Methods: 150 probands with a psychotic disorder, 100 first degree relatives, and 50 healthy controls in the Psychosis Human Connectome Project will complete the DPX task while undergoing 3T functional magnetic resonance imaging scan. Traditional general linear model, as well as a novel multiway method called parallel factor analysis, will be used to examine brain mechanisms involved in proactive as well as reactive control during the DPX task.

Results: In a preliminary analysis of 24 probands (38.3 ± 12.8 years, 9 females) and 27 healthy controls (36.2 ± 14.0 years, 11 females), probands showed behavioral deficits in proactive control as compared to healthy controls. Neuroimaging analysis in healthy controls with general linear model showed a cluster in the left inferior frontal gyrus that was involved in both proactive and reactive control. Additionally, overlap in proactive and reactive control was observed in bilateral supramarginal/angular gyrus and right inferior occipital gyrus, although these two mechanisms also involved distinct brain regions.

Discussion: Consistent with previous findings, probands showed a specific deficit in proactive control in the DPX task. Proactive and reactive control in healthy controls engaged the same brain regions in the prefrontal cortex, replicating findings in rhesus macaques. Further analyses will reveal the role of the prefrontal cortex as well as other brain regions in the cognitive control deficits in psychotic disorders.

T72. NEURAL ABNORMALITIES IN PSYCHIATRIC AND NEUROLOGIC DISORDERS: IDENTIFYING PATHOLOGY AGAINST A BACKDROP OF NORMAL BRAIN DEVELOPMENT

Abstract not included.

T73. IDENTIFYING KEY VOXELS IN SCHIZOPHRENIA THAT ARE CORRELATED WITH AGE OF ONSET AND DURATION OF ILLNESS

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Background: Schizophrenia is a chronic, disabling mental disorder. Patients suffering from multiple degradations. Presently, several different brain regions are found to be involved in the neuropathology of schizophrenia, including limbic and temporal lobe, cingulate gyrus, and basal ganglia [1]. By applying the deep learning method in structural brain magnetic resonance images, an explainable deep neural network (EDNN) framework is used to identify the key structural deficits in schizophrenia [2]. We then sought to identify the correlation between demographic and cognitive profiles and structural deficits in schizophrenia.

Methods: We used the general linear model to examine predictors of clinical assessment scale in response to two different voxel integrity models for patients with schizophrenia. The EDNN key voxels included 183 voxels which were trained by the structural MRI data, which is consisted of 200 schizophrenic patients and 200 age and gender-matched healthy control subjects. Brain MRI images were normalized and segmented into gray matter (GM), white matter (WM), and cerebrospinal fluid (CSF) space. The clinical assessment data were obtained from the same group, including sex, age, onset age, duration of illness, digit span task and mini-mental status examination. Next, the average image intensity from identified key voxels was used as the response, and cognitive data as predictors to build a regression model. We also compared the model results with those obtained from anatomical parcellation with significant between-group differences in the image intensity.

Results: In terms of its predictions to the integrity of grey matters using the linear regression model, the EDNN data yields 0.33 of R-squared value, and on the other hand, anatomical parcellation reaches 0.33 of R-squared value. We also found that the key voxels identified by the EDNN were significantly correlated to the age of onset and duration of illness.

Discussion: Our results suggest that, at the statistical level, our EDNN dataset can derive comparable results using much fewer voxels. The structural deficit identified by EDNN model was mostly contributed by the age of onset and duration of illness, which is consistent with gray matter loss observed in the course of schizophrenia.

T74. EVALUATING COGNITIVE CONTROL MECHANISMS WITHIN PATIENT AND HEALTHY POPULATIONS

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Background: Cognitive control mechanisms enable an individual to regulate, coordinate, and sequence thoughts and actions in order to obtain desirable outcomes. Cognitive control is typically conceptualized as dual processes that occur in frontoparietal regions: proactive control, which uses sustained activation to enact anticipatory planning and goal maintenance, and reactive control, which entails retrieving information as presently needed (Braver, 2012), with patients with schizophrenia being especially susceptible to proactive control impairments (Poppe et al., 2016). However, nonhuman primate research suggests most prefrontal neurons ‘switch,’ firing during both proactive and reactive control, implying overlap between neural encoding of these two processes (Blackman et al., 2016). We sought to examine the overlapping neural circuitry of proactive and reactive control in healthy and patient populations using the Dot Pattern Expectancy Task (DPX).

Methods: 47 patients with schizophrenia (SZ) and 56 matched healthy controls (HC) completed 4 blocks of the DPX through the Cognitive Neuroscience Test Reliability and Clinical applications for Serious mental illness (CNTRaCS). During a 3-Tesla fMRI scan, participants followed the ‘X-then-Y’ rule, in which they were to press one button whenever an A cue was followed by an X probe, and another button for any other non-target stimulus sequence. Dissimilarity between proactive and reactive activation was evaluated within bilateral regions implicated in cognitive control: the medial frontal gyrus, superior frontal gyrus, and anterior cingulate cortex. Neuroimaging data was processed with FMRIB Software Library (FSL) packages. Probe accuracy and reaction time data were divided into ‘first half’ and ‘second half’ groups, depending on the block during which it occurred.

Results: Behavioral data analysis showed HC subjects showed a greater proclivity to engaging in proactive control across the study length than SZ subjects. HC subjects were also faster than SZ subjects in trials that required successful marshalling of proactive control. However, there was no within-subject increase in proactive proclivity or speed across the study procedure, complicating recent findings that suggest proactive control increases as a function of trial set length (Janowich & Cavanagh, 2018).

ROI activation analysis showed no significant difference between HC and SZ proactive – reactive dissimilarity. Interestingly, within-ROI activation levels were significantly negative for both subject groups, implying these regions may be slightly more active during reactive processes.

Discussion: Results point to a between-group difference of relative strengths and weaknesses in proactive control, despite shared neural substrates. The lack of distinct ROI preference for proactive control offers support for the malleable nature of regions implicated in human cognitive control. Future analysis may investigate the association between proactive-reactive ROI dissimilarity and clinical and real-world functioning measures among patients.