Supplementary Online Content

Fishman I, Keown CL, Lincoln AJ, Pineda JA, Müller R-A. Atypical cross talk between mentalizing and mirror neuron networks in autism spectrum disorder. *JAMA Psychol*. Published online April 16, 2014. doi: 10.100/jamapsychiatry.2014.83.

This supplementary material has been provided by the authors to give readers additional information about their work.

eAppendix 1. Methods.

Participants

Ten participants with ASD were reported to be taking the following psychoactive medications: Adderall; Xanax; Concerta, Zoloft; Celexa; Risperdal, fluoxetine; Concerta, Zoloft, Risperdal; Adderall, fluoxetine; Daytrana, Provigil, Zoloft, Risperdal; Buspar, Risperdal; Concerta, Lexapro (see also eTable 1).

Nineteen out of 25 participants with ASD were administered Module 3 of the ADOS, while 6/25 participants were administered Module 4.

The racial/ethnical composition of the sample was as following: in the ASD group there were seventeen Caucasian, six Hispanic/Latino, and two Asian participants; in the TD group there were seventeen Caucasian, five Hispanic/Latino, and three Asian participants.

eAppendix 2. Results.

Specificity of the increased ToM-MNS cross-talk finding.

To test the specificity of the finding that atypical ToM-MNS connectivity is associated with more severe social impairment, supplementary analyses were performed to examine whether between-network connectivity with an unrelated, non-social network is also related to ASD social symptoms. Seeds in primary motor cortex (right and left M1), a key area of the motor control, were selected to identify the motor network. FC analysis was conducted in an identical manner to that described in the main manuscript: namely, the average signal across the time series was extracted from the right and left M1 seeds (created as 6 mm radius spheres) and was used to calculate whole-brain correlations. Direct group comparisons (corrected $p < .05$) revealed several significant clusters of overconnectivity in ASD, including greater connectivity (ASD > TD) of right M1 with bilateral IFG, ACC, and PC/PCC, and of left M1 with ACC (see Table S4), in line with recent reports (e.g., Uddin et al., 2013). A mean motor network connectivity score was calculated by averaging *z* scores for all significantly overconnected clusters; in addition, mean ToM-motor and MNS-motor between-network connectivity indices were computed by averaging *z* scores for all between-network ROI pairs, respectively. While significant correlation was detected between the mean motor connectivity and ADI-social ($r = .47$, $p < .023$, uncorrected), there were no correlations between ToM-motor, or MNS-motor connectivity and ADOS-CS, ADI-Social or ADI-Communication scores (rs = .08 - .15, all ps > .5). In other words, connectivity between motor and other, social networks was not associated with ASD symptoms (while the atypical within-network connectivity was). This supplemental analysis suggests that the relationship between abnormal ToM-MNS cross-talk and greater social impairment does not generalize to other between-network patterns of connectivity, but rather provides support to the notion that social dysfunction in ASD is specifically associated with inadequate segregation between two social networks.

eTable 1. List of psychoactive medications in ASD cohort

Participants	Medication class:			
	Stimulants[1]	Antipsychotics[2]	SSRI/Antidepressants[3]	Anxiolytics/Other[4]
1	+			
2				+
3	+		+	
4			+	
5		+	+	
6	+	+	+	
7	+		+	
8	+	+	+	+
9		+		+
10	+		+	

Medications in the current sample:

[1]Adderall, Concerta, Daytrana; [2]Risperdal; [3]Celexa, Zoloft, Fluoxetine, Lexapro; [4]Buspar, Xanax, Provigil.

eTable 2. Regions Showing Functional Connectivity with the MNS within ASD and TD groups

ASD (n = 25)				TD (n = 25)			
Peak Location Additional regions [% volume of cluster]	Vol (μl)	Peak *t*	x y z	**Peak Location** Additional regions [% volume of cluster]	Vol (μl)	Peak *t*	x y z
laIPS seed:							
L Inf. Par. Lobule [26] L PostCent. Gyrus [19] L Sup. Par. Lobule [18] L PreCent. Gyrus [15] L SupraMarginal Gyrus [8]	37368	21.76	-38 -44 44	**L PostCent. Gyrus** [26] L Inf. Par. Lobule [11] L Sup. Par. Lobule [11] R PostCent. Gyrus [8] R Sup. Par. Lobule [8]	108756	20.76	-40 -44 42
R Sup. Par. Lobule [25] R PostCent. Gyrus [21] R Inf. Par. Lobule [15] R SupraMarginal Gyrus [13] R PreCent. Gyrus [9]	24192	11.29	38 -38 40	**R PreCent. Gyrus** [25] R IFG, p. Op [24] R IFG, p. Tri [24] R Mid. Front. Gyrus [23]	9936	11.25	56 2 30
L Inf. Temp. Gyrus [49] L Mid. Temp. Gyrus [21] L Inf. Occ. Gyrus [20] L Fusiform Gyrus [5]	4941	9.05	-50 -56 -6	**L Inf. Temp. Gyrus** [28] L Fusiform Gyrus [17] L Inf. Occ. Gyrus [17] L Mid. Occ. Gyrus [13] L Mid. Temp. Gyrus [7]	9342	10.77	-44 -64 -4
L Med. Front. Gyrus [46] L Mid. Cing. Gyrus [27] R Med. Front. Gyrus [14] R Mid. Cing. Gyrus [10]	3780	8.02	-4 -16 50	**R Inf. Temp. Gyrus** [47] R Mid. Temp. Gyrus [18] R Fusiform Gyrus [9]	9234	10.33	46 -58 -6
R IFG, p. Op [64] R PreCent. Gyrus [34]	2106	8.84	44 2 26	**L PreCent. Gyrus** [64] L IFG, p. Op [29] L Mid. Front. Gyrus [7]	4401	10.52	-50 4 38
L PreCent. Gyrus [77] L IFG, p. Op [16] L PostCent. Gyrus [6]	1053	8.12	-44 2 30	**R Putamen** [38] R Caudate [20] R Pallidum [17]	4320	9.37	14 8 8
R Inf. Temp. Gyrus [98]	756	7.50	50 -46 -10	**L IFG, p. Tri** [61] L Mid. Front. Gyrus [36]	4158	9.54	-40 16 30
				L Putamen [55] L Caudate [16] L Pallidum [11]	4023	9.30	-14 14 6
raIPS seed:							
R Sup. Par. Lobule [24] R PostCent. Gyrus [19] R SupraMarginal Gyrus [16] R Inf. Par. Lobule [16] R Precuneus [10]	34749	19.91	38 -44 44	**R PostCent. Gyrus** [19] R Sup. Par. Lobule [14] R SupraMarginal Gyrus [10] R Inf. Par. Lobule [9] R PreCent. Gyrus [8]	65367	21.93	44 -44 48
L Inf. Par. Lobule [40]	23976	11.56	-14 -62 56	**L PostCent. Gyrus** [24]	43200	13.36	-40 -44 42

L Sup. Par. Lobule [27] L SupraMarginal Gyrus [11] L PostCent. Gyrus [6] L Precuneus [5]				L Inf. Par. Lobule [21] L Sup. Par. Lobule [16] L PreCent. Gyrus [11] L Precuneus [6]			
L PreCent. Gyrus [57] L PostCent. Gyrus [18] L Sup. Front. Gyrus [14] L Mid. Front. Gyrus [5]	6426	8.26	-46 -16 44	**L Inf. Temp. Gyrus** [25] L Mid. Occ. Gyrus [19] L Mid. Temp. Gyrus [14] L Inf. Occ. Gyrus [12] L Fusiform Gyrus [11]	9936	11.86	-50 -58 -4
L Inf. Occ. Gyrus [38] L Inf. Temp. Gyrus [36] L Mid. Temp. Gyrus [11] L Mid. Occ. Gyrus [7]	4104	8.47	-40 -64 -6	**R Inf. Temp. Gyrus** [69] R Inf. Occ. Gyrus [15] R Mid. Temp. Gyrus [7]	5292	9.87	52 -58 -6
R PreCent. Gyrus [50] R IFG, p. Op [47]	3105	10.21	50 -2 26	**R Putamen** [48] R Insula [14] R Pallidum [10]	5211	8.52	38 -4 12
L Med. Front. Gyrus [54] R Med. Front. Gyrus [30] R Mid. Cing. Gyrus [10]	2754	8.16	-4 2 50	**R IFG, p. Op** [45] R PreCent. Gyrus [40] R Rolandic Operculum [13]	4752	9.54	46 2 30
R Sup. Front. Gyrus [46] R PreCent. Gyrus [36] R Med. Front. Gyrus [13]	2403	7.82	34 -10 54	**R Mid. Front. Gyrus** [57] R IFG, p. Tri [43]	3726	7.67	46 34 14
R Inf. Temp. Gyrus [92] R Inf. Occ. Gyrus [7]	2052	7.43	52 -50 -10	**L PreCent. Gyrus** [55] L IFG, p. Op [39]	1998	8.56	-46 4 32
L Precuneus [42] R Precuneus [20] L Mid. Cing. Gyrus [16] L ParaCent. Lobule [15]	1917	10.47	-8 -38 50	**L IFG, p. Tri** [64] L Mid. Front. Gyrus [35]	1404	7.70	-44 28 30
R Mid. Front. Gyrus [67] R IFG, p Tri [33]	1593	7.53	40 34 32	**R Mid. Occ. Gyrus** [85] R Mid. Temp. Gyrus [7]	783	10.74	38 -70 8
L IFG, p. Tri [68] L Mid. Front. Gyrus [32]	999	7.70	-38 34 14				
L Fusiform Gyrus [86]	837	7.32	-34 -46 -22				
<u>lPMC seed</u>:							
L Mid. Front. Gyrus [21] L Sup. Med. Gyrus [17] L Inf. Front. Gyrus [10] L Sup. Front. Gyrus [9] L PreCent. Gyrus [8]	60723	19.16	-44 4 38	**L Mid. Front. Gyrus** [14] L IFG, p. Tri [9] L Sup. Front. Gyrus [8] L Sup. Med. Gyrus [8] L PreCent. Gyrus [6]	132489	19.18	-44 4 36
L Angular Gyrus [47] L Inf. Par. Lobule [22] L Mid. Temp. Gyrus [15] L SupraMarginal Gyrus [6]	7803	9.30	-44 -50 38	**R Mid. Front. Gyrus** [28] R IFG, p. Tri [24] R IFG, p. Orb [15] R IFG, p. Op [13] R PreCent. Gyrus [10]	22653	12.35	46 8 38

L Mid. Temp. Gyrus [99]	4482	8.75	-58 -38 2	**L Inf. Par. Lobule** [37] L Angular Gyrus [26] L Mid. Temp. Gyrus [11] L Mid. Occ. Gyrus [8]	21546	11.83	-34 -64 38
L Caudate [55] L Pallidum [15] L Putamen [15]	3996	12.99	-8 8 14	**R Caudate** [33] R Putamen [32] R Pallidum [9]	7911	12.55	14 4 14
R Mid. Temp. Gyrus [99]	972	7.89	64 -34 -4	**L Mid. Temp. Gyrus** [70] L Inf. Temp. Gyrus [26]	7263	9.81	-56 -40 0
R Mid. Front. Gyrus [50] R Sup. Front. Gyrus [50]	837	7.35	22 50 26	**R Angular Gyrus** [90]	1431	8.04	44 -62 36
				R Mid. Temp. Gyrus [68] R Sup. Temp. Gyrus [31]	1161	7.04	56 -52 8
				R Inf. Par. Lobule [91] R SupraMarginal Gyrus [9]	702	7.09	44 -46 36
			<u>rPMC seed</u>:				
R Mid. Front. Gyrus [44] R IFG, p. Tri [19] R IFG, p. Op [15] R PreCent. Gyrus [13]	23868	21.53	40 4 38	**R Mid. Frontal Gyrus** [14] L Mid. Front. Gyrus [8] R Sup. Front. Gyrus [7] R IFG, p. Tri [6]	116343	27.45	44 4 38
L PreCent. Gyrus [31] L IFG, p. Tri [29] L Mid. Front. Gyrus [24] L IFG, p. Op [15]	9045	10.03	-44 10 32	**R Mid. Temp. Gyrus** [51] R Angular Gyrus [21] R Inf. Par. Lobule [14]	18360	9.47	58 -50 6
R Inf. Par. Lobule [36] R Angular Gyrus [29] R Mid. Occ. Gyrus [16] R SupraMarginal Gyrus [9]	8181	9.53	52 -46 42	**R Precuneus** [45] L Precuneus [31] R Mid. Cing. Gyrus [13] L Mid. Cing. Gyrus [9]	11637	11.15	4 -52 38
L Inf. Par. Lobule [78] L Angular Gyrus [29]	6939	8.56	-38 -50 36	**L Inf. Par. Lobule** [65] L SupraMarginal Gyrus [11] L Sup. Par. Lobule [6]	6831	8.72	-50 -50 44
L Sup. Med. Gyrus [34] R Sup. Med. Gyrus [20] R Mid. Cing. Gyrus [15] L Mid. Cing. Gyrus [13]	6750	8.83	2 20 50	**L Mid. Temp. Gyrus** [83] L Sup. Temp. Gyrus [12]	1593	7.88	-52 -52 20
R Mid. Front. Gyrus [42] R IFG, p. Orb [27] R IFG, p. Tri [14] R Sup. Front. Gyrus [9]	3618	7.73	28 56 12	**L Mid. Front. Gyrus** [99]	1404	6.98	-28 52 20
L IFG, p. Tri [59] L Mid. Front. Gyrus [19] L IFG, p. Opb [17]	2970	8.83	-44 40 2	**L Mid. Temp. Gyrus** [91] L Inf. Temp. Gyrus [6]	1269	7.54	-56 -34 0
R Mid. Temp. Gyrus [68] R Inf. Temp. Gyrus [32]	1539	7.57	56 -44 -6	**L IFG, p. Orb** [83] L Mid. Orb. Gyrus [14]	837	7.33	-38 44 -4
R Caudate [69]	1323	8.20	14 4 14				

L Putamen [61] L Pallidum [38]	783	7.43	-16 -2 6					
				lpSTS seed:				
L Mid. Temp. Gyrus [64] L Mid. Occ. Gyrus [9] L SupraMarginal Gyrus [8]	20115	14.78	-44 -58 8	**L Mid. Temp. Gyrus** [18] L Sup. Temp. Gyrus [8] L Mid. Occ. Gyrus [7]	72009	18.49	-50 -56 12	
R Mid. Temp. Gyrus [77] R Sup. Temp. Gyrus [16]	9423	11.09	58 -50 12	**L Precuneus** [18] L PostCent. Gyrus [15] L PreCent. Gyrus [12] L Med. Front. Gyrus [11] R Med. Front. Gyrus [9] R Precuneus [9]	37125	12.01	-4 -55 48	
L Putamen [31] L Thalamus [16] L Caudate [7]	7587	8.94	4 -28 8	**R Mid. Temp. Gyrus** [36] R Sup. Temp. Gyrus [19] R Putamen [14]	29781	11.74	58 -52 8	
R IFG, p. Tri [50] R IFG, p. Orb [29] R IFG, p. Op [20]	4428	9.12	50 34 2	**L Putamen** [39] L Caudate [10] L Insula [10]	10746	9.95	-28 -14 2	
L IFG, p. Tri [44] L IFG, p. Op [28] L IFG, p. Orb [11]	3448	7.91	-50 16 20	**R PreCent. Gyrus** [58] R PostCent. Gyrus [34]	3510	8.41	50 -16 30	
L Precuneus [76] R Precuneus [23]	2187	8.47	-2 -56 48	**R PreCent. Gyrus** [43] R IFG, p. Op [24] R Mid. Front. Gyrus [18] R IFG, p. Tri [15]	2079	8.07	46 -2 38	
L Med. Front. Gyrus [63] R Med. Front. Gyrus [33]	2187	8.13	-2 -2 66	**L IFG, p. Tri** [22] L Temp. Pole [18] L Sup. Temp. Gyrus [15] L Inf. Front. Gyrus [13] L IFG, p. Op [8]	2052	8.50	-46 14 8	
R Sup. Temp. Gyrus [45] R Mid. Temp. Gyrus [36] R Med. Temp. Pole [18]	1674	8.01	58 -16 6	**L PreCent. Gyrus** [44] L Mid. Front. Gyrus [31] L IFG, p. Op [17]	1998	8.27	-46 10 36	
L Fusiform Gyrus [37] L Inf. Temp. Gyrus [29] L Inf. Occ. Gyrus [27]	1647	7.47	-32 -50 -22	**R PostCent. Gyrus** [88] R Sup. Par. Lobule [9]	1620	7.25	28 -38 54	
L IFG, p. Orb [89]	1350	9.23	-32 32 -6	**R Mid. Front. Gyrus** [95]	1323	11.85	28 22 44	
R Putamen [78] R Pallidum [13]	1215	7.20	26 2 8	**R PreCent. Gyrus** [97]	1134	7.81	26 -26 62	
L Ant. Cing. Cortex [46] L Mid. Cing. Cortex [32] R Mid. Cing. Cortex [12]	1107	9.35	-2 8 38	**L Mid. Front. Gyrus** [99]	621	7.05	-26 46 20	
L PreCent. Gyrus [60] L Mid. Front. Gyrus [37]	1053	8.45	-40 -2 50					

L Mid. Cing. Cortex [87] R Mid. Cing. Cortex [11]	810	7.42	2	-26	42					
L IFG, p. Tri [99]	756	6.89	-50	26	14					
R Precuneus [48] L Precuneus [41]	648	7.02	8	-58	60					
						rpSTS seed:				
R Mid. Temp. Gyrus [63] R Mid. Occ. Gyrus [15] R Sup. Temp. Gyrus [11]	16605	28.17	50	-56	12	**R Precuneus** [20] L Precuneus [15] R Mid. Cing. Gyrus [10] L Mid. Cing. Gyrus [9]	40743	13.52	4	-46 44
L Mid. Temp. Gyrus [47] L Mid. Occ. Gyrus [42]	11205	13.75	-34	-80	30	**R Mid. Temp. Gyrus** [62] R Sup. Temp. Gyrus [14] R Mid. Occ. Gyrus [9]	22599	23.59	46	-56 8
L Precuneus [28] R Precuneus [15] R Calcarine Gyrus [14]	3807	8.04	2	-56	2	**L Mid. Temp. Gyrus** [57] L Mid. Occ. Gyrus [24] L SupraMarginal Gyrus [6]	15471	12.16	-50	-62 12
R Mid. Front. Gyrus [62] R PreCent. Gyrus [34]	1809	8.44	40	2	48	**R IFG, p. Tri** [36] R PreCent. Gyrus [24] R Mid. Front. Gyrus [13] R IFG, p. Op [12] R IFG, p. Orb [11]	9936	10.88	50	28 0
R IFG, p. Tri [56] R IFG, p. Op [42]	1296	8.44	56	16	20	**R Med. Front. Gyrus** [43] R Sup. Med. Gyrus [17] L Med. Frontal Gyrus [16] L Sup. Med. Gyrus [12]	4212	10.12	8	16 60
L Precuneus [64] R Precuneus [21] L Sup. Par. Lobule [14]	621	7.42	4	-58	44	**R Putamen** [49] R Pallidum [10] R Caudate [10]	4104	8.39	32	-8 2
						L PreCent. Gyrus [97]	1998	9.46	-28	-26 50
						R Mid. Front. Gyrus [67] R Sup. Front. Gyrus [32]	1593	8.33	26	22 50

Note: Only clusters with a minimum volume of 600 μl are displayed.
MNS = mirror neuron system; laIPS = left anterior intraparietal sulcus; raIPS = right anterior intraparietal sulcus; lPMC = left premotor cortex; rPMC = right premotor cortex; lpSTS = left posterior superior temporal sulcus; rpSTS = right posterior superior temporal sulcus; IFG = Inferior Frontal Gyrus; L = left; R = right; Front. = Frontal; Temp. = Temporal; Par. = Parietal; Occ. = Occipital; Inf. = Inferior; Sup. = Superior; Mid. = Middle; Med. = Median; Ant. = Anterior; Post. = Posterior; Cing. = Cingulate.

eTable 3. Regions Showing Functional Connectivity with the ToM within ASD and TD groups

ASD (n = 25)				TD (n = 25)			
Peak Location Additional regions [% volume of cluster]	Vol (μl)	Peak *t*	x y z	**Peak Location** Additional regions [% volume of cluster]	Vol (μl)	Peak *t*	x y z
lTPJ seed:							
L Sup. Med. Gyrus [25] L Sup. Front. Gyrus [17] L Mid. Front. Gyrus [17] R Sup. Front. Gyrus [11] R Sup. Med. Gyrus [10] R Mid. Front. Gyrus [6]	34830	11.74	-40 14 44	**L Sup. Med. Gyrus** [25] L Mid. Front. Gyrus [17] L Sup. Front. Gyrus [15] R Sup. Med. Gyrus [12] R Sup. Front. Gyrus [7] L Ant. Cing. Cortex [6]	53460	12.13	-10 10 56
L Angular Gyrus [40] L Mid. Temp. Gyrus [23] L Inf. Par. Lobule [8]	12960	20.14	-46 -56 24	**L Precuneus** [32] R Precuneus [15] L Mid. Cing. Gyrus [14] L Post. Cing. Gyrus [8]	27243	10.65	-2 -58 42
L Angular Gyrus [46] R Precuneus [16] L Post. Cing. Gyrus [13] L Precuneus [8]	9774	11.23	2 -52 2	**L Angular Gyrus** [35] L Mid. Temp. Gyrus [19] L Inf. Par. Lobule [13] L SupraMarginal Gyrus [7]	18333	21.79	-50 -56 24
R Angular Gyrus [58] R Mid. Temp. Gyrus [25] R Inf. Par. Lobule [7]	9342	13.74	46 -58 26	**R Mid. Temp. Gyrus** [51] R Angular Gyrus [26] R Sup. Temp. Gyrus [10]	15255	11.87	52 -56 18
L Mid. Temp. Gyrus [81] L Inf. Temp. Gyrus [12]	9261	10.99	-52 -4 -16	**L Mid. Temp. Gyrus** [87]	9747	12.49	-52 -2 -12
R Mid. Temp. Gyrus [71] R Sup. Temp. Gyrus [14] R Inf. Temp. Gyrus [8]	4617	8.71	64 -28 2	**L Hippocampus** [33] L ParaHipp. Gyrus [30] L Fusiform Gyrus [16]	3969	8.38	-26 -2 -10
L IFG, p. Orb [61] L IFG, p. Tri [27]	2646	8.24	-44 28 4	**L Caudate** [81] L Putamen [9]	2565	9.72	-10 4 14
L Putamen [80]	864	7.96	-26 -14 6	**L IFG, p. Tri** [46] L IFG, p. Orb [45]	2322	8.31	-44 28 -6
L Caudate [99]	864	8.64	-10 8 14	**L Sup. Temp. Gyrus** [98]	1053	7.63	-44 -28 12
				R Hippocampus [37] R ParaHippocampal Gyrus [35]	891	7.69	28 -20 -12
				R Mid. Front. Gyrus [95]	810	7.85	44 14 42
				R Caudate [99]	756	8.27	16 14 12
rTPJ seed:							
L Sup. Med. Gyrus [19] R Sup. Front. Gyrus [18] R Sup. Med. Gyrus [17] R Mid. Front. Gyrus [12]	36936	12.27	2 52 30	**L Precuneus** [27] R Precuneus [23] L Mid. Cing. Gyrus [9] L Post. Cing. Gyrus [7]	34101	10.91	8 -44 6

L Sup. Front. Gyrus [12] L Mid. Front. Gyrus [11]				R Mid. Cing. Gyrus [7]			
L Precuneus [34] R Precuneus [24] L Post. Cing. Cortex [9] R Post. Cing. Cortex [6]	15363	14.67	8 -58 26	**R Mid. Front. Gyrus** [24] R Sup. Front. Gyrus [18] R Sup. Med. Gyrus [17] L Sup. Med. Gyrus [15] R Ant. Cing. Cortex [8] L Ant. Cing. Cortex [6]	33480	12.18	40 14 42
R Angular Gyrus [51] R Mid. Temp. Gyrus [25] R Sup. Temp. Gyrus [6]	13878	23.08	50 - 56 24	**R Angular Gyrus** [45] R Mid. Temp. Gyrus [23] R Inf. Temp. Gyrus [10] R Sup. Temp. Gyrus [8]	16443	20.16	50 -52 20
L Angular Gyrus [45] L Mid. Temp. Gyrus [22] L Mid. Occ. Gyrus [7]	10206	14.11	-46 -58 24	**L Angular Gyrus** [40] L Mid. Temp. Gyrus [20] L Inf. Par. Lobule [13]	14445	16.50	-46 -56 24
L Mid. Temp. Gyrus [96]	2565	10.13	-58 -14 -10	**L Mid. Front. Gyrus** [71] L Sup. Front. Gyrus [19]	9909	10.18	-20 26 50
R Mid. Temp. Gyrus [99]	2106	7.68	50 -34 0	**L Mid. Temp. Gyrus** [99]	5454	8.33	-62 -20 -6
				R Mid. Temp. Gyrus [57]	3537	8.59	52 -10 -12
				L Fusiform Gyrus [42] L Hippocampus [20] L ParaHippocampal Gyrus [18]	2160	9.70	-22 -28 0
				R Caudate [73]	1458	8.19	10 -2 26
				R Sup. Front. Gyrus [57] R Mid. Front. Gyrus [43]	1080	6.87	32 50 12
				<u>mPFC seed</u>:			
L Sup. Med. Gyrus [21] L Sup. Front. Gyrus [15] R Sup. Med. Gyrus [14] R Sup. Front. Gyrus [13] L Mid. Front. Gyrus [11]	61776	22.62	4 46 24	**L Sup. Med. Gyrus** [17] L Sup. Front. Gyrus [14] R Sup. Med. Gyrus [12] L Mid. Front. Gyrus [11] R Sup. Front. Gyrus [10] L Ant. Cing. Cortex [8] R Ant. Cing. Cortex [7]	87912	23.80	2 52 26
L Precuneus [36] R Precuneus [17] L Post. Cing. Cortex [14] R Post. Cing. Cortex [9]	9855	10.53	-4 -50 24	**L Precuneus** [26] L Mid. Cing. Gyrus [14] R Precuneus [12] L Post. Cing. Cortex [10] R Mid. Cing. Cortex [10]	20520	13.77	2 -22 36
L Mid. Temp. Gyrus [37] L Angular Gyrus [35] L SupraMarginal Gyrus [6]	7398	12.78	-50 -62 20	**L Mid. Temp. Gyrus** [34] L IFG, p. Orb [24] L IFG, p. Tri [16] L Med. Temp. Pole [9]	14742	12.86	-50 20 8
L Mid. Temp. Gyrus [82] L Med. Temp. Pole [14]	6777	9.38	-58 -10 -10	**L Angular Gyrus** [56] L Mid. Temp. Gyrus [22]	6885	11.43	-46 -62 26

R Mid. Temp. Gyrus [57] R Angular Gyrus [27] R Sup. Temp. Gyrus [14]	5805	13.16	46 -52 20	**R Mid. Temp. Gyrus** [63] R Med. Temp. Pole [24] R Inf. Temp. Gyrus [10]	5994	10.20	52 -8 -12
L IFG, p. Orb [57] L IFG, p. Tri [18] L Insula [15]	4374	9.18	-40 34 -6	**L Caudate** [76]	4104	9.07	-10 14 12
R IFG, p. Orb [65] R Insula [20]	1944	9.89	38 20 -12	**R IFG, p. Orb** [72] R IFG, p. Tri [27]	1620	8.48	50 22 6
L Caudate [98]	1404	8.31	-14 14 14	**R Angular Gyrus** [36] R Mid.Temp. Gyrus [23]	1296	7.47	52 -62 20
L Hippocampus [36] L ParaHippocampal Gyrus [23] L Lingual Gyrus [11]	621	7.01	-16 -34 0				
R Lingual Gyrus [34] R Hippocampus [22] R ParaHippocampal Gyrus [15]	567	8.02	16 -26 -4				
			PCC seed:				
L Precuneus [35] R Precuneus [28] L Mid. Cing. Gyrus [8] R Mid. Cing. Gyrus [7]	34749	24.38	2 -56 38	**L Precuneus** [21] R Precuneus [19] L Mid. Cing. Gyrus [7] R Mid. Cing. Gyrus [7]	66231	23.17	2 -52 38
R Mid. Front. Gyrus [80] R Sup. Front. Gyrus [19]	9261	11.81	34 20 44	**R Mid. Front. Gyrus** [31] L Sup. Med. Gyrus [26] R Sup. Front. Gyrus [17] R Sup. Med. Gyrus [10] L Ant. Cing. Cortex [5]	19521	15.20	46 10 42
R Angular Gyrus [50] R Inf. Par. Lobule [18] R Mid. Temp. Gyrus [16] R Sup. Temp. Gyrus [9]	8073	11.65	50 -52 36	**L Angular Gyrus** [36] L Mid. Temp. Gyrus [20] L Inf. Par. Lobule [18] L Mid. Occ. Gyrus [13]	16956	12.73	-38 -68 20
L Mid. Front. Gyrus [97]	3996	9.38	-32 22 42	**R Angular Gyrus** [44] R Mid. Temp. Gyrus [35] R Inf. Par. Lobule [7] R Sup. Temp. Gyrus [6]	13878	10.09	40 -70 36
L Angular Gyrus [61] L Inf. Par. Lobule [36]	2970	8.45	-32 -58 38	**L Mid. Front. Gyrus** [69] L Sup. Front. Gyrus [15]	11745	11.02	-46 10 36
R Ant. Cing. Cortex [42] L Sup. Med. Gyrus [23] R Sup. Med. Gyrus [15] L Ant. Cing. Cortex [13]	1890	8.15	2 38 24	**L Mid. Temp. Gyrus** [88] L Sup. Temp. Gyrus [11]	2781	8.04	-46 -4 -10
R Sup. Front. Gyrus [60] R Mid. Front. Gyrus [39]	999	8.14	26 50 14	**R Mid. Temp. Gyrus** [94]	1836	9.23	52 -14 -10
				L Mid. Temp. Gyrus [99]	1755	8.52	-58 -40 0
				R Caudate [86]	945	6.77	10 10 8

R Mid. Temp. Gyrus [98]	837	8.46	64	-32	-4

Note: Only clusters with a minimum volume of 600 μl are displayed.
ToM = theory of mind; lTPJ = left temporal-parietal junction; rTPJ = right temporal-parietal junction; mPFC = medial prefrontal cortex; PCC = posterior cingulate cortex/precuneus; IFG = Inferior Frontal Gyrus; L = left; R = right; Front. = Frontal; Temp. = Temporal; Par. = Parietal; Occ. = Occipital; Inf. = Inferior; Sup. = Superior; Mid. = Middle; Med. = Median; Ant. = Anterior; Post. = Posterior; Cing. = Cingulate.

eTable 4. Participant characteristics for a subsample of 15 ASD participants with ADOS-CS ≥ 10 and 15 matched TD controls

		ASD (n = 15)		TD (n = 15)		
Gender (M/F)		13/2		13/2		
Handedness (R/L)		12/3		13/2		
		M (SD)	range	*M* (SD)	range	*p* value
Age (years)		14.6 (2.0)	11.8-17.7	14.5 (1.5)	12.4-16.8	0.92
Verbal IQ		106 (15)	83-128	107 (10)	87-126	0.94
Non-verbal IQ		108 (18)	70-140	108 (12)	86-129	0.90
Full-scale IQ		109 (15)	81-139	108 (11)	88-126	0.95
ADOS	Communication	3.6 (1.2)	2-6	n/a		--
	Social Interaction	9.5 (2.3)	6-13	n/a		--
	Repetitive Behavior	2.3 (1.6)	0-5	n/a		--
ADI-R	Social Interaction	16.5 (6.2)	6-24	n/a		--
	Communication	13.3 (6.0)	4-25	n/a		--
	Repetitive Behavior	6.5 (2.4)	3-11	n/a		--
SRS, Total		77.7 (9.8)	58-94	41.3 (5.5)	35-52	<0.000

Note: IQ, intelligence quotient; ADOS, Autism Diagnostic Observation Schedule; ADI-R, Autism Diagnostic Interview-Revised; SRS, Social Responsiveness Scale

eTable 5. Regions Exhibiting Group Differences (ASD vs. TD) in Functional Connectivity with M1

	Seed	Peak Location	Talairach coordinates			Cluster Volume (μl)	T-score
			x	y	z		
Motor	rM1	R ACC	10	-46	38	1134	-3.36
		R IFG	16	20	-12	918	-3.61
		L ACC	-4	8	-6	891	-4.02
		R/L PCC	2	-50	2	783	-3.72
	lM1	L Superior, Middle Frontal Gyrus	-10	50	0	1755	-3.75
		R/L ACC	2	32	6	810	-3.00

Note: rM1 = right primary motor cortex (Talairach coordinates: 40 –16 48); lM1 = left primary motor cortex (–38 –16 48); ACC = Anterior Cingulate Cortex; IFG = Inferior Frontal Gyrus; PCC = Posterior Cingulate Cortex; L: left; R: right.

eFigure. Within-group functional connectivity maps for the MNS (top panel) and ToM (bottom panel) seeds from the subset of 15 ASD participants with ADOS-CS ≥ 10 and 15 TD participants.
Results of the within-group (ASD, TD; $p < .05$ corrected) analyses obtained in a subsample of 15 ASD participants with ADOS ≥ 10 and 15 matched TD participants, for each MNS and ToM seeds (top and bottom panels, respectively) are presented in a conjunction view. Seed ROIs are presented on the axial slices on the left, and are indicated by black circles on the inflated maps.
laIPS = left anterior intraparietal sulcus; raIPS = right anterior intraparietal sulcus; lPMC = left premotor cortex; rPMC = right premotor cortex; lpSTS = left posterior superior temporal sulcus; rpSTS = right posterior superior temporal sulcus; lTPJ = left temporal-parietal junction; rTPJ = right temporal-parietal junction; mPFC = medial prefrontal cortex; PCC = posterior cingulate cortex/precuneus; L: left; R: right.