Supplementary Material

Supplementary Table 1. Participant characteristics and group matching within each diffusion-weighted imaging b-value protocol.

b-value=1500s/mm^2	ASD (n = 13)		TC (n = 9)			
	Mean ± SD	[Range]	Mean ± SD	[Range]	p^*	% diff
Sex (M/F)	11/2		9/0		0.22	--
Age (years)	53.1 ± 6.4	[46-67]	53.1 ± 7.9	[41-70]	0.99	<0.1
EHI[†]	78 ± 31	[20-100]	82 ± 18	[43-100]	0.42	-1.2
WASI-II Verbal IQ	111 ± 16	[79-154]	118 ± 13	[101-142]	0.31	-1.5
Non-verbal IQ	118 ± 9	[98-133]	108 ± 14	[90-128]	0.05	2.3
Full-scale IQ	116 ± 11	[97-137]	115 ± 13	[99-138]	0.79	0.3
ADOS-2 Social Affect	9.9 ± 3.5	[5-17]	--		--	--
RRB	4.3 ± 1.8	[2-8]	--		--	--
Comparison Score	7.5 ± 2.1	[3-10]	--		--	--
BMAT[§] Fine Motor	14 ± 1	[12-14]	14 ± 1	[12-14]	0.70	-0.2
Manual Dexterity	13 ± 3	[7-16]	14 ± 1	[12-16]	0.11	-3.1
Coordination	9 ± 2	[4-10]	10 ± 1	[8-10]	0.1	-3.1
Strength & Flexibility	14 ± 3	[8-18]	16 ± 3	[10-18]	0.34	-2.3
Balance & Mobility	9 ± 1	[7-9]	8 ± 1	[6-9]	0.23	1.3
Total brain volume (cm^3)	1569 ± 129	[1225-1783]	1485 ± 110	[1285-1653]	0.13	1.4
Motion dropout (% slices)	0.07 ± 0.18	[0-0.64]	0.01 ± 0.02	[0-0.06]	0.29	40.4
dMRI absolute RMSD	1.01 ± 0.64	[0.34-2.59]	0.93 ± 0.54	[0.43-2.06]	0.75	2.2
dMRI relative RMSD	0.51 ± 0.30	[0.18-1.03]	0.32 ± 0.09	[0.17-0.49]	0.08	11.5

b-value=1000s/mm^2	ASD (n = 12)		TC (n = 15)			
	Mean ± SD	[Range]	Mean ± SD	[Range]	p^*	% diff
Sex (M/F)	9/3		12/3		0.76	--
Age (years)	50.3 ± 7.4	[41-61]	50.7 ± 6.6	[41-61]	0.88	-0.2
EHI[†]	83 ± 30	[11-100]	89 ± 19	[40-100]	0.55	-1.7
WASI-II Verbal IQ	95 ± 28	[52-160]	112 ± 15	[85-144]	0.07	-3.9
Non-verbal IQ	96 ± 26	[56-138]	115 ± 11	[100-135]	0.02	-4.4
Full-scale IQ	95 ± 27	[51-143]	115 ± 11	[92-137]	0.02	-4.7
ADOS-2[‡] Social Affect	10.5 ± 3.9	[6-19]	--		--	--
RRB	3.1 ± 1.5	[1-6]	--		--	--
Comparison Score	7.2 ± 1.4	[5-10]	--		--	--
BMAT Fine Motor	13 ± 2	[8-15]	14 ± 0	[13-14]	0.12	-1.5
Manual Dexterity	12 ± 4	[2-16]	14 ± 1	[12-17]	0.02	-5.4
Coordination	9 ± 2	[6-10]	10 ± 1	[7-10]	0.02	-3.1

Strength & Flexibility	13 ± 5	[6-18]	17 ± 1	[14-18]	<.01	-6.8
Balance & Mobility	9 ± 1	[7-9]	9 ± 1	[7-9]	0.16	-1.1
Total brain volume (cm^3)	1459 ± 222	[1085-1767]	1497 ± 156	[1096-1686]	0.61	-0.6
Motion dropout (% slices)	0.02 ± 0.03	[0-0.11]	<0.01 ± <0.01	[0-0.01]	0.12	45.7
dMRI absolute RMSD	1.70 ± 1.51	[0.38-5.34]	1.26 ± 0.61	[0.44-2.78]	0.31	7.5
dMRI relative RMSD	0.35 ± 0.18	[0.16-0.76]	0.31 ± 0.12	[0.18-0.59]	0.54	2.6

*T-tests; Chi-Square test for sex.

†EHI unavailable for 3 participants (b=1500 s/mm^2: 2 ASD; b=1000 s/mm^2: 1 TC).

‡ADOS-2 scores unavailable for 1 ASD participant due to administrator error (see text).

§BMAT was not completed in 2 participants (1 ASD, 1 TC).

Abbreviations: EHI=Edinburgh Handedness Inventory; WASI-II=Wechsler Abbreviated Scale of Intelligence, 2nd edition; ADOS-2=Autism Diagnostic Observation Scale, 2nd edition; RRB=Restricted and Repetitive Behaviors; BMAT=Bruininks Motor Assessment Scale – Short form; RMSD=average voxel-wise root mean square displacement (head motion); diff=difference between groups.

Supplementary Table 2. Frequency and proportion of hand knob shape variants by diagnostic group.

		Left		Right		Overall	
Group	Shape	N	%	N	%	N	%
ASD	Omega	20	80.0%	20	80.0%	40	80.0%
	Epsilon	4	16.0%	5	20.0%	9	18.0%
	Null	1	4.0%	0	0.0%	1	2.0%
TC	Omega	20	83.3%	19	79.2%	39	81.3%
	Epsilon	4	16.7%	4	16.7%	8	16.7%
	Null	0	0.0%	1	4.2%	1	2.1%

Supplementary Table 3. Results of additional group by age interaction term in ANCOVAs performed on each hand knob measure.

Region	Measure	df	*p*	*q*	Partial η^2	Direction of effect
Left PrC_{hand}	Volume	1, 46	0.585	0.70	0.007	--
Right PrC_{hand}	Volume	1, 46	0.010	0.06	0.140	+ age trend in ASD and – age trend in TC groups
Left PoC_{hand}	Volume	1, 46	0.835	0.94	0.001	--
Right PoC_{hand}	Volume	1, 46	0.111	0.26	0.056	--
PrC_{hand}	LI Volume	1, 46	0.056	0.20	0.079	--
PoC_{hand}	LI Volume	1, 46	0.146	0.29	0.046	--
Left PoC-PrC_{hand} u-fibers	FA	1, 43	0.932	0.99	0.000	--
	MD	1, 43	0.294	0.50	0.026	--
	Volume	1, 43	0.360	0.50	0.020	--
Right PoC-PrC_{hand} u-fibers	FA	1, 44	0.536	0.69	0.009	--
	MD	1, 44	0.073	0.22	0.073	--
	Volume	1, 44	0.008	0.06	0.152	+ age trend in ASD and – age trend in TC groups
PoC-PrC_{hand} u-fibers	LI FA	1, 43	0.346	0.50	0.021	--
	LI MD	1, 43	0.334	0.50	0.022	--
	LI Volume	1, 43	0.116	0.26	0.058	--
Left PoC-PrC_{hand}	FC	1, 38	0.036	0.16	0.113	--
Right PoC-PrC_{hand}	FC	1, 38	0.985	0.99	0.000	--
PoC-PrC_{hand}	LI FC	1, 38	0.006	0.06	0.190	- age trend in ASD and + age trend in TC groups

Symbols: + positive, - negative.

Supplementary Table 4. Results of ANCOVAs additionally controlling for TBV, $RMSD_{rot}$ and excluding weakly right-handed individuals.

Variable additionally controlling for	Region	Measure	df	*p*	Partial η^2
TBV	Right PrC_{hand}	Volume	1, 45	0.013	0.129
	PrC_{hand}	LI Volume	1, 45	0.011	0.134
	PoC_{hand}	LI Volume	1, 45	0.017	0.119
$RMSD_{rot}$	Right PrC_{hand}	Volume	1, 45	0.009	0.143
	PrC_{hand}	LI Volume	1, 45	0.025	0.107
	PoC_{hand}	LI Volume	1, 45	0.037	0.093
Excluding weakly right-handed individuals	Right PrC_{hand}	Volume	1, 33	<0.001	0.292
	PrC_{hand}	LI Volume	1, 33	0.001	0.327
	PoC_{hand}	LI Volume	1, 33	0.009	0.185

Abbreviations: $RMSD_{rot}$=Root mean squared deviation in roll, pitch and yaw rotations from MNI standard space.

Supplementary Table 5. Results of the ANCOVAs performed on the upper and lower pre and postcentral measures and their group means, standard deviations.

Region	Measure	df	*p*	*q*	Partial η^2	ASD mean ± SD	TC mean ± SD
Left PrC_{upper}	Volume	1, 46	0.189	0.49	0.037	2.61 ± 0.84	2.93 ± 0.83
Right PrC_{upper}	Volume	1, 45	0.180	0.49	0.040	2.82 ± 0.83	3.18 ± 0.99
Left PoC_{upper}	Volume	1, 46	0.050	0.18	0.081	1.47 ± 0.49	1.97 ± 0.83
Right PoC_{upper}	Volume	1, 45	0.819	0.92	0.001	1.78 ± 0.76	1.74 ± 0.61
PrC_{upper}	LI Volume	1, 45	0.942	0.94	<.001	-7.4 ± 31.5	-6.7 ± 35.4
PoC_{upper}	LI Volume	1, 45	0.353	0.56	0.019	-8.0 ± 49.9	5.1 ± 17.5
Left PoC-PrC_{upper} u-fibers	FA	1, 43	0.343	0.56	0.021	0.33 ± 0.04	0.34 ± 0.03
	MD	1, 43	0.279	0.56	0.027	7.48 ± 0.28	7.39 ± 0.28
	Volume	1, 43	0.374	0.56	0.018	12.91 ± 3.06	13.87 ± 4.69
Right PoC-PrC_{upper} u-fibers	FA	1, 44	0.237	0.53	0.032	0.33 ± 0.03	0.34 ± 0.04
	MD	1, 44	0.007	0.13	0.152[a]	7.47 ± 0.35	7.23 ± 0.24
	Volume	1, 44	0.550	0.75	0.008	12.82 ± 3.62	13.69 ± 5.75
PoC-PrC_{upper} u-fibers	LI FA	1, 43	0.905	0.94	<.001	0.3 ± 10.4	0.8 ± 11.0
	LI MD	1, 43	0.040	0.18	0.095	0.3 ± 2.9	2.2 ± 3.4
	LI Volume	1, 43	0.667	0.80	0.004	0.6 ± 24.5	3.7 ± 36.0
Left PoC-PrC_{upper}	FC	1, 38	0.015	0.14	0.145[a]	1.11 ± 0.36	1.38 ± 0.43
Right PoC-PrC_{upper}	FC	1, 38	0.025	0.15	0.126[a]	1.10 ± 0.31	1.37 ± 0.40
PoC-PrC_{upper}	LI FC	1, 38	0.586	0.75	0.008	-1.6 ± 25.7	-0.1 ± 33.7
Left PrC_{lower}	Volume	1, 46	0.536	0.90	0.008	8.69 ± 1.33	8.94 ± 1.37
Right PrC_{lower}	Volume	1, 46	0.564	0.90	0.007	8.49 ± 1.13	8.69 ± 1.25
Left PoC_{lower}	Volume	1, 46	0.421	0.90	0.014	5.89 ± 0.81	5.67 ± 1.13

Right PoC_{lower}	Volume	1, 46	0.412	0.90	0.015	5.13 ± 1.15	5.42 ± 1.29
PrC_{lower}	LI Volume	1, 46	0.904	0.90	<.001	2.2 ± 15.9	2.7 ± 11.7
PoC_{lower}	LI Volume	1, 46	0.068	0.61	0.071	15.3 ± 20.6	5.1 ± 17.5
Left PoC-PrC_{lower} u-fibers	FA	1, 44	0.800	0.90	0.001	0.33 ± 0.02	0.33 ± 0.02
	MD	1, 44	0.725	0.90	0.003	7.14 ± 0.23	7.12 ± 0.22
	Volume	1, 44	0.795	0.90	0.002	26.10 ± 4.04	26.01 ± 5.26
Right PoC-PrC_{lower} u-fibers	FA	1, 44	0.883	0.90	<.001	0.32 ± 0.02	0.33 ± 0.03
	MD	1, 44	0.189	0.88	0.039	7.18 ± 0.25	7.08 ± 0.23
	Volume	1, 44	0.863	0.90	0.001	25.38 ± 4.09	25.99 ± 4.95
PoC-PrC_{lower} u-fibers	LI FA	1, 44	0.717	0.90	0.003	3.0 ± 7.0	1.4 ± 7.8
	LI MD	1, 44	0.195	0.88	0.038	-0.6 ± 2.6	0.6 ± 2.3
	LI Volume	1, 44	0.527	0.90	0.009	3.0 ± 17.7	-0.5 ± 16.9
Left PoC-PrC_{lower}	FC	1, 38	0.023	0.41	0.129	1.18 ± 0.24	1.48 ± 0.50
Right PoC-PrC_{lower}	FC	1, 38	0.273	0.90	0.032	1.28 ± 0.36	1.39 ± 0.49
PoC-PrC_{lower}	LI FC	1, 38	0.321	0.90	0.026	-11.1 ± 19.1	6.6 ± 25.4

[a] Medium size effects of group (partial η^2>.125).
Volume in ml, MD in (x 10^{-4} mm^2/s).
3 extreme outliers (>3 SD from the mean) were removed for PrC_{upper} volume (1 participant), PoC_{upper} volume (1 participant) and left PoC-PrC_{upper} u-fibers (1 participant).

Supplementary Table 6. Partial correlation results between hand knob measures and BMAT subscales in the ASD and TC groups.

	Manual dexterity			Coordination			Strength and flexibility		
	Partial *r*	*p*	*q*	Partial r	*p*	*q*	Partial r	*p*	*q*
					ASD				
Left PrC_{hand} volume	0.123	0.575	0.97	-0.026	0.905	1.00	0.079	0.719	0.97
Left PoC_{hand} volume	0.198	0.364	0.97	0.256	0.239	0.97	0.144	0.514	0.97
Right PrC_{hand} volume	-0.240	0.270	0.97	-0.002	0.994	1.00	0.142	0.519	0.97
Right PoC_{hand} volume	0.058	0.791	0.97	0.480	0.021[a]	0.65	0.089	0.685	0.97
LI PrC_{hand} volume	0.433	0.039[a]	0.70	0.035	0.874	1.00	-0.012	0.958	1.00
LI PoC_{hand} volume	0.196	0.371	0.97	-0.214	0.327	0.97	0.047	0.831	1.00
Left PoC-PrC_{hand} FA	-0.226	0.324	0.97	-0.327	0.149	0.97	-0.071	0.759	0.97
Left PoC-PrC_{hand} MD	-0.112	0.628	0.97	0.108	0.641	0.97	0.064	0.783	0.97
Left PoC-PrC_{hand} volume	0.286	0.208	0.97	0.127	0.582	0.97	0.293	0.197	0.97
Right PoC-PrC_{hand} FA	-0.075	0.747	0.97	0.149	0.518	0.97	-0.146	0.528	0.97
Right PoC-PrC_{hand} MD	-0.038	0.870	1.00	0.012	0.959	1.00	0.128	0.580	0.97
Right PoC-PrC_{hand} volume	0.201	0.381	0.97	0.362	0.107	0.97	0.188	0.415	0.97
LI PoC-PrC_{hand} FA	-0.103	0.656	0.97	-0.489	0.024[a]	0.65	0.118	0.611	0.97
LI PoC-PrC_{hand} MD	-0.094	0.684	0.97	0.145	0.529	0.97	-0.105	0.649	0.97
LI PoC-PrC_{hand} volume	0.281	0.218	0.97	-0.153	0.508	0.97	0.225	0.327	0.97
Left PoC-PrC_{hand} FC	0.001	0.997	1.00	0.124	0.623	0.97	-0.073	0.772	0.97
Right PoC-PrC_{hand} FC	-0.022	0.930	1.00	0.081	0.749	0.97	-0.109	0.666	0.97
LI PoC-PrC_{hand} FC	0.011	0.965	1.00	0.126	0.619	0.97	0.084	0.741	0.97
					TC[b]				
Left PrC_{hand} volume	0.088	0.688	0.90	--	--	--	0.072	0.743	0.90
Left PoC_{hand} volume	0.410	0.052	0.77	--	--	--	0.127	0.565	0.90
Right PrC_{hand} volume	0.395	0.062	0.77	--	--	--	0.039	0.860	0.90
Right PoC_{hand} volume	0.329	0.125	0.77	--	--	--	0.170	0.439	0.90
LI PrC_{hand} volume	-0.298	0.167	0.77	--	--	--	-0.054	0.808	0.90
LI PoC_{hand} volume	-0.066	0.766	0.90	--	--	--	-0.094	0.670	0.90
Left PoC-PrC_{hand} FA	-0.226	0.572	0.90	--	--	--	-0.071	0.723	0.90
Left PoC-PrC_{hand} MD	-0.112	0.901	0.90	--	--	--	0.064	0.298	0.89
Left PoC-PrC_{hand} volume	0.286	0.453	0.90	--	--	--	0.293	0.241	0.79

Right PoC-PrC_{hand} FA	-0.075	0.157	0.77	--	--	--	-0.146	0.171	0.77
Right PoC-PrC_{hand} MD	-0.038	0.883	0.90	--	--	--	0.128	0.795	0.90
Right PoC-PrC_{hand} volume	0.201	0.502	0.90	--	--	--	0.188	0.682	0.90
LI PoC-PrC_{hand} FA	-0.103	0.142	0.77	--	--	--	0.118	0.418	0.90
LI PoC-PrC_{hand} MD	-0.094	0.565	0.90	--	--	--	-0.105	0.237	0.79
LI PoC-PrC_{hand} volume	0.281	0.636	0.90	--	--	--	0.225	0.219	0.79
Left PoC-PrC_{hand} FC	-0.149	0.520	0.90	--	--	--	-0.046	0.844	0.90
Right PoC-PrC_{hand} FC	0.172	0.456	0.90	--	--	--	-0.108	0.641	0.90
LI PoC-PrC_{hand} FC	-0.376	0.093	0.77	--	--	--	0.068	0.770	0.90

[a] Findings with $p<.05$ uncorrected.

[b] BMAT Coordination scores were at ceiling for almost all TC participants and were therefore excluded from analyses.

Supplementary Table 7. Partial correlation results between hand knob measures and ADOS-2 sub-scores in the ASD group.

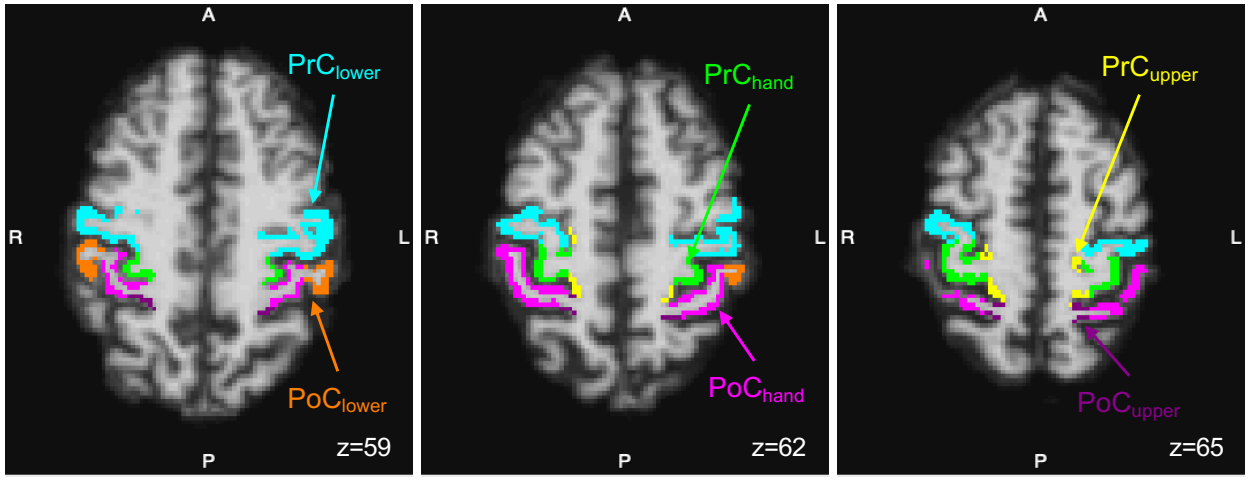
	Social Affect			RRB			Comparison Score		
	Partial *r*	*p*	*q*	Partial *r*	*p*	*q*	Partial *r*	*p*	*q*
Left PrC_{hand} volume	0.191	0.382	0.73	0.022	0.921	0.94	0.076	0.730	0.94
Left PoC_{hand} volume	0.087	0.692	0.94	0.083	0.705	0.94	0.046	0.835	0.94
Right PrC_{hand} volume	0.201	0.357	0.73	-0.197	0.367	0.73	-0.066	0.766	0.94
Right PoC_{hand} volume	-0.151	0.492	0.81	-0.165	0.452	0.79	-0.308	0.152	0.73
LI PrC_{hand} volume	0.115	0.601	0.90	0.336	0.117	0.73	0.263	0.225	0.73
LI PoC_{hand} volume	0.249	0.251	0.73	0.229	0.294	0.73	0.295	0.172	0.73
Left PoC-PrC_{hand} FA	0.224	0.330	0.73	0.035	0.880	0.94	0.243	0.289	0.73
Left PoC-PrC_{hand} MD	0.024	0.917	0.94	0.040	0.863	0.94	0.084	0.718	0.94
Left PoC-PrC_{hand} volume	0.198	0.390	0.73	-0.214	0.352	0.73	-0.028	0.903	0.94
Right PoC-PrC_{hand} FA	-0.143	0.537	0.85	-0.309	0.173	0.73	-0.279	0.221	0.73
Right PoC-PrC_{hand} MD	0.158	0.494	0.81	0.356	0.113	0.73	0.345	0.125	0.73
Right PoC-PrC_{hand} volume	-0.268	0.240	0.73	-0.505	0.019[a]	0.31	-0.584	0.005[a]	0.27
LI PoC-PrC_{hand} FA	0.289	0.204	0.73	0.425	0.055	0.59	0.493	0.023[a]	0.31
LI PoC-PrC_{hand} MD	-0.108	0.641	0.91	-0.540	0.012[a]	0.31	-0.372	0.097	0.73
LI PoC-PrC_{hand} volume	0.222	0.335	0.73	0.223	0.332	0.73	0.274	0.229	0.73
Left PoC-PrC_{hand} FC	-0.019	0.939	0.94	0.052	0.837	0.94	0.064	0.802	0.94
Right PoC-PrC_{hand} FC	0.199	0.428	0.77	-0.049	0.848	0.94	0.119	0.637	0.91
LI PoC-PrC_{hand} FC	-0.239	0.339	0.73	0.149	0.556	0.86	0.058	0.818	0.94

[a] Findings with $p<.05$ uncorrected.

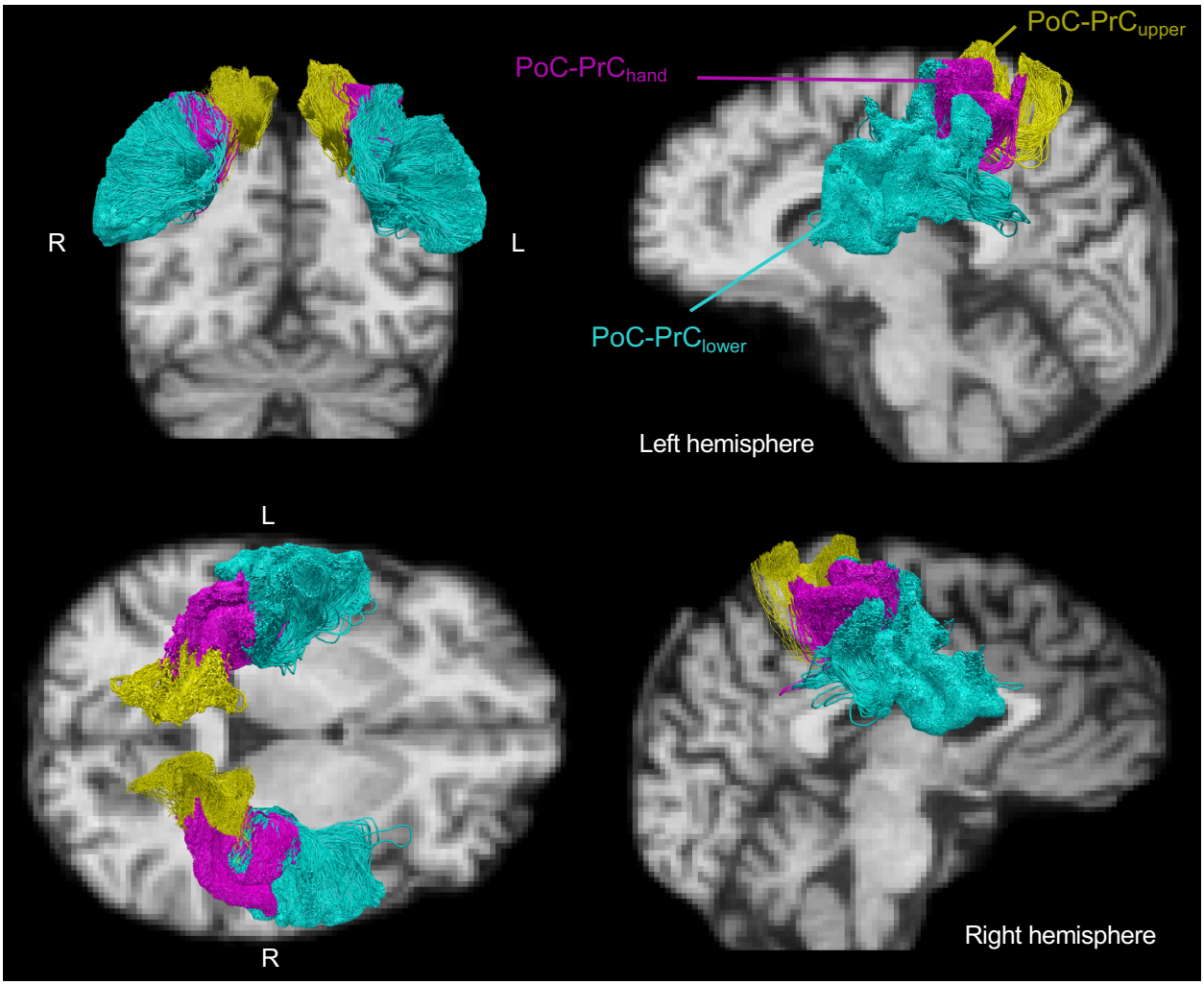
Supplementary Table 8. Partial correlation results between corresponding u-fiber and functional connectivity measures in the ASD and TC groups.

		Left PoC-PrC$_{hand}$ FC			Right PoC-PrC$_{hand}$ FC			LI PoC-PrC$_{hand}$ FC		
	df	Partial *r*	*p*	*q*	Partial *r*	*p*	*q*	Partial *r*	*p*	*q*
					ASD					
Left PoC-PrC$_{hand}$ FA	14	-0.064	0.813	0.90						
Left PoC-PrC$_{hand}$ MD	14	-0.202	0.453	0.89						
Left PoC-PrC$_{hand}$ volume	14	0.035	0.896	0.90						
Right PoC-PrC$_{hand}$ FA	14				-0.084	0.756	0.90			
Right PoC-PrC$_{hand}$ MD	14				-0.239	0.374	0.89			
Right PoC-PrC$_{hand}$ volume	14				0.647	0.007[a]	0.06			
LI PoC-PrC$_{hand}$ FA	14							0.068	0.802	0.90
LI PoC-PrC$_{hand}$ MD	14							-0.374	0.154	0.69
LI PoC-PrC$_{hand}$ volume	14							0.185	0.494	0.89
					TC					
Left PoC-PrC$_{hand}$ FA	16	0.433	0.072	0.59						
Left PoC-PrC$_{hand}$ MD	16	-0.188	0.455	0.62						
Left PoC-PrC$_{hand}$ volume	16	0.102	0.686	0.77						
Right PoC-PrC$_{hand}$ FA	16				0.342	0.165	0.59			
Right PoC-PrC$_{hand}$ MD	16				0.067	0.791	0.79			
Right PoC-PrC$_{hand}$ volume	16				-0.278	0.264	0.59			
LI PoC-PrC$_{hand}$ FA	16							0.225	0.369	0.62
LI PoC-PrC$_{hand}$ MD	16							0.299	0.228	0.59
LI PoC-PrC$_{hand}$ volume	16							0.177	0.481	0.62

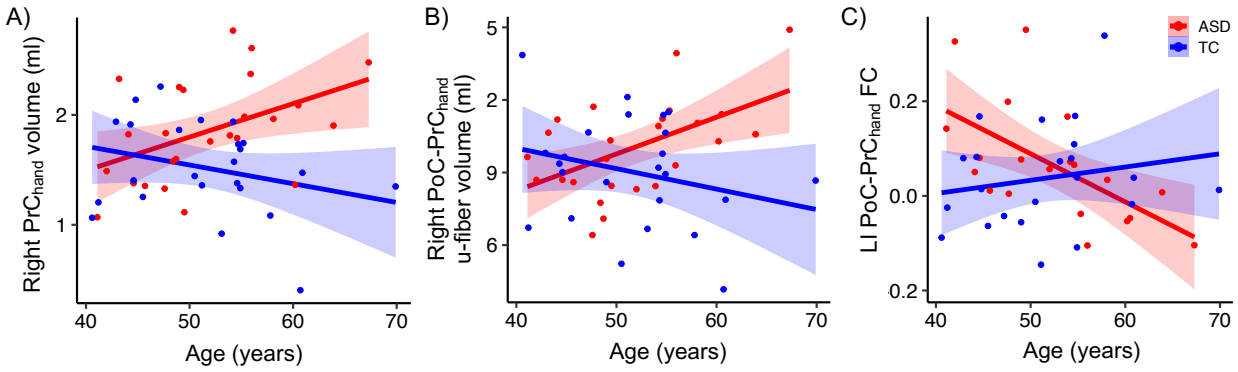
[a] Significant at $p<.05$, uncorrected.



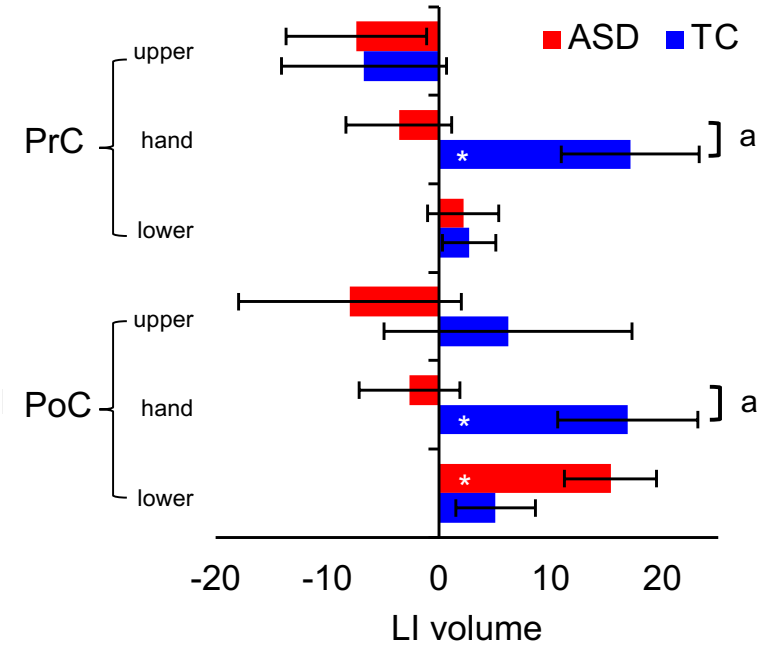
Supplementary Figure 1. PrC and PoC sub-parcels shown on multiple axial slices in a representative participant with ASD.



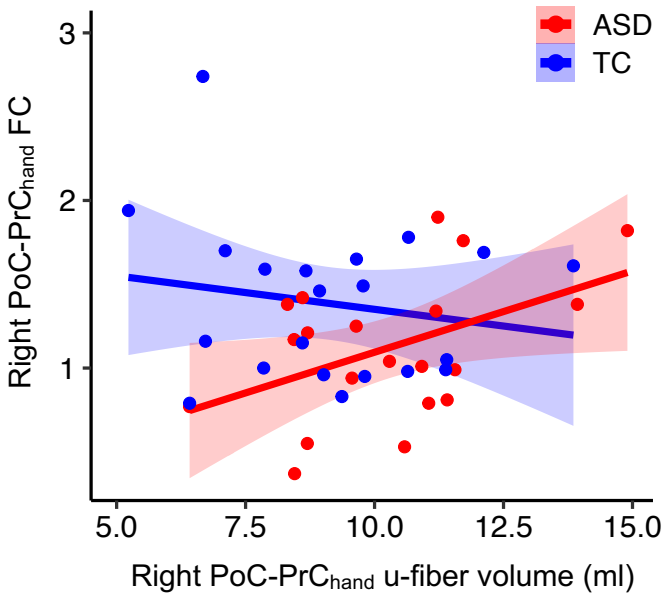
Supplementary Figure 2. PoC-PrC u-fiber sub-tracts corresponding to PrC and PoC sub-parcels shown from multiple angles in native diffusion space with a T1-weighted underlay in a representative participant with ASD.



Supplementary Figure 3. Scatterplots show group by age interaction effects in A) right PrC_{hand} volume (q=.06), showing a positive slope with age in the ASD (r=.455, p=.022) but not TC (r=-.281, p=.184) group; B) right hand knob u-fiber volume (q=.06), with a similar positive slope with age in the ASD (r=.533, p=.006) but not TC (r=-.260, p=.219) group; and C) LI PoC-PrC_{hand} FC (q=.06), with a negative slope with age in the ASD (r=-.603, p=.005) but not TC (r=.184, p=.413) group. Pearson correlations were run on each group separately to determine the direction of effects.



Supplementary Figure 4. Laterality index of volume in the pre and postcentral sub-parcels (upper, hand knob, and lower). [a] BF>3 (group difference); [*]p<.05, uncorrected (differs from zero).



Supplementary Figure 5. The scatterplot shows a strong positive relationship between corresponding right PoC-PrC$_{hand}$ u-fiber volume and FC in the ASD group (partial r=.647, q=.06), but did not survive FDR correction. Shaded areas in the scatterplots represent 95% confidence intervals.