via QR code.

Conclusions

- SCZ exhibited impaired performance on a dichotic listening task and attenuated event-related early alpha synchronization.
- Reduced alpha synchronization may reflect deficits in selective attention in SCZ, but do not fully explain decremented auditory discrimination.
- Strong effects of condition, but lack of group differences in late alpha and beta suppression suggest a specific deficit in early auditory processing, but intact higher order attentional processes.
- BP generally exhibited similar, though less profound, behavioral and ERP deficits as compared with SCZ suggesting that dysfunctional auditory processing is not specific to SCZ.
- Further analyses will investigate associations with other relevant frequency bands (e.g. delta/theta) and clinical outcomes.

Citations

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