Appendix

Appendix 1. Main admission criteria

Main exclusion criteria comprised intellectual disability (estimated full-scale IQ <80), current substance use/abuse, assessed by detailed clinical interview and urine drug screen prior to MRI scan, clinical instability and MRI contraindications (e.g. in-body metal). Clinical diagnoses were ascertained using the Autism Diagnostic Observation Schedule (ADOS; [1]) module 4 for ASD, and the Structured Clinical Interview for DSM-IV (SCID; [2]) for SZ (including schizoaffective disorder, SZA). HC status entailed no current DSM-IV Axis I diagnosis, as determined by the SCID and ADOS as well as a detailed health questionnaire, no history of psychiatric hospitalization or pharmacological treatment, or reported first degree relative diagnosed with ASD, SZ, psychosis or bipolar disorder. All procedures were approved by Hartford Hospital's and Yale University's institutional review boards, and participants gave written informed consent prior to participation.

Appendix 2. List of ICs by network

Network	brain region	X[a]	y[a]	Z[a]
Visual	B. lateral occipital cortex	-30	-97	-8
	B. pericalcarine sulcus	-9	-67	7
	L. lingual gyrus	-12	-46	-5
	B. pericalcarine sulcus	0	-91	4
	L. lingual gyrus	-21	-70	-14
	R. fusiform gyrus	21	-70	-14
	B. fusiform gyrus	42	-64	-20
	B. lingual gyrus	12	-94	-17
	B. superior parietal lobule	24	-67	58
	B. cuneus	0	-79	43
Sensory-motor	B. paracentral cortex	0	-19	73
	R. postcentral gyrus	39	-19	64
	L. postcentral gyrus	-42	-34	61
	B. precentral gyrus	-54	-7	28
	B. posterior insula	-42	-22	10
	B. SMA	0	11	49
	B. STS	57	-28	-5
Control	B. mid ACC	0	-7	31
	L. anterior insula	-39	11	-5
	R. anterior insula	36	17	-11
	B. IPL	63	-25	25
	B. VLPFC	-48	17	25
	B. dorsal ACC	0	29	31

Default mode	B. MPFC	0	56	28
	R. Fronto-parietal cortex^	48	-52	52
	L. Fronto-parietal cortex^	-42	-64	49
	R. post. STS- MTS	57	-55	7
	B. Rostral ACC	0	44	-8
	B. PCC	0	-49	25
	B. precuneus	0	-58	61
	L. STS- MTS	-57	-40	-2
Amygdala-temporal pole	L. amygdala	-24	2	-14
	R. temporal pole	33	8	-26
	L. temporal pole	-33	5	-26
	R. amygdala	24	-7	-23
	L. amygdala	-24	-10	-20
Subcortical	R. pallidum	24	-4	1
	R. putamen (anterior)	18	8	-8
	L. putamen (anterior)	-18	5	-2
	R. putamen (posterior)	30	-16	-2
	L. putamen	-18	14	-8
	L. thalamus	-15	-13	13
	R. thalamus	12	-13	16
	L. thalamus	-12	-22	1
	R. thalamus	12	-19	1
	R. thalamus	18	-34	10
	R. hippocampus- parahippocampus	27	-34	-14
	L. hippocampus	-24	-22	-17
Cerebellum	Cerebellum 1	0	-55	-5
	Cerebellum 2	18	-40	-23
	Cerebellum 3	21	-49	-47
	Cerebellum 4	-15	-49	-17
	Cerebellum 5	-36	-67	-44
	Cerebellum 6	-18	-43	-47
	Cerebellum 7	-27	-40	-17
	Cerebellum 8	-3	-43	-14

[a] MNI coordinates at peak activation.

L.– Left; R.- right; B- bilateral.

IC abbreviations (alphabetically ordered): ACC- anterior cingulate cortex; IPL- inferior parietal lobule; MTS- medial temporal sulcus; PCC- posterior cingulate cortex, SMA- supplementary motor area; STS- superior temporal sulcus; VLPFC- ventrolateral prefrontal cortex

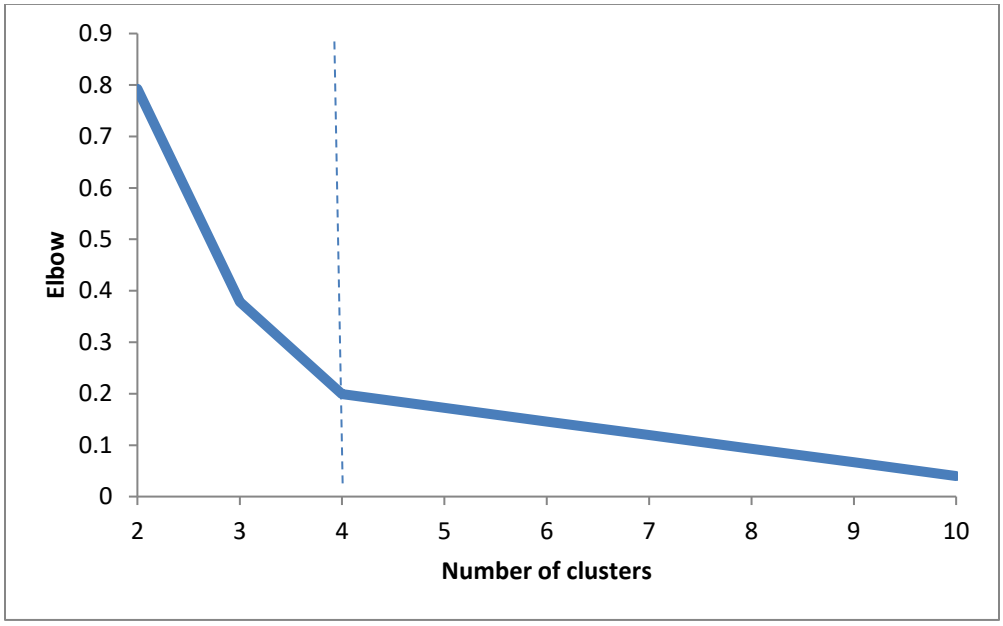
^ fronto-parietal cortex ICs include IPL and DLPFC.

Appendix 3. No correlation between motion and dFNC parameters

To further test an association between head motion (mean framewise-displacement, root mean square) and dFNC parameters, Spearman's correlation was conducted. No correlation was found between any of the dFNC parameters to extent of motion.

Appendix 4. Number of states estimation

The cluster validity index (computed as the ratio of within-cluster distances to between-cluster distance) was used to select the optimal number of distinct states. The elbow criterion indicated four as the optimal number of states.



Appendix 5. Associations between dFNC parameters to medication intake and IQ score

A) To test for the effect of medication intake, sensitivity analyses were conducted. For antipsychotic treatment we examined bivariate correlations between dFNC measures to clorpromazine (CPZ) equivalent dose within each one of the clinical groups.

Correlations between CPZ equivalent dose and dFNC parameters

		NS	NT	FT1	FT2	FT3	DT1	DT2	DT3
SZ	R	-0.115	-0.373	-0.093	0.281	-0.165	0.473	0.196	0.375
	Sig.	0.583	0.066	0.658	0.174	0.432	0.686	0.347	0.138
	N	25	25	25	25	25	3	25	17
ASD	r	-0.614	-0.352	-0.078	0.314	-0.329	.[a]	0.697	-0.342
	Sig.	0.271	0.561	0.901	0.606	0.589	.	0.191	0.658
	N	5	5	5	5	5	1	4	5

[a]. correlation cannot be computed because at least one of the variables is constant

B) Additionally, within each of the clinical groups, we used Welch's ANOVA to compare dFNC values of participants treated vs. not-treated with antipsychotic and antidepressant medications.

Comparisons of dFNC parameters between participants taking <u>antipsychotic</u> medications and those who are not

Taking anti-psychotics?		ASD					SZ				
		N	**Mean**	**Std. Error**	**ANOVA**	**Sig.**	**N**	**Mean**	**Std. Error**	**ANOVA**	**Sig.**
NS	Yes	6	2.000	0.258	$F_{(1, 6810)}$ = 0.303	0.599	29	1.900	0.103	$F_{(1,3.396)}$ = 0.060	0.820
	No	26	2.150	0.107			4	2.000	0.408		
NT	Yes	6	4.00	1.390	$F_{(1,8.776)}$ = 3.839	0.083	29	3.210	0.482	$F_{(1,3.887)}$ = 0.023	0.888
	No	26	7.150	0.811			4	3.000	1.291		
FT1	Yes	6	0.005	0.005	$F_{(1,26.007)}$ = 3.894	0.059	29	0.004	0.003	$F_{(1,3.344)}$ = 0.471	0.537
	No	26	0.074	0.035			4	0.013	0.013		
FT2	Yes	6	0.821	0.071	$F_{(1, 10.559)}$ = 3.348	0.096	29	0.870	0.032	$F_{(1,4.264)}$ = 0.002	0.965
	No	26	0.661	0.050			4	0.867	0.072		
FT3	Yes	6	0.174	0.067	$F_{(1,7.722)}$ = 1.449	0.264	29	0.098	0.021	$F_{(1,3.508)}$ = 0.093	0.777
	No	26	0.265	0.034			4	0.121	0.073		
DT1	Yes	1	26.000	-	-	-	3	18.833	9.338	-	-
	No	6	101.126	23.036			1	44.000	-		
DT2	Yes	6	381.755	108.230	$F_{(1,7.128)}$ = 1.516	0.257	29	441.681	51.201	$F_{(1,3.712)}$ = 0.009	0.930
	No	26	235.878	48.241			4	426.668	152.202		
DT3	Yes	5	67.207	10.560	$F_{(1,5.113)}$ = 0.596	0.474	21	46.125	4.405	$F_{(1,2.063)}$ = 0.540	0.537
	No	24	58.529	3.841			3	72.222	35.246		

Comparisons of dFNC parameters between participants taking <u>antidepressant</u> medications and those who are not

Taking anti-depressants?		ASD					SZ				
		N	**Mean**	**Std. Error**	**ANOVA)**	**Sig.**	**N**	**Mean**	**Std. Error**	**ANOVA**	**Sig.**
NS	Yes	12	2.000	0.213	$F_{(1,15.152)}$ = 0.724	0.402	11	1.820	0.182	$F_{(1, 19.277)}$ = 0.387	0.541
	No	20	2.200	0.092			22	1.950	0.123		
NT	Yes	12	5.080	1.097	$F_{(1, 25.131)}$ = 2.693	0.113	11	2.090	0.563	$F_{(1, 27.582)}$ = 4.110	0.052
	No	20	7.450	0.936			22	3.730	0.578		
FT1	Yes	12	0.018	0.012	$F_{(1, 21.625)}$ = 2.288	0.145	11	0.008	0.008	$F_{(1, 11.839)}$ = 0.309	0.589
	No	20	0.087	0.044			22	0.003	0.002		
FT2	Yes	12	0.780	0.059	$F_{(1, 27.615)}$ = 2.945	0.097	11	0.900	0.045	$F_{(1, 23.588)}$ = 0.615	0.441
	No	20	0.638	0.058			22	0.855	0.038		
FT3	Yes	12	0.202	0.051	$F_{(1, 22.238)}$ = 1.326	0.262	11	0.092	0.045	$F_{(1, 14.096)}$ = 0.070	0.795
	No	20	0.275	0.037			22	0.105	0.020		
DT1	Yes	3	34.111	4.244	$F_{(1, 3.317)}$ = 27.492	**0.010**	1	37.500	-	-	-
	No	4	132.605	18.299			3	21.000	11.504		
DT2	Yes	12	361.718	91.274	$F_{(1, 15.824)}$ = 2.452	0.137	11	520.682	82.191	$F_{(1, 20.084)}$ = 1.452	0.242
	No	20	204.737	42.361			22	399.451	58.045		
DT3	Yes	9	61.250	6.904	$F_{(1, 14.680)}$ = 0.047	0.831	7	45.286	9.517	$F_{(1, 12.884)}$ = 0.240	0.633
	No	20	59.474	4.363			17	51.076	7.024		

Bold- significant result

C) Similarly, since IQ average differed between the groups, bi-variate correlation were calculated between IQ score to each of the ordinal dFNC measures, within each one of the diagnostic groups.

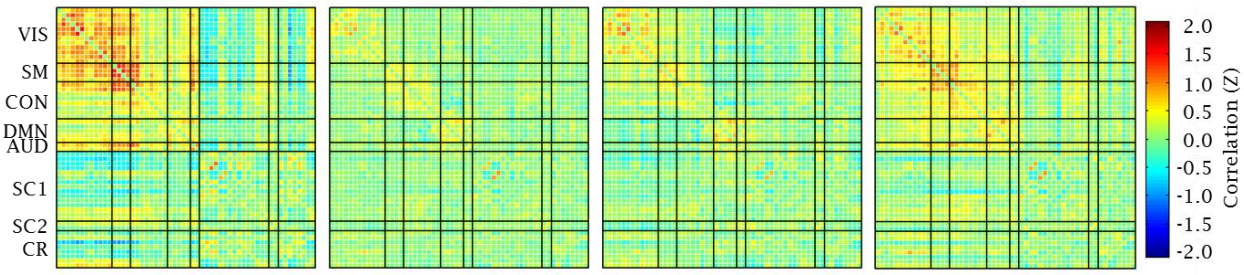
Correlations between full scale IQ score and dFNC parameters

		NS	**NT**	**FT1**	**FT2**	**FT3**	**DT1**	**DT2**	**DT3**
HC	r	-0.200	-0.336	-0.068	0.189	-0.311	0.017	**0.354**	-0.111
	Sig.	0.257	0.052	0.704	0.284	0.073	0.948	**0.043**	0.537
	N	34	34	34	34	34	18	**33**	33
ASD	r	0.097	0.106	-0.026	-0.119	0.108	0.144	-0.149	-0.161
	Sig.	0.599	0.565	0.888	0.517	0.554	0.758	0.416	0.404
	N	32	32	32	32	32	7	32	29
SZ	r	0.155	0.171	-0.192	-0.248	**0.384**	-0.949^	-0.248	-0.154
	Sig.	0.390	0.342	0.283	0.163	**0.027**	0.051	0.164	0.473
	N	33	33	33	33	**33**	4	33	24

Bold- significant result

Appendix 6. State plots k=5

In order to verify that the state decomposition generated by the k=4 reflects a true underlying pattern, a k=5 state decomposition was produces as well. K=5 resulted in four *reoccurring* states, and an additional state that occurred in 1% of the windows (similarly to the k=4 solution) which was thus excluded from analysis. As can be seen in the figure below, the overall structure of the results highly resembled that of the k=4 decomposition.



K=5 state plots: whole brain cross-correlation plots for each of the reoccurring* FC states (black lines mark division into networks).

* Four reoccurring states are presented. The fifth state occurred in 1% of the windows (as in the k=4 solution), and is thus excluded from analysis.

Appendix 7. Group differences in temporal dynamics- controlled for head motion

Repeating the group comparisons while controlling for head motion (framewise-displacement root mean square) showed similar results to the main ANOVA, and no significant effect for motion in any of the dFNC parameters

	dFNC sig.	**dFNC Pairwise comparisons**	**Motion sig.**
NS	P<0.000	SZ<HC (p<0.001) ASD<HC (p=0.011)	P=0.559
NT	P<0.000	SZ<HC (p<0.000) SZ<ASD (p<0.000)	P=0.220
FT1	P<0.000	SZ<HC (p<0.001) ASD<HC (p=0.002)	P=0.503
FT2	P<0.000	SZ>HC (p<0.001) ASD>HC (p=0.003) SZ>ASD (p=0.007)	P=0.464

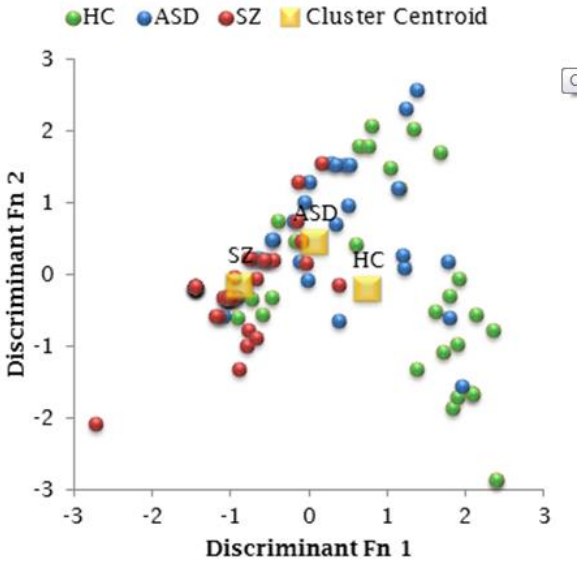
FT3	P<0.000	SZ<HC (p<0.001) SZ<ASD (p<0.001)	P=0.644
DT1	P=0.021	SZ<HC (p=0.007) SZ<ASD (p=0.023)	P=0.945
DT2	P<0.000	SZ>HC (p<0.001) SZ>ASD (p=0.006)	P=0.882
DT3	P=0.258	N.A.	P=0.369

Appendix 8. Group differences in state engagement

When considering the particular states that participants occupied, far fewer patients from both groups entered the highly connected state, as compared to HC. Chi-square tests indicated that significantly fewer SZ and ASD participants entered state 1 as compared to HC (Fischer's exact test: p=0.001, p=0.012; respectively), and significantly fewer SZ participants entered state 3, as compared to HC (Fischer's exact test: p=0.013). No differences were found between the groups for state 2.

Appendix 9. Classification plot and structure matrix

Classification canonical discriminant functions plot



Structure Matrix

	Function	
	1	2

FT2	-.849	.251
NT	.818	.193
FT3	.741	.312
FT1	.655	-.547
NS	.603	-.356
SE 1 (y/n)	.563	-.530
SE 3 (y/n)	.412	.119
SE 2 (y/n)	-.168	.273

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Appendix 10. Discriminant analysis cross-validation

To ensure stability of the results, the classification analysis was repeated using a leave-one out method. In cross validation, each case is classified by the functions derived from all cases other than that case. The results per-group are presented in the table below. Overall, 52.5% of cross-validated grouped cases correctly classified, while 57.6% of original grouped cases correctly classified (chance-level is 33%). These results re-iterate those of the original classification, thus attesting to their stability.

Leave-one-out cross validation

		Predicted Group Membership		
		Assigned SZ	**Assigned ASD**	**Assigned HC**
Diagnostic Group	SZ	**75.8% (25)**	21.2% (7)	3.0% (1)
	ASD	31.3% (10)	**43.8% (14)**	25.0% (8)
	HC	29.4% (10)	32.4% (11)	**38.2% (13)**

Gray- participants that were assigned to their diagnostic group

Appendix 11.Single parameter classification results

When repeating the classification using number of transitions (NT) as a single independent variable an overall of 54.5% cases were correctly classified (with 54.5% in cross-validation as well), while 57.6% of

original grouped cases correctly classified (chance-level is 33%). The results per-group are presented in the table below.

		Predicted Group Membership		
		Assigned SZ	**Assigned ASD**	**Assigned HC**
Diagnostic Group	SZ	**75.8% (25)**	15.2% (5)	9.1% (3)
	ASD	34.4% (11)	**21.9% (7)**	43.8% (14)
	HC	23.5% (8)	11.8% (4)	**64.7% (22)**
Cross-Validation	SZ	**75.8% (25)**	15.2% (5)	9.1% (3)
	ASD	34.4% (11)	**21.9% (7)**	43.8% (14)
	HC	23.5% (8)	11.8% (4)	**64.7% (22)**

Gray- participants that were assigned to their diagnostic group

Appendix 12. –QLS sensitivity analysis.

To test for the effect of overall clinical severity, a sensitivity analysis was conducted. The Quality of Life Scale (QLS; [3]), a 21-item scale based on a semi-structured interview was used, as a proxy of overall severity. We examined bivariate correlations between dFNC measures to QLS score within each one of the clinical groups. Results are presented in the table hereinafter.

Correlations of dFNC parameters with QLS Total Score (Spearman's Rho)

		NS	**NT**	**FT1**	**FT2**	**FT3**	**DT1**	**DT2**	**DT3**
HC	r	0.138	-0.072	-0.067	0.014	0.033	-0.250	0.011	0.114
	Sig.	0.443	0.689	0.713	0.937	0.856	0.318	0.953	0.535
	N	33	33	33	33	33	18	32	32
ASD	r	0.276	0.284	0.270	**-0.359**	0.297	0.571	-0.273	0.021
	Sig.	0.133	0.122	0.142	**0.047**	0.105	0.180	0.137	0.916
	N	31	31	31	**31**	31	7	31	28
SZ	r	0.198	0.134	0.040	0.011	0.011	0.400	-0.035	-0.362
	Sig.	0.268	0.459	0.827	0.952	0.952	0.600	0.846	0.082^
	N	33	33	33	33	33	4	33	24

Bold- significant result

1. Lord, C., et al., *The Autism Diagnostic Observation Schedule—Generic: A standard measure of social and communication deficits associated with the spectrum of autism.* Journal of autism and developmental disorders, 2000. **30**(3): p. 205-223.
2. First, M.B., et al., *Structured clinical interview for DSM-IV-TR axis I disorders, research version, patient edition*. 2002, SCID-I/P.
3. Heinrichs, D.W., T.E. Hanlon, and W.T. Carpenter Jr, *The Quality of Life Scale: an instrument for rating the schizophrenic deficit syndrome.* Schizophrenia bulletin, 1984. **10**(3): p. 388-398.