

# Intrinsic Network Connectivity Differentially Predicts Components of Attention in Patients with Schizophrenia and Bipolar Disorder

M.A. Hunter<sup>1,2,3,4</sup>, V.P. Clark<sup>1,4,5</sup>, V.D. Calhoun<sup>3,4,5,6</sup>, Y. Chen<sup>7</sup>, J.C. Edgar<sup>7</sup>, M.X. Huang<sup>8,9</sup>, B. Howell<sup>2,3</sup>, and J.M. Cañive<sup>1,2,3,4</sup>

1. Dept. of Psychology, The University of New Mexico (UNM), Albuquerque, N.M., U.S.A. 2. Psychiatry Research, Raymond G. Murphy VA Center, N.M. 3. Dept. Psychiatry, UNM. 4. The Mind Research Network & LRRI, N.M. 5. Dept. Neurosciences, UNM. 6. Depts. Electrical & Computer Engineering, UNM. 7. Dept. Radiology, Children's Hospital of Philadelphia. 8. Dept. Radiology, University of California San Diego. 9. Research and Psychiatry Services, VA San Diego Healthcare System.



## Background & Hypotheses

- Schizophrenia (SZ) and bipolar disorder (BP) are recurrent and heterogeneous illnesses that cause significant disability. In recent years, traditional diagnostic constructs have been increasingly challenged, especially in the cases where prominent neurocognitive and symptom dimensions cut across diagnostic boundaries.
- In order to characterize and understand the common relationships between SZ and BP, it is essential to identify the overlapping patterns of abnormalities. However, we also hypothesized that there may be unique differences, which can be found in the multifactorial attributes of attention, intrinsic brain dynamics and/or symptom ratings.

## Measures of Attention

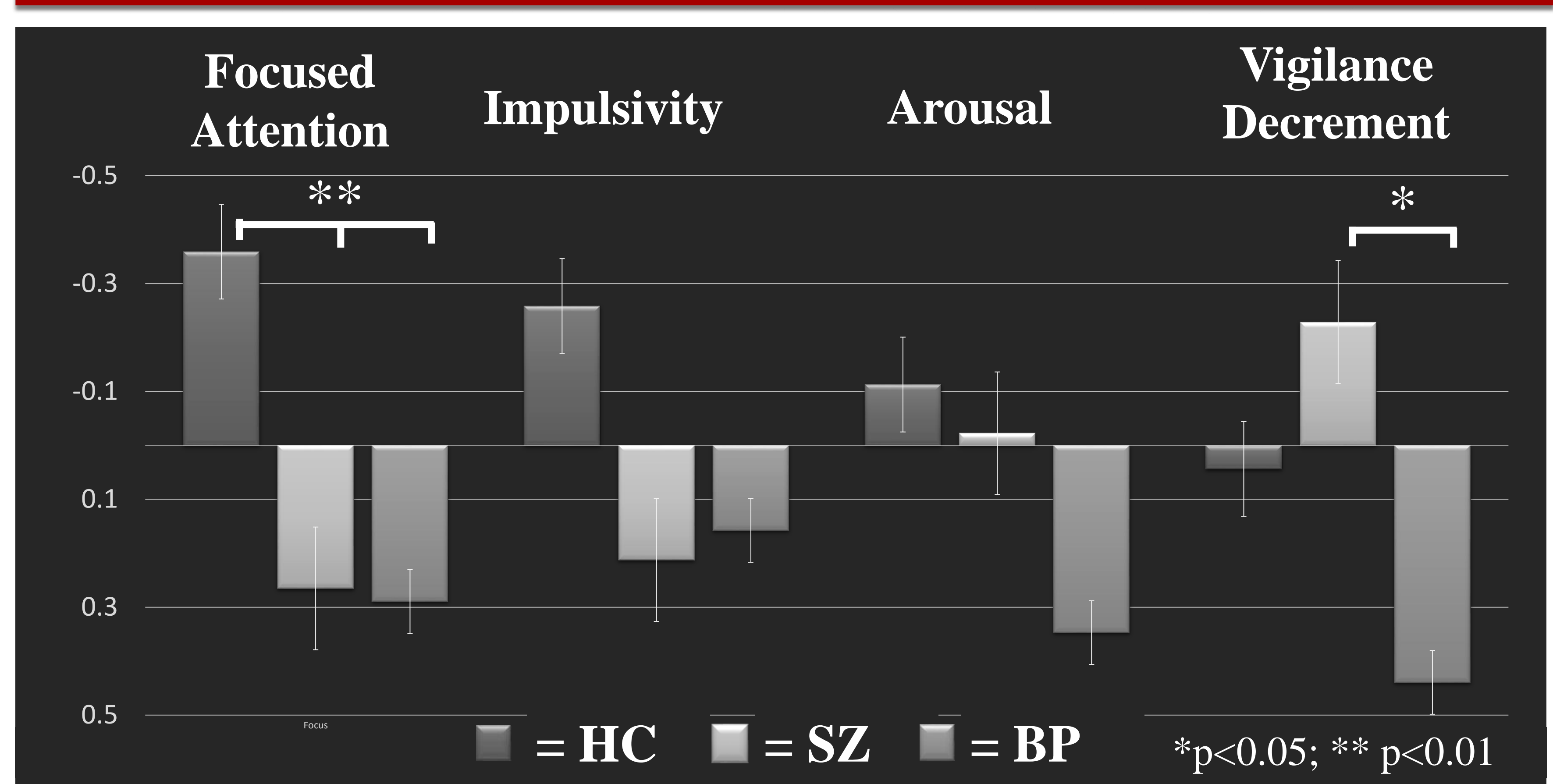
- Performance on the Conner's continuous performance task II (C-CPT) and resting-state fMRI were obtained from 41 chronic SZ patients, 17 euthymic BP patients with a history of psychosis, and 44 demographically-matched healthy controls (HC). This task measures the ability to direct and focus attention on a specific stimulus for an extended period.

### C-CPT Factor Structure (n=102)

Variables	Focused Attention	Impulsivity	Arousal	Vigilance Decrement	Factor Communalities
Variability	.858	.002	.375	.029	0.86
Hit RT SE	.825	.195	.433	.022	0.89
Omissions	.719	.241	-.045	.281	0.68
Perseverations	.703	.008	-.104	-.037	0.55
Commissions	.299	-.839	-.148	.033	0.81
Hit RT	.449	.753	.144	.034	0.77
Response Style	.426	.704	-.132	.106	0.69
Hit SE ISI Change	.042	.041	.829	.024	0.72
Hit RT ISI Change	.104	.062	.818	.007	0.68
Hit RT Block Change	-.009	.016	-.015	.875	0.77
Hit SE Block Change	.111	.035	.067	.843	0.72
<b>Factor model fit</b>					<b>Cumulative</b>
Variance explained	32.80%	14.69%	13.53%	12.62%	<b>73.67%</b>

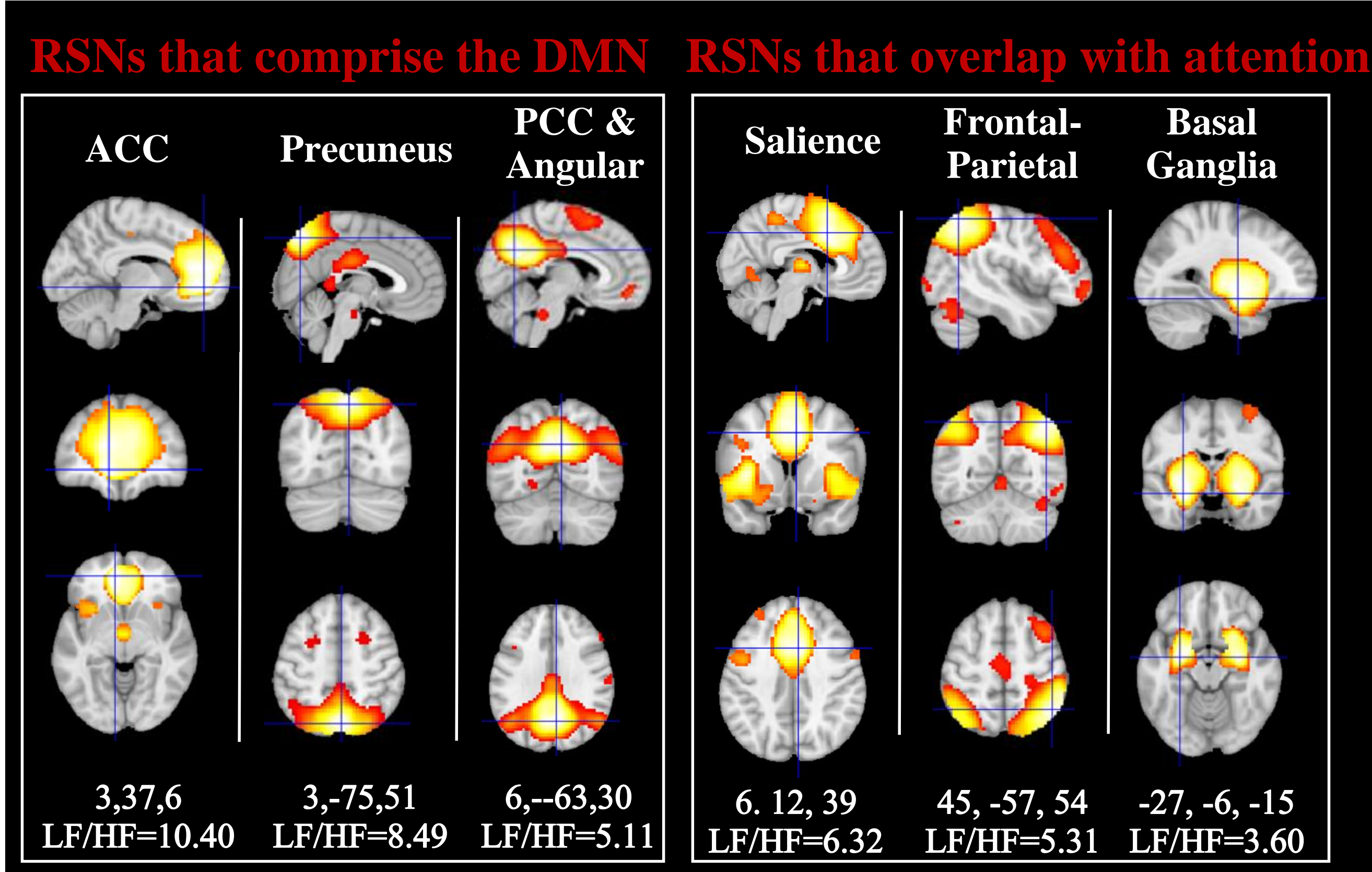
**Extraction method:** principal component analysis with VARIMAX rotation and Kaiser normalization; converged in 6 iterations. KMO measure of sampling adequacy=0.60,  $P < 0.001$ . RT = reaction time; SE = standard error; ISI = inter-stimulus interval.

### C-CPT Factor Score Group Comparisons

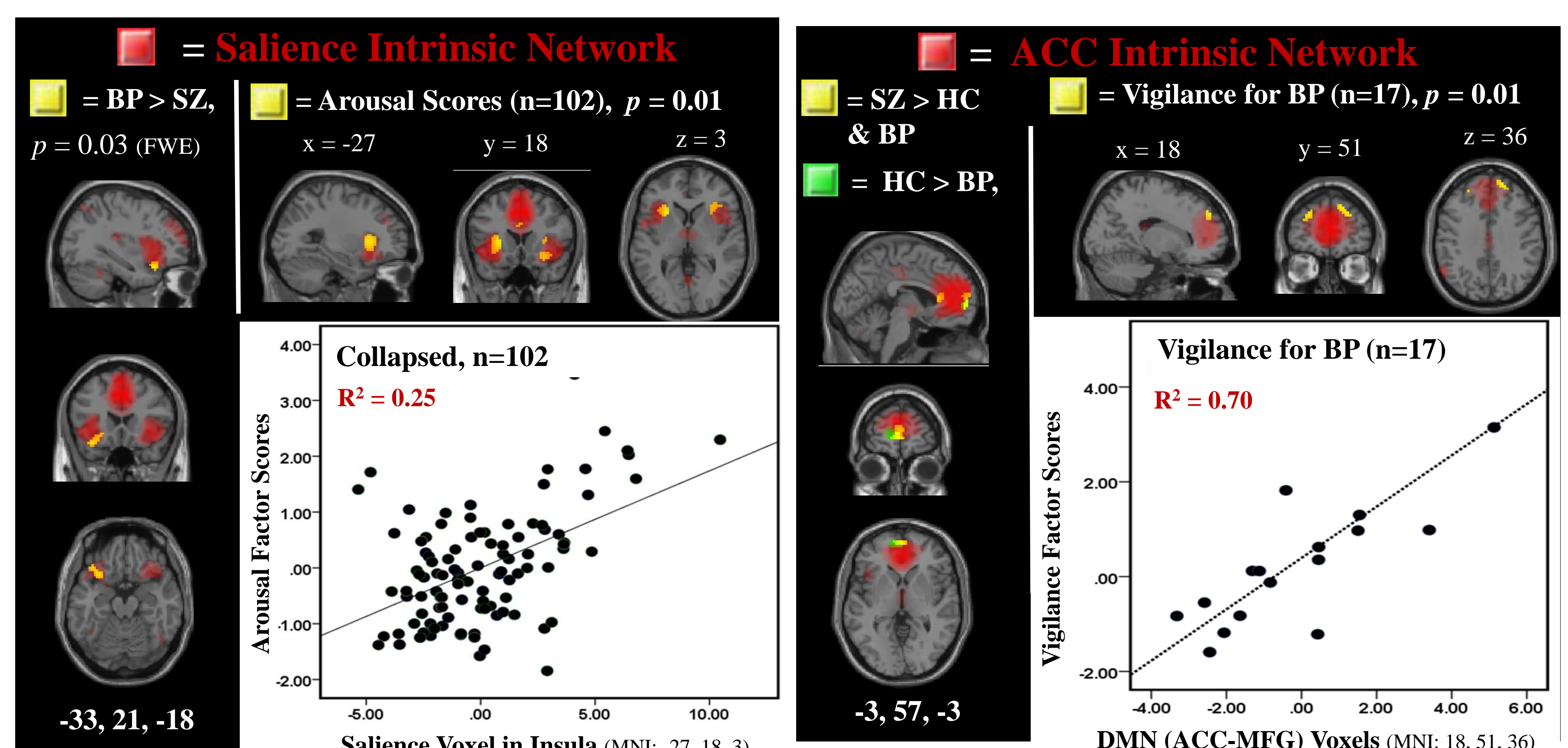


**fMRI Methods:** Resting-state fMRI measures were obtained within 8 days (on average) of the C-CPT. High-resolution T2\*-weighted functional images were acquired using a gradient-echo EPI sequence with, TR=2s, flip angle=75°, slice thickness=3.5mm, for a total of 5-mins with eyes-closed. Group independent component analysis (ICA) decomposed fMRI scans into 75 networks. Six resting-state networks were identified with significant voxel-wise functional connectivity in anatomical regions of interest. To compare C-CPT normalized factor scores and ICA-generated spatial maps, 3-way ANCOVAs were computed (using  $p < 0.05$ , FWE-corrected, with age, sex and motion displacement as covariates). Multiple regressions in SPM8 tested their relationships.

### Group-level ICA-generated Source Maps



### Group Comparisons on RSNs and Attention Relationships



### SVM Rank-ordered Classification of Attributes

Support Vector Machine Learning		Logistic Regression*
SVM Rank-ordered Attributes*	Weight Magnitudes	Coefficients
Negative Symptoms (PANSS)	1.1 +- 0.3	0.27
ACC RSN SM Contrast	2.0 +- 0.45	16.35
Vigilance Decrement (CPT)	4.1 +- 1.3	-0.49
General Symptoms (PANSS)	4.2 +- 1.4	0.06
Arousal (CPT)	5.4 +- 1.43	
LH Insula (Salience) RSN SM	5.9 +- 1.51	
Impulsivity (CPT)	6.2 +- 1.25	
Focused Attention (CPT)	8.1 +- 1.3	
Positive Symptoms (PANSS)	8.9 +- 1.76	
RH Insula (Salience) RSN SM	9.1 +- 0.83	

**Within-patients Classification Accuracy: 85%**

### Conclusions

- While a shared cognitive impairment in focused attention was observed in both patient groups, sub-functions of attention (e.g., vigilance) may be differentially impaired.
- The observed differences in intrinsic connectivity of the ACC and the left insula of the salience networks may contribute to the unique impairments found in the patient's attentional profiles.
- Although the current results support a dimensional approach to psychosis, research is still needed to further examine the various differences in patient characteristics and neural systems in order to tailor unique and specific treatment interventions.



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