

**Online supplement**  
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**Table DS1** Details of medications that the schizophrenia subjects were receiving

Medication status	n	Mean risperidone doses	Mean risperidone equivalents/day#
Drug-naïve/free	9 (6 / 3)	0	
Risperidone	11	4.63 mg/day	2.32
Risperidone+ Olanzapine	1	Risp=6 mg/day + Olanzapine= 15 mg/day	6
Olanzapine	1	15 mg/day	3
Clozapine	1	25 mg/day	0.5
Flupenthixol	1	6mg/day	2*

# [1 risperidone equivalent = 2 mg of risperidone = 100 mg chlorpromazine = 5 mg olanzapine = 75 mg quetiapine = 60 mg ziprasidone = 7.5 mg aripiprazole = 100 mg clozapine per day (Woods, 2003)]

\*3 mg of Flupenthixol per day is equivalent to 100 mg of chlorpromazine (The Maudsley Prescribing Guidelines, 10<sup>th</sup> Edn. Eds: Taylor D, Paton C and Kapur S). Since 100 mg of chlorpromazine is equivalent to 2 mg of risperidone (Woods, 2003), 6 mg of flupenthixol may be considered as 2 risperidone equivalents.

**Table DS2** Estimated maximum incremental movement parameters during the overt verbal fluency task.

	Maximum incremental translations			Maximum incremental rotations		
	(mm, Mean $\pm$ SD, range)			(degrees, Mean $\pm$ SD, range)		
	X	Y	Z	Pitch	Roll	Yaw
HS	0.25 $\pm$ 0.25 (0.03 - 1.09)	0.41 $\pm$ 0.35 (0.13 - 1.46)	0.54 $\pm$ 0.49 (0.09 - 1.93)	0.01 $\pm$ 0.01 (0.00 - 0.03)	0.00 $\pm$ 0.00 (0.00 - 0.02)	0.01 $\pm$ 0.01 (0.00 - 0.02)
SZ	0.22 $\pm$ 0.23 (0.08 - 1.25)	0.39 $\pm$ 0.22 (0.18 - 1.04)	0.63 $\pm$ 0.59 (0.12 - 2.45)*	0.02 $\pm$ 0.02 (0.00 - 0.09)	0.01 $\pm$ 0.01 (0.00 - 0.04)	0.01 $\pm$ 0.01 (0.00 - 0.03)

HS: Healthy Subjects; SZ: Schizophrenia. No significant group differences (Mann Whitney - U test). \* Only one subject in SZ group had a maximum translational incremental movement of >2.0 mm in Z plane

**Table DS3** Voxel-level local maxima of blood oxygen level-dependent functional magnetic resonance imaging signal significant at  $p < 0.05$  (false discovery rate corrected) with extent threshold of 20 voxels in healthy participants with the word generation *v.* word repetition contrast ( $n = 24$ )

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Medial Frontal Gyrus	Left	9	11.09	-10	31	33
Cingulate Gyrus	Right	32	10.49	4	27	32
Cingulate Gyrus	Left	32	10.33	-2	25	36
Medial Frontal Gyrus	Left	6	9.98	-8	16	42
Inferior Frontal Gyrus	Left	47	9.39	-32	21	-8
Insula	Right	13	8.63	42	12	-2
Insula	Left	13	8.27	-42	14	5
Insula	Left	13	8.22	-34	16	-1
Inferior Frontal Gyrus	Right	47	8.05	36	21	-8
Insula	Left	13	7.85	-40	12	10
Inferior Frontal Gyrus	Left	47	7.74	-32	29	-5
Medial Frontal Gyrus	Right	8	7.62	8	27	41
Inferior Frontal Gyrus	Left	13	6.74	-40	26	13
Insula	Left	13	6.38	-42	9	18
Inferior Frontal Gyrus	Left	9	6.34	-36	11	25
Medial Frontal Gyrus	Right	6	6.24	14	16	49
Rostral prefrontal cortex*	Right	10	6.15	38	42	20
Rostral prefrontal cortex*	Right	10	5.44	30	45	9
Rostral prefrontal cortex*	Left	10	5.20	-30	51	14
Thalamus	Right		5.19	18	-34	16
Precentral Gyrus	Left	6	5.18	-30	5	31
Rostral prefrontal cortex*	Left	10	5.01	-30	36	15
Thalamus	Left		4.97	-6	-5	15
Rostral prefrontal cortex*	Left	10	4.91	-40	38	26
Middle Frontal Gyrus	Left	9	4.89	-42	31	28
Inferior Frontal Gyrus	Left	13	4.64	-44	27	6
Thalamus	Left		4.53	-4	-23	9
Cingulate Gyrus	Left	32	4.50	-22	11	34
Caudate, body	Left		4.47	-10	1	15
Caudate, tail	Left		3.94	-20	-42	11
Middle Frontal Gyrus	Left	6	3.67	-26	12	45
Middle Frontal Gyrus	Left	8	3.59	-26	18	51

\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex

**Table DS4** Voxel-level local maxima of blood oxygen level-dependent functional magnetic resonance imaging signal significant at  $p < 0.05$  (false discovery rate corrected) with extent threshold of 20 voxels in participants with schizophrenia with the word generation *v.* word repetition contrast (n = 24)

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Insula	Left	13	12.40	-38	19	-1
Inferior Frontal Gyrus	Left	46	9.98	-34	30	19
Cingulate Gyrus	Left	32	9.81	-4	21	41
Medial Frontal Gyrus	Left	32	9.33	-10	14	45
Cingulate Gyrus	Right	32	8.87	10	25	28
Anterior Cingulate	Left	24	8.45	-8	25	25
Inferior Frontal Gyrus	Left	47	8.08	-40	35	2
Rostral prefrontal cortex*	Left	10	6.76	-32	51	3
Insula	Right		6.68	36	23	1
Inferior Frontal Gyrus	Left	13	6.36	-40	30	8
Middle Frontal Gyrus	Left	8	6.28	-48	10	40
Inferior Frontal Gyrus	Right	47	6.28	46	13	-4
Insula	Left	13	6.01	-34	18	18
Inferior Frontal Gyrus	Left	9	5.67	-40	7	24
Insula	Left	13	5.58	-40	5	18
Rostral prefrontal cortex*	Right	10	5.57	34	43	14
Inferior Frontal Gyrus	Right	47	5.42	44	21	-6
Cuneus	Left	17	5.21	-18	-93	5
Rostral prefrontal cortex*	Left	10	5.07	-34	55	10
Inferior Frontal Gyrus	Left	9	5.02	-50	19	27
Inferior Frontal Gyrus	Right	47	4.92	34	21	-13
Middle Frontal Gyrus	Right	8	4.48	48	12	38
Precentral Gyrus	Left	6	4.45	-34	2	35
Angular Gyrus	Left	39	4.25	-28	-55	34
Superior Temporal Gyrus	Right	22	4.21	61	-27	7
Rostral prefrontal cortex*	Right	10	4.19	34	46	23
Fusiform Gyrus	Left	37	4.14	-44	-55	-16
Anterior Cingulate	Right	32	4.08	14	34	19
Middle Temporal Gyrus	Left	21	3.82	-55	-8	-5
Declive	Right		3.75	36	-61	-20
Superior Temporal Gyrus	Right	22	3.63	63	-40	20
Superior Temporal Gyrus	Left	13	3.56	-55	-40	17
Superior Temporal Gyrus	Right	38	3.50	44	15	-19
Red Nucleus	Left		3.37	-4	-26	-5
Rostral prefrontal cortex*	Left	10	3.24	-24	48	27
Medial Frontal Gyrus	Right	9	3.21	12	38	31
Lingual Gyrus	Left	18	3.17	-24	-91	-2
Middle Temporal Gyrus	Left	22	3.02	-57	-33	3
Inferior Parietal Lobule	Left	40	2.99	-46	-41	26

\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex.

**Table DS5** Voxel-level local maxima of Blood Oxygen Level Dependent (BOLD) fMRI signal significant at  $p < 0.05$ , corrected by false discovery rate (FDR) method (extent threshold of 20 voxels) in healthy subjects with the word repetition vs. word generation contrast ( $n = 24$ ). Related to Figure 4 and Figure DS5.

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Middle Temporal Gyrus	Left	39	12.75	-38	-65	22
Fusiform Gyrus	Right	20	10.77	40	-40	-13
Precuneus	Left	31	9.40	-12	-55	30
Middle Temporal Gyrus	Right	39	9.31	38	-65	22
Precuneus	Right	31	9.29	2	-47	30
Precuneus	Right	31	9.24	14	-51	28
Middle Temporal Gyrus	Right	39	8.88	40	-71	22
Middle Temporal Gyrus	Left	37	8.44	-44	-70	7
Cingulate Gyrus	Right	31	8.38	10	-43	28
Middle Occipital Gyrus	Left	19	8.36	-38	-72	7
Middle Temporal Gyrus	Left	39	8.30	-42	-75	11
Precuneus	Right	7	8.27	22	-66	31
Middle Temporal Gyrus	Left	37	8.12	-48	-58	5
Medial Frontal Gyrus	Right	6	7.88	14	-21	49
Cuneus	Left	7	7.71	-4	-66	31
Superior Parietal Lobule	Right	7	7.51	20	-49	61
Middle Temporal Gyrus	Left	37	7.30	-44	-58	0
Postcentral Gyrus	Right	5	7.15	18	-41	67
Superior Temporal Gyrus	Right	39	7.07	46	-59	21
Cuneus	Left	19	6.99	-26	-78	28
Posterior Cingulate	Right	29	6.92	8	-44	15
Middle Occipital Gyrus	Left	19	6.91	-30	-75	24
Cingulate Gyrus	Right	24	6.67	20	-9	47
Precentral Gyrus	Right	4	6.55	34	-15	52
Postcentral Gyrus	Right	3	6.54	20	-36	63
Middle Temporal Gyrus	Right	19	6.43	46	-60	14
Superior Temporal Gyrus	Right	39	6.40	44	-54	14
Paracentral Lobule	Left	5	6.38	-22	-44	56
Cuneus	Right	18	6.37	18	-79	22
Paracentral Lobule	Left	5	6.30	0	-32	51
Precuneus	Right	7	6.27	16	-49	39
Postcentral Gyrus	Left	5	6.21	-20	-45	65
Middle Occipital Gyrus	Right	37	6.21	50	-70	5
Paracentral Lobule	Right	31	6.17	6	-27	47
Postcentral Gyrus	Right	43	6.15	55	-11	17
Precuneus	Right	7	6.15	8	-52	49
Precuneus	Right	7	6.14	6	-41	44
Precuneus	Right	7	6.11	12	-46	45
Postcentral Gyrus	Left	3	6.09	-50	-13	49
Precentral Gyrus	Left	4	6.00	-42	-13	47
Medial Frontal Gyrus	Right	6	5.98	10	-7	50
Middle Temporal Gyrus	Right	37	5.92	50	-64	3
Postcentral Gyrus	Right	3	5.90	32	-23	49
Precentral Gyrus	Right	4	5.87	48	-13	47
Middle Temporal Gyrus	Left	19	5.87	-38	-58	14
Fusiform Gyrus	Left	37	5.84	-36	-40	-13
Cingulate Gyrus	Left	31	5.84	-20	-19	47
Medial Frontal Gyrus	Left	6	5.73	-10	-19	47
Middle Temporal Gyrus	Left	39	5.67	-44	-54	14
Medial Frontal Gyrus	Right	6	5.64	20	-15	54

Insula	Right	13	5.58	42	-44	13
Precentral Gyrus	Left	4	5.55	-18	-19	53
Paracentral Lobule	Right	5	5.53	16	-37	46
Postcentral Gyrus	Left	4	5.53	-14	-32	61
Cingulate Gyrus	Right	23	5.51	8	-28	33
Cingulate Gyrus	Right	24	5.51	16	-5	50
Superior Parietal Lobule	Left	7	5.49	-14	-61	56
Postcentral Gyrus	Right	43	5.43	63	-11	19
Cuneus	Right	18	5.40	4	-91	12
Paracentral Lobule	Right	5	5.35	16	-34	51
Precentral Gyrus	Right	6	5.33	28	-9	50
Medial Frontal Gyrus	Left	6	5.33	-12	-26	62
Postcentral Gyrus	Right	3	5.26	44	-19	49
Cingulate Gyrus	Left	24	5.22	-14	-7	46
Postcentral Gyrus	Left	43	5.20	-50	-17	17
Middle Occipital Gyrus	Right	19	5.18	48	-52	1
Cuneus	Left	18	5.16	-12	-78	24
Precentral Gyrus	Left	6	5.12	-26	-14	65
Precentral Gyrus	Right	6	5.12	48	-14	34
Insula	Right	13	5.12	38	-13	17
Cingulate Gyrus	Left	31	5.04	-10	-31	37
Culmen	Left		5.03	-30	-34	-20
Postcentral Gyrus	Right	3	5.00	57	-13	43
Cingulate Gyrus	Left	31	4.87	-12	-25	38
Lingual Gyrus	Left	18	4.83	-2	-74	2
Parahippocampal Gyrus	Right		4.79	34	-22	-12
Paracentral Lobule	Left	5	4.70	-12	-42	59
Middle Temporal Gyrus	Right	21	4.70	59	-54	6
Precentral Gyrus	Right	6	4.69	22	-16	67
Lentiform Nucleus	Left		4.65	-26	-16	-8
Medial Frontal Gyrus	Left	6	4.64	-12	-21	54
Parahippocampal Gyrus	Right	19	4.63	30	-51	-6
Middle Frontal Gyrus	Right	6	4.60	26	-3	50
Precentral Gyrus	Left	4	4.59	-18	-20	58
Medial Frontal Gyrus	Left	6	4.59	-4	-13	60
Insula	Left	13	4.53	-38	-32	26
Insula	Left	13	4.51	-40	-22	27
Medial Frontal Gyrus	Left	6	4.47	-8	-18	62
Parahippocampal Gyrus	Left		4.43	-32	-16	-18
Caudate, tail	Right		4.41	36	-16	-8
Insula	Left	13	4.40	-36	-11	15
Postcentral Gyrus	Left	3	4.38	-59	-20	36
Insula	Right	13	4.38	50	-20	25
Lingual Gyrus	Left	18	4.38	-6	-70	-3
Postcentral Gyrus	Right	3	4.38	61	-18	34
Precentral Gyrus	Left	6	4.36	-18	-16	63
Postcentral Gyrus	Left	3	4.34	-24	-30	57
Medial Frontal Gyrus	Left	6	4.33	-10	-12	61
Precentral Gyrus	Left	4	4.32	-59	-7	21
Declive	Left		4.27	-32	-57	-7
Uvula	Left		4.27	-14	-69	-25
Precentral Gyrus	Right		4.18	18	-26	66
Parahippocampal Gyrus	Left		4.15	-34	-10	-15
Precentral Gyrus	Left	6	4.15	-55	-3	26
Precentral Gyrus	Right	4	4.14	26	-24	66
Cingulate Gyrus	Left	23	4.13	-10	-10	30
Medial Frontal Gyrus	Left	6	4.11	-14	-8	65
Middle Temporal Gyrus	Right	21	4.09	63	-45	-1
Postcentral Gyrus	Right	2	4.03	38	-25	38

Precentral Gyrus	Left	4	4.03	-53	-16	36
Cingulate Gyrus	Left	31	3.99	-18	-33	46
Medial Frontal Gyrus	Left	6	3.97	-16	-11	54
Postcentral Gyrus	Left	3	3.96	-32	-32	50
Medial Frontal Gyrus	Right	6	3.96	4	-17	58
Superior Frontal Gyrus	Right	6	3.91	18	-10	65
Postcentral Gyrus	Left	2	3.87	-44	-20	32
Lentiform Nucleus	Right		3.86	28	-14	-6
Culmen	Left		3.73	-30	-51	-19
Culmen	Left		3.68	-22	-58	-26
Cingulate Gyrus	Left	23	3.68	2	-26	23
Fusiform Gyrus	Left	19	3.65	-24	-59	-7
Lingual Gyrus	Right	19	3.63	22	-66	-3
Parahippocampal Gyrus	Left		3.47	-34	-18	-11
Medial Frontal Gyrus	Left	6	3.47	-2	-5	54
Pyramis	Left		3.37	-20	-64	-27
Precentral Gyrus	Right	6	3.24	44	-2	30
Lentiform Nucleus	Left		6.71	-20	9	-7
Lentiform Nucleus	Right		6.37	22	13	-7
Anterior Cingulate	Left	32	5.88	-8	46	-4
Anterior Cingulate	Left	24	5.17	-2	37	-2
Lentiform Nucleus	Right		5.15	20	7	-10
Caudate, head	Left		5.10	-16	19	-3
Anterior Cingulate	Right	32	4.92	8	44	-4
Anterior Cingulate	Right	24	4.82	8	39	-2
Anterior Cingulate	Right	24	4.50	10	33	2
Caudate, head	Right		4.31	10	23	3
Anterior Cingulate	Left		4.21	-8	29	0
Medial Frontal Gyrus	Right	9	3.67	8	53	16
Rostral prefrontal cortex*	Right	10	3.47	4	57	12
Caudate, head	Left		3.37	0	12	1
Rostral prefrontal cortex*	Left	10	3.19	-6	55	14
Inferior Frontal Gyrus	Left	47	2.74	-22	23	-13
Rostral prefrontal cortex*	Left	10	2.68	-12	49	10
Anterior Cingulate	Left	24	2.56	0	25	2
Caudate, head	Right		2.50	12	14	18
Middle Temporal Gyrus	Left	21	4.62	-51	-12	-16
Cerebellar Tonsil	Right		3.81	10	-56	-39
Medial Frontal Gyrus	Right	9	3.02	22	32	26
Superior Frontal Gyrus	Right	9	2.50	20	39	35
Middle Frontal Gyrus	Right	8	2.44	22	37	41

\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex

**Table DS6** Brain areas of significantly greater activations [word generation vs word repetition contrast,  $P < 0.01$  (uncorrected)] in schizophrenia subjects ( $n=24$ ) compared to healthy subjects ( $n=24$ ) determined by a permutation based non-parametric two sample pseudo-t test implemented in SnPM.

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Caudate Tail	Right		3.25	16	-28	25
Caudate Body	Left		2.96	-16	5	26
Rostral Prefrontal Cortex*	Left	10	2.87	-18	47	9
Rostral Prefrontal Cortex*	Right	10	2.84	22	52	23
Caudate Body	Right		2.83	12	3	24
Inferior Frontal Gyrus	Left	47	2.64	-44	21	-1
Insula	Right	13	2.37	42	-8	-1
Cingulate Gyrus	Right	24	2.32	20	11	29
Clastrum	Right		2.32	28	-14	21
Insula	Right	13	2.26	34	-11	17
Caudate Body	Right		2.20	18	-6	30
Clastrum	Right		2.19	30	-11	19
Caudate Body	Left		2.17	-18	-28	27
Cingulate Gyrus	Right	32	1.93	22	13	31

\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex



**Table DS7** Brain areas of significantly greater deactivations [word repetition vs word generation,  $P < 0.01$  (uncorrected)] in healthy subjects ( $n=24$ ) compared to schizophrenia subjects ( $n=24$ ) determined by a permutation based non-parametric two sample pseudo-t test implemented in SnPM.

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Postcentral Gyrus	Right	40	3.88	44	-29	46
Postcentral Gyrus	Right	2	3.74	51	-21	47
Fusiform Gyrus	Right	20	3.68	36	-38	-17
Angular Gyrus	Left	39	3.42	-30	-60	34
Rostral prefrontal cortex	Right	10	3.42	38	48	-2
Culmen	Left		3.30	-32	-40	-20
Precuneus	Left	19	3.23	-30	-68	37
Postcentral Gyrus	Left	40	3.20	-46	-32	51
Middle Frontal Gyrus	Right	6	3.14	28	-5	50
Precuneus	Right	7	3.14	20	-70	44
Postcentral Gyrus	Left	43	3.14	-59	-17	19
Middle Occipital Gyrus	Left	18	3.09	-32	-83	4
Postcentral Gyrus	Right	2	3.08	36	-27	36
Rostral prefrontal cortex	Left	10	3.07	-40	49	5
Middle Temporal Gyrus	Left	37	2.97	-48	-66	7
Cuneus	Left	19	2.97	-14	-84	28
Sub-Gyral	Right	6	2.79	30	-3	57
Precuneus	Left	7	2.72	-16	-76	37

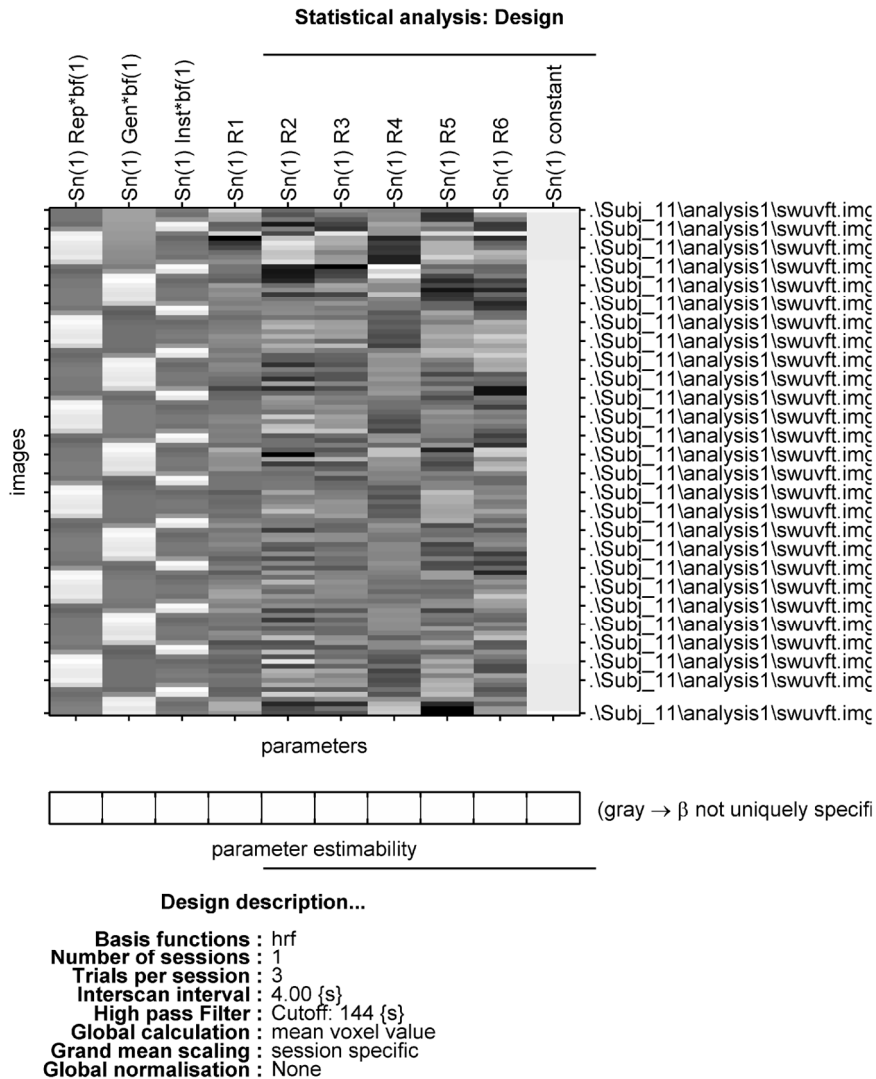
\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex.

**Table DS8** Regression analysis of word repetition – word generation contrast images with the difference of word generation – word repetition latencies (lat-diff<sub>gen-rep</sub>) in healthy subjects.

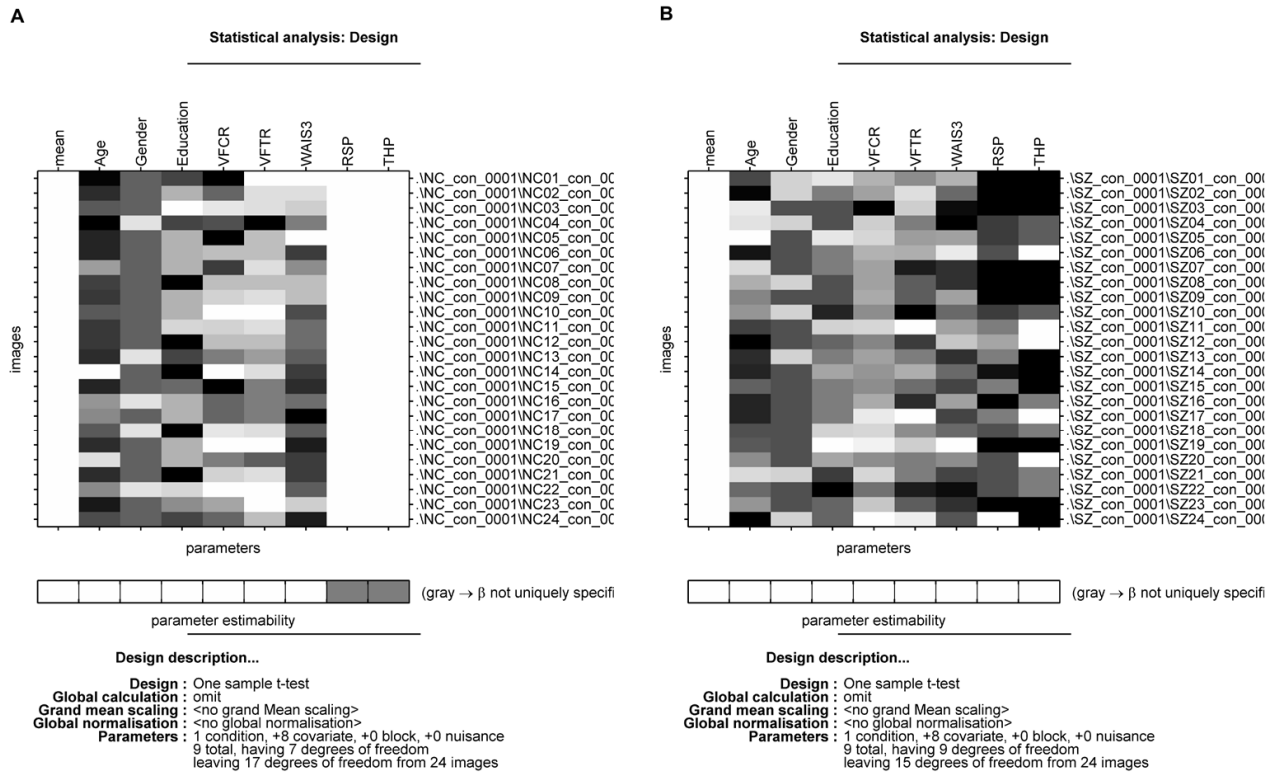
Voxel-level local maxima of fMRI BOLD signals showing significant inverse correlations (P<0.05, corrected by false discovery rate method, extent threshold 20 voxels, n = 14). Related to Figure 5.

Region	Left/ right	Brodmann area	t-test	Coordinates		
				x	y	z
Parahippocampal Gyrus	Left	30	21.05	12	-39	6
Culmen	Left		12.63	8	-45	1
Thalamus	Left		10.67	8	-31	9
Middle Frontal Gyrus	Left	6	19.96	-36	12	49
Middle Frontal Gyrus	Right	6	8.39	-32	8	44
Declive	Left		17.09	-20	-65	-15
Declive	Left		12.40	-20	-80	-14
Declive	Left		11.09	-10	-76	-15
Declive	Left		16.60	18	-65	-12
Declive	Left		7.52	24	-73	-20
Middle Frontal Gyrus	Left	9	15.28	-46	17	38
Insula	Left		14.47	-46	10	1
Middle Frontal Gyrus	Left	6	13.72	-28	-9	45
Precuneus	Left	7	12.33	-20	-62	49
Precuneus	Left	7	8.87	-20	-54	47
Medial Frontal Gyrus	Left	6	11.64	-4	31	37
Thalamus	Right		11.18	18	-23	9
Rostral Prefrontal Cortex	Left	10	10.54	42	47	14
Lingual Gyrus	Right	18	9.95	24	-58	1
Inferior Frontal Gyrus	Right	46	9.93	36	36	13
Rostral Prefrontal Cortex*	Right	10	7.59	38	43	11
Cingulate Gyrus	Right	32	9.71	-24	10	44
Middle Frontal Gyrus	Right	6	9.65	-26	9	55
Cerebellar Lingual	Right		9.34	-6	-45	-15
Middle Frontal Gyrus	Right	9	9.29	38	35	37
Lingual Gyrus	Right	18	9.08	14	-70	-2
Superior Frontal Gyrus	Left	9	8.74	26	44	35
Inferior Frontal Gyrus	Left	44	8.51	-42	16	12
Middle Frontal Gyrus	Right	6	8.20	32	4	42
Middle Frontal Gyrus	Left	6	7.20	28	10	49
Rostral Prefrontal Cortex*	Right	10	8.02	14	47	11
Cuneus	Right	18	7.90	26	-79	22
Superior Parietal Lobule	Left	7	7.64	-30	-57	56
Cerebellar Lingual	Left		7.47	4	-45	-15
Cingulate Gyrus	Right	32	7.38	16	21	39
Middle Temporal Gyrus	Left	19	7.21	34	-63	14
Nodule	Left		7.04	-4	-46	-28
Declive	Left		7.02	-8	-69	-13
Middle Frontal Gyrus	Left	6	6.97	-48	8	42
Middle Occipital Gyrus	Left	18	6.93	-24	-86	-2
Lentiform Nucleus	Right		6.92	-18	12	3
Cuneus	Right	18	6.91	-22	-86	19
Middle Frontal Gyrus	Right	9	6.79	-48	8	38

\*Brodmann Area 10 labelled as superior / middle / medial frontal gyrus by Talairach Daemon has been relabelled as rostral prefrontal cortex

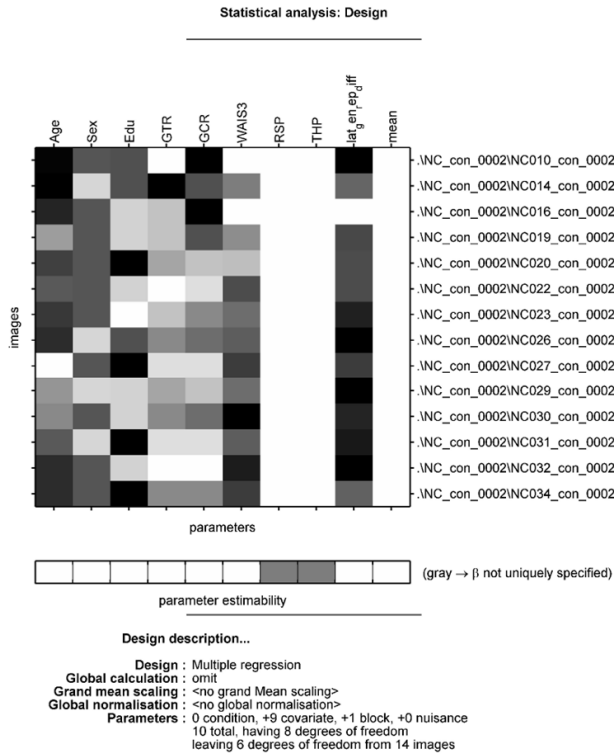


**Figure DS1** Design matrix of the general linear model used for the first level within-subject analysis of fMRI images. The model included three task-related regressors representing the word repetition condition (Column 1, Rep), word generation (Column 2, Gen) and the between block instruction (Column 3, Inst) conditions. Six co-variables of no interest representing the estimated translational and rotational movement parameters (Columns 4-9) were also modelled. T- contrasts tested were  $[-1 \ 1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0]$  and  $[1 \ -1 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0]$ .

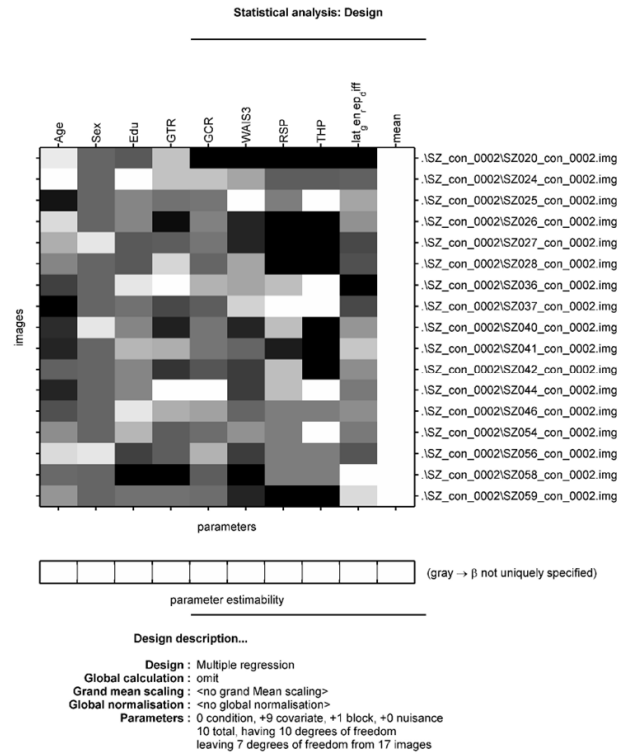


**Figure DS2** Design matrix of the general linear models used for the second level within-group one-sample random effects (RFX) analysis (A: Healthy subjects group; B: Schizophrenia subjects). In addition to the contrast images from the first level analysis, the model included 8 co-variates (Columns 2 to 9) of no interest viz., Age, Gender, Education, verbal fluency correct responses score (VFCR), verbal fluency total responses score (VFTR), score on the matrix reasoning test of Wechsler Adult Intelligence Scale (WAIS-III), antipsychotic medication dosage (risperidone-equivalents) and anti-cholinergic medication dosage (trihexyphenidyl dose). The T – contrasts [1 0 0 0 0 0 0 0] and [-1 0 0 0 0 0 0 0] were tested.

A

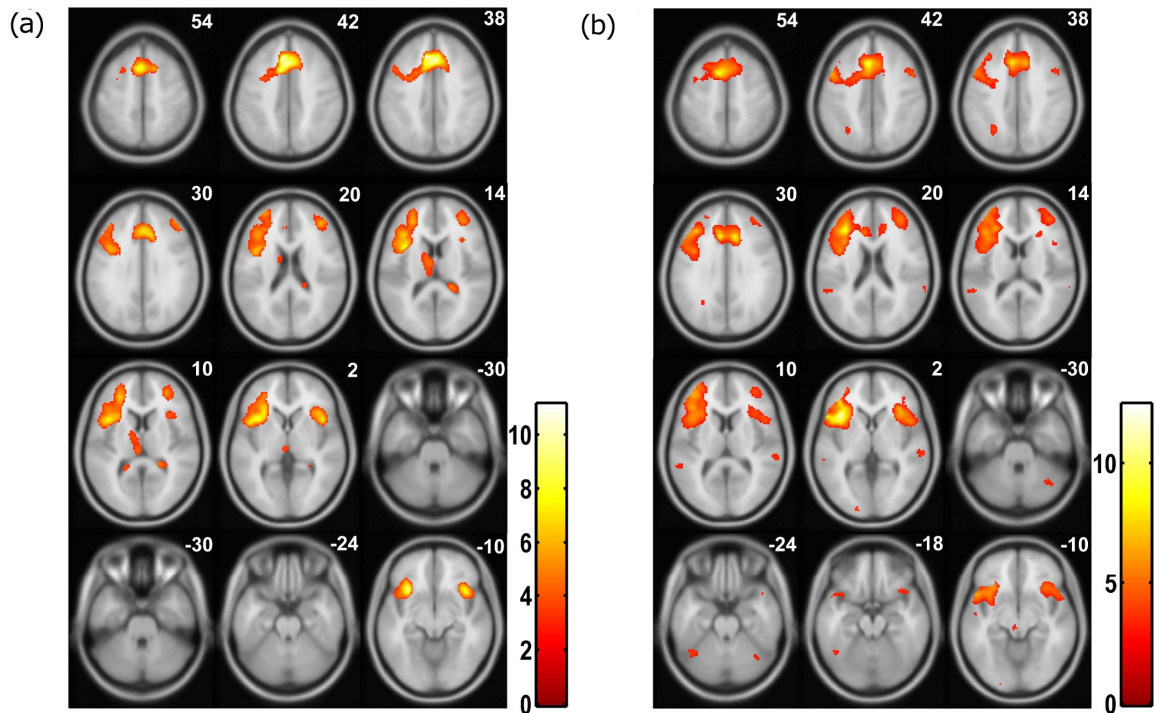


B



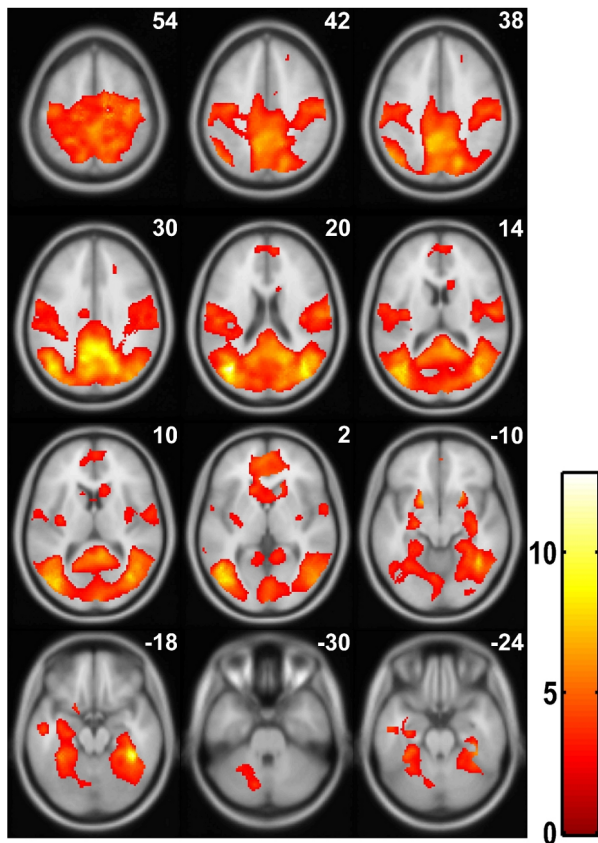
**Figure DS3** Design matrix for the regression analysis.

The model included the 8 co-variates (Columns 1 to 8) of no interest viz., Age, Gender, Education, verbal fluency correct responses score (VFCR), verbal fluency total responses score (VFTR), score on the matrix reasoning test of Wechsler Adult Intelligence Scale (WAIS3), antipsychotic medication dosage (RSP) and anti-cholinergic medication dosage (THP) and the regressor “difference in mean latencies between word generation and word repetition trials” ( $lat_{gen-rep}$ ). The T - contrasts  $[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ 1]$  and  $[0\ 0\ 0\ 0\ 0\ 0\ 0\ 0\ -1]$  were tested.

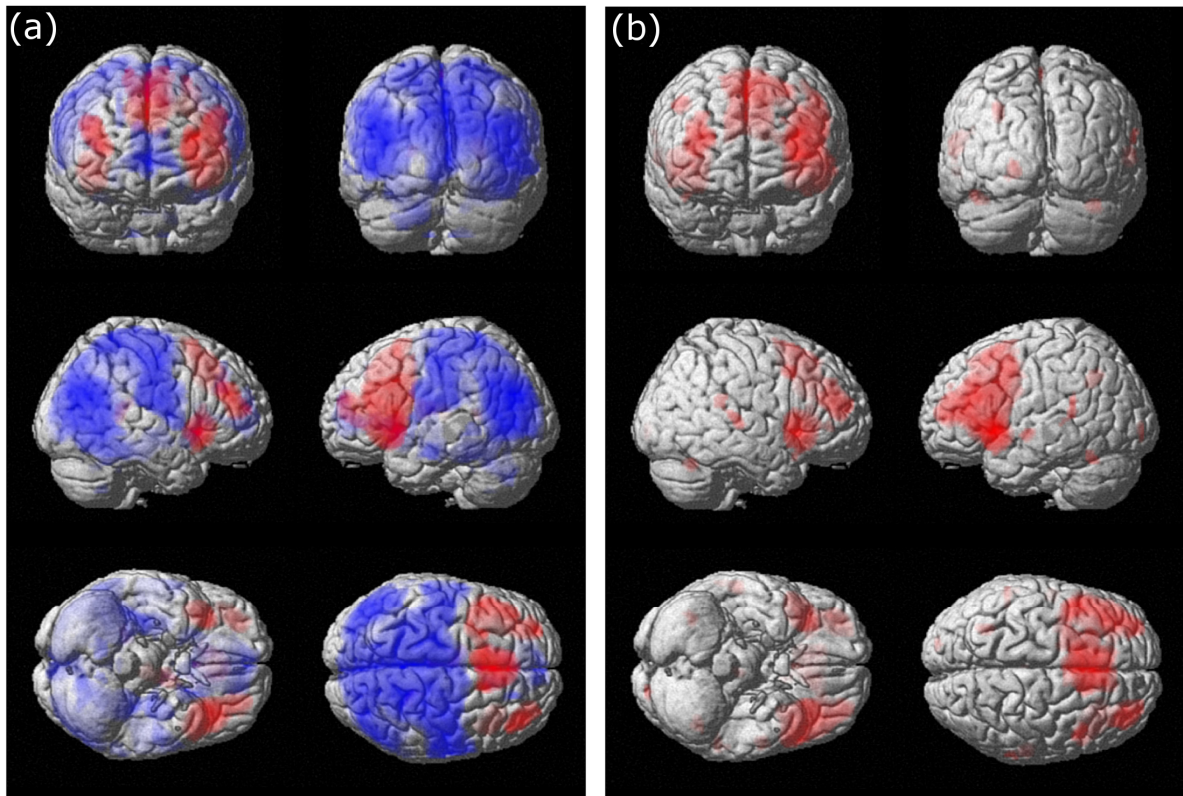


**Figure DS4** One-sample random effects (RFX) analysis, word generation – word repetition contrast.

(a) Blood Oxygen Level Dependent (BOLD) fMRI signal responses in healthy subjects (n=24, 1 condition, 6 covariates, leaving 17 degrees of freedom). (b) BOLD fMRI signal responses in schizophrenia subjects (n=24, 1 condition, 8 covariates, leaving 17 degrees of freedom). T-maps thresholded at  $P < 0.05$ , corrected for multiple comparisons by false discovery rate (FDR) method and extent threshold of 20 voxels. Display according to neurological convention (image left is subject's left).

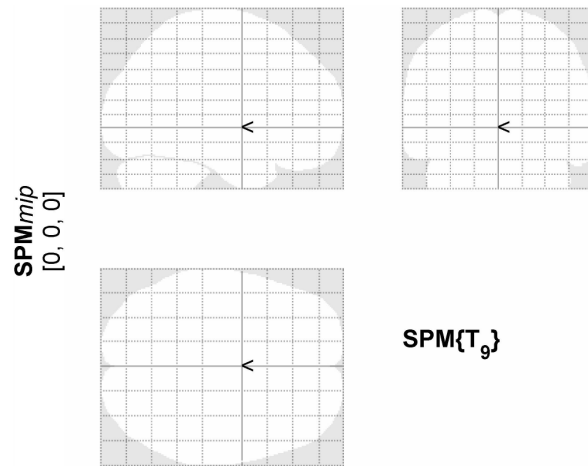


**Figure DS5** One-sample random effects (RFX) analysis, word repetition – word generation contrast. Blood Oxygen Level Dependent (BOLD) fMRI signal responses in healthy subjects (n=24, 1 condition, 6 covariates, leaving 17 degrees of freedom). T-maps thresholded at  $P < 0.05$ , corrected for multiple comparisons by false discovery rate (FDR) method and extent threshold of 20 voxels. Display according to neurological convention (image left is subject's left).



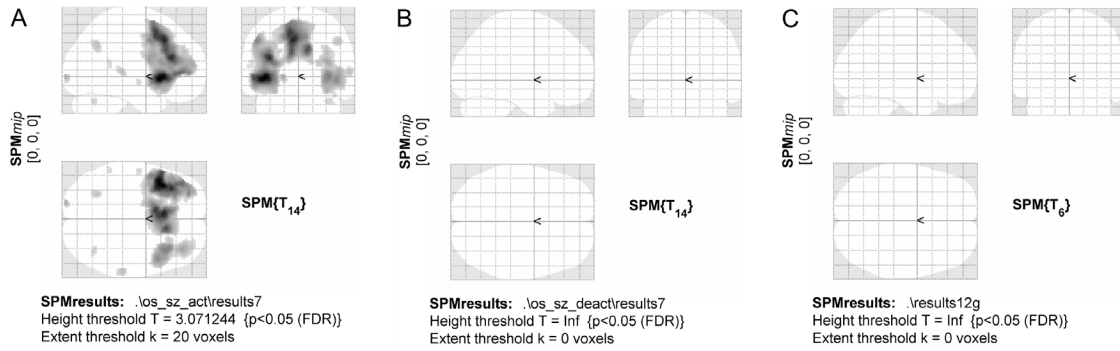
**Figure DS6** fMRI BOLD activations and ‘deactivations’ associated with word generation. (a) Responses in healthy subjects (n=24). (b) Responses in schizophrenia subjects (n=24). The BOLD activations associated with word generation are represented in red, while the deactivations are represented in blue. Schizophrenia subjects were characterized by deficient deactivations during word generation, while both groups activated broadly similar brain areas during task performance. T-maps thresholded at  $P < 0.05$ , corrected for multiple comparisons by false discovery rate (FDR) method and extent threshold of 20 voxels. Display according to neurological convention (image left is subject’s left).



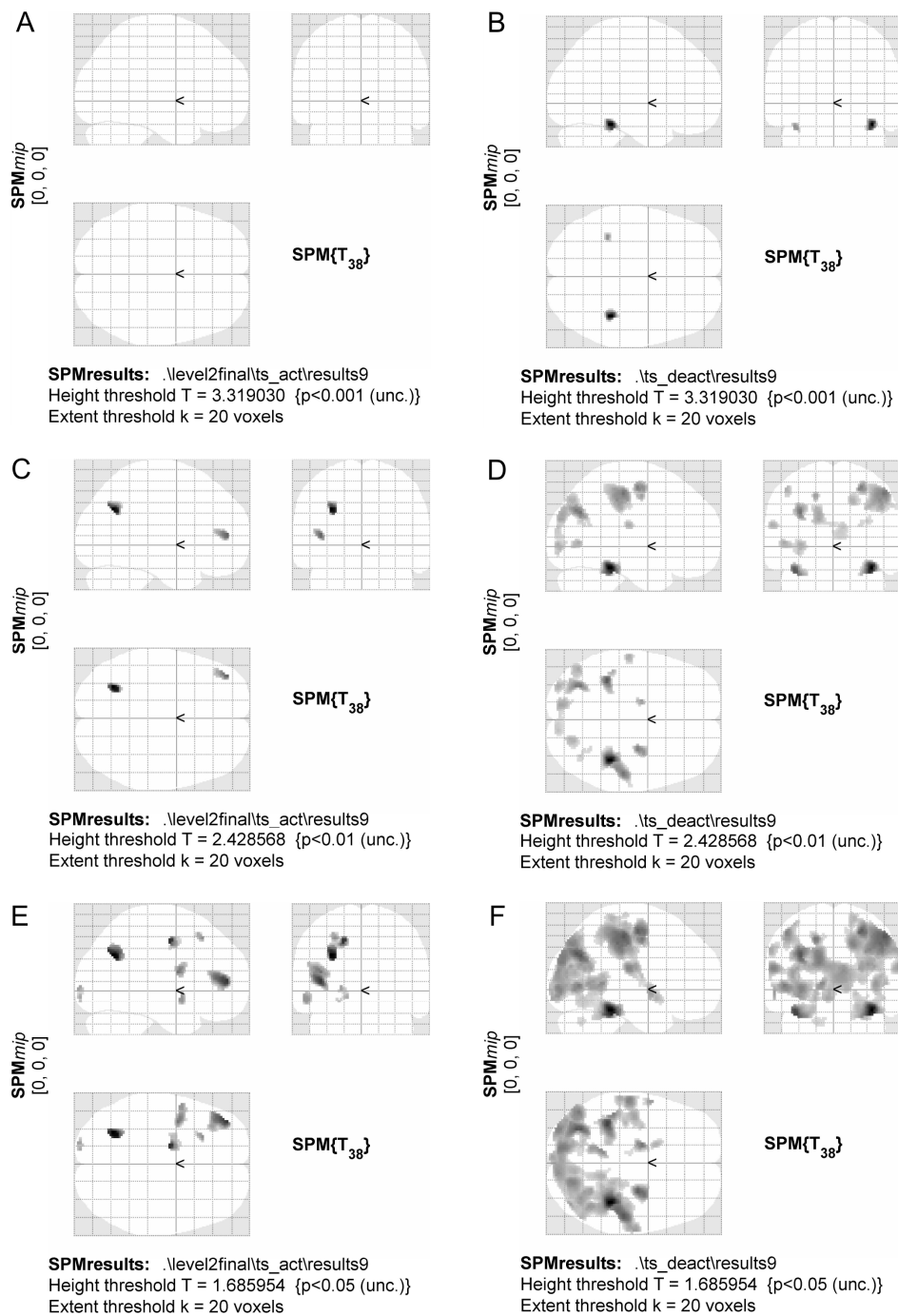


**SPMresults:** .results7  
 Height threshold  $T = \text{Inf } \{p < 0.05 \text{ (FDR)}\}$   
 Extent threshold  $k = 0$  voxels

**Figure DS7** Regression analysis in schizophrenia subjects repeated without the medication co-variables. No brain regions with significant correlation between deactivations and response latency measures were found at  $p < 0.05$  (FDR corrected)



**Figure DS8** One-sample RFX analysis and regression analysis repeated after excluding the one schizophrenia subject with a maximum translational incremental movement of >2.0 mm in the Z plane. Activations (A) and deactivations (B) in the one sample RFX analyses and regression analysis for relation between task-related deactivation and  $\text{lat-diff}_{\text{gen-rep}}$ (C) were not substantially different from the original results.



**Figure DS9** Two sample t-test implemented in SPM. A, C and E – Brain regions of greater activations in schizophrenia subjects compared to healthy subjects at  $p < 0.001$ ,  $P < 0.01$  and  $P < 0.05$  (uncorrected) respectively; B, D and F - Brain regions of greater deactivations in healthy subjects compared to schizophrenia subjects at  $p < 0.001$ ,  $P < 0.01$  and  $P < 0.05$  (uncorrected) respectively.