

## SUPPLEMENTAL MATERIAL

### Modulating the motor system by action observation after stroke

#### Abbreviations:

Brodmann Area	BA
Inferior Parietal Cortex	IPC
Superior Parietal Lobule	SPL
Amygdala	Amyg
Montreal Neurological Institute	MNI
False Discovery Rate	FDR
Family Wise Error	FWE
T-value	T
Left	L
Right	R

## Supplemental Results

### Behavioral Results

As expected, for participants with stroke, mean movement time for the paretic right hand (13.94s) was longer than for the left hand (2.41s,  $t(11)=-7.22$ ,  $p=.001$ ). Mean FAS score for the paretic right hand (FAS=2.00) was lower than for the left hand (FAS=4.96,  $t(11)=8.34$ ,  $p=.001$ ). For non-disabled participants, mean movement time for the non-dominant left hand (1.90s) was longer than for the right hand (1.67s,  $t(11)=2.56$ ,  $p=.03$ ). Mean FAS score did not differ between hands (FAS=4.98). Mean movement time was longer for participants with stroke than non-disabled participants for both the right ( $t(22)=8.54$ ,  $p=.001$ ) and left hand ( $t(22)=2.05$ ,  $p=.05$ ). Mean FAS score was lower for participants with stroke than non-disabled participants for the right hand ( $t(22)=-8.29$ ,  $p=.001$ ), but did not differ for the left hand ( $p=.56$ ).

### Main Effect of Action Observation on Regions of Interest

For description, we performed a region of interest analysis for the main effect of action observation using one-sample t-tests. For participants with stroke, right (paretic) hand action observation lead to significant activations in the left inferior frontal gyrus pars opercularis (mean = 0.38,  $t(11) = 2.71$ ,  $p = .02$ , 95% CI: 0.07, 0.70) and the left precentral gyrus (mean = 0.48,  $t(11) = 3.44$ ,  $p = .005$ , 95% CI: 0.17, 0.78); and a trend toward significant activation in the left supramarginal gyrus (mean = 0.31,  $t(11) = 1.94$ ,  $p = .08$ , 95% CI: -0.04, 0.66).

**I. Main effect of right hand action observation.** Brain regions activated during right hand action observation for participants with stroke and non-disabled participants.

BRAIN REGION	BA	SIDE	T	x	y	z
<b>STROKE</b>						
Inferior Parietal Lobule		L	12.76	-26	-54	54
Lingual Gyrus	18	L	10.13	-6	-84	-10
Calcarine Gyrus	17	L	10.05	0	-84	-8
Lingual Gyrus	hOC3v V3v	R	8.46	26	-86	-10
Middle Occipital Gyrus	hOC5 V5	L	8.35	-46	-72	2
Precentral Gyrus		L	7.7	-28	-12	56
Cerebellum	Lobule V	R	7.65	32	-34	-30
Fusiform Gyrus		R	7.2	34	-72	-18
Cerebellum	Lobule VIIIb	R	6.22	22	-44	-50
Supplementary Motor Area		L	5.65	-8	0	54
Inferior Frontal Gyrus p. Opercularis	44	L	5.25	-44	10	28
Supramarginal Gyrus*	IPC (PF)	L	5.15	-56	-28	42
Middle Frontal Gyrus		R	4.39	38	-2	62
Inferior Frontal Gyrus p. Opercularis	44	L	3.72	-56	14	14
Precentral Gyrus	44	R	3.38	54	12	40
Cerebellar Vermis			3.31	6	-72	-38
Cerebellum	Lobule VIIa	R	3.26	6	-76	-36
Precentral Gyrus		R	3.22	30	-4	48
<b>NON-DISABLED</b>						
Angular Gyrus	hIP3	R	12.79	30	-62	48
Postcentral Gyrus	IPC (PFt)	R	11.69	56	-18	30
Cerebellum	Lobule VI	R	10.65	38	-54	-24
Inferior Frontal Gyrus p. Opercularis		R	10.61	48	10	28
Middle Occipital Gyrus	17	R	9.36	24	-92	6
Inferior Parietal Lobule	hIP3	R	8.91	34	-48	52
Superior Parietal Lobule		L	8.72	-28	-56	62
Inferior Parietal Lobule	SPL (7PC)	L	8.43	-32	-48	52
Middle Cingulate Cortex		L	7.45	-12	-18	46
Middle Frontal Gyrus		L	7.15	-28	-6	58
Thalamus		R	6.9	18	-26	8
Precentral Gyrus		R	6.7	40	0	50
Supramarginal Gyrus*	IPC (PF)	R	6.62	54	-32	48
Precentral Gyrus		L	5.97	-52	4	44
Supplementary Motor Area		L	5.82	-10	6	56
Precentral Gyrus	44	L	5.77	-58	8	24
Thalamus		L	5.7	-18	-30	4
Supplementary Motor Area		R	5.43	8	14	54
Fusiform Gyrus	Amyg (LB)	R	4.48	36	-4	-30
Middle Cingulate Cortex	6	R	4.18	4	2	40
Inferior Frontal Gyrus p. Triangularis	44	L	3.46	-38	18	22
Paracentral Lobule		L	3.4	-10	-38	74
Amygdala	Amyg (LB)	R	3.36	30	2	-20
Supplementary Motor Area		R	3.2	8	2	54
Supramarginal Gyrus	IPC (PFcm)	L	3.14	-50	-40	24
Precuneus	SPL (5M)	R	3	4	-50	66
Precuneus		L	2.95	-10	-42	72

MNI coordinates,  $p < .05$  FDR corrected, \* $p < .05$  FWE small volume corrected.

**II. Main effect of left hand action observation.** Brain regions activated during left hand action observation for participants with stroke and non-disabled participants.

BRAIN REGION	BA	SIDE	T	x	y	z
<b>STROKE</b>						
Fusiform Gyrus	hOC3v V3v	L	11.93	-20	-86	-8
Inferior Occipital Gyrus		L	11.72	-26	-84	-10
Precentral Gyrus	6/44	L	11.31	-58	6	28
Lingual Gyrus	18	R	10.91	20	-84	-8
Calcarine Gyrus	17	R	10.26	18	-84	6
Lingual Gyrus	hOC3v V3v	R	10.1	18	-70	-6
Superior Parietal Lobule	2	R	9.83	30	-48	58
Inferior Frontal Gyrus p. Opercularis*	44	L	8.79	-58	8	28
Superior Frontal Gyrus		R	6.67	30	-8	64
Superior Temporal Gyrus	IPC (PFm)	R	5.98	64	-44	22
Supramarginal Gyrus*	IPC (PF)	R	5.74	66	-40	20
Supplementary Motor Area		L	4.81	-6	0	64
Hippocampus		R	4.51	24	-6	-22
Superior Frontal Gyrus		L	4.25	-28	-2	68
Cerebellum	Lobule VIIIb	R	3.98	18	-48	-50
Precentral Gyrus		R	3.91	56	8	40
Cerebellum		L	3.72	-14	-50	-50
Cerebellum	Lobule V	R	3.67	30	-36	-36
Parahippocampal Gyrus		L	3.67	-30	-26	-20
Supplementary Motor Area		R	3.56	10	0	60
Precentral Gyrus		R	3.37	28	-14	70
Fusiform Gyrus		L	3.26	-38	-20	-20
Inferior Frontal Gyrus p. Triangularis	44	R	3.1	50	14	24
Inferior Frontal Gyrus p. Triangularis	45	R	3.09	56	26	26
Supplementary Motor Area		R	3	14	-6	62
<b>NON-DISABLED</b>						
Superior Parietal Lobule	SPL (7P)	R	11	20	-72	48
Cerebellum	Lobule VI	R	10.96	34	-56	-24
Cerebellum	Lobule VI	L	10.03	-26	-58	-18
Lingual Gyrus	18	R	9.88	16	-74	0
Superior Parietal Lobule		L	9.88	-28	-56	56
Supramarginal Gyrus*	IPC (PF)	L	8.65	-54	-34	48
Inferior Frontal Gyrus p. Opercularis*	44	L	6.38	-58	12	28
Inferior Frontal Gyrus p. Opercularis*	44	R	6.3	52	12	30
Supramarginal Gyrus*	IPC (PF)	R	5.74	56	-38	20
Middle Cingulate Cortex		L	4.79	-12	-22	42
Amygdala		R	3.63	32	0	-16
Fusiform Gyrus		R	3.59	38	-6	-30
Inferior Frontal Gyrus p. Triangularis	45	R	2.92	58	20	8

MNI coordinates,  $p < .05$  FDR corrected. \* $p < .05$  FWE small volume corrected.

**III. Brain activity compared between right hand and left hand action observation.** Brain regions showing greater activation during right compared to left or left compared to right hand action observation, in participants with stroke and in non-disabled participants. For non-disabled participants, no brain regions showed greater activations during right hand as compared to left hand action observation.

BRAIN REGION	BA	SIDE	T	x	y	z
<b>STROKE</b>						
<b>RIGHT HAND &gt; LEFT HAND</b>						
Inferior Frontal Gyrus p. Opercularis*	44	L	5.32	-44	6	20
Postcentral Gyrus	1/2	L	10.72	-38	-38	66
<b>LEFT HAND &gt; RIGHT HAND</b>						
Calcarine Gyrus	17	R	20.69	16	-82	10
Lingual Gyrus	18	R	17.65	14	-66	-4
Postcentral Gyrus	2	R	8.81	36	-48	64
Middle Temporal Gyrus	hOC5 (V5)	R	5.12	48	-66	6
Inferior Parietal Lobule	2	R	4.91	30	-40	52
Cerebellum	Lobule VI	L	4.37	-26	-44	-22
Middle Temporal Gyrus	hOC5 (V5)	R	4.13	54	-66	2
<b>NON-DISABLED</b>						
<b>LEFT HAND &gt; RIGHT HAND</b>						
Superior Parietal Lobule	2	R	14.01	34	-50	62
Lingual Gyrus	17	R	11.33	18	-70	2
Calcarine Gyrus	17	R	8.86	16	-78	4
Cerebellum	Lobule VI	L	8.28	-8	-60	-6
Superior Frontal Gyrus		R	7.88	20	-10	64
Supplementary Motor Area		R	6.89	8	-20	48
Middle Frontal Gyrus		R	6.81	44	-4	56
Precentral Gyrus		R	6.78	30	-16	66
Middle Occipital Gyrus	17	L	6.54	-16	-96	4
Supplementary Motor Area		R	5.83	14	4	70
Postcentral Gyrus	2	R	5.77	38	-32	48
Inferior Parietal Lobule	2	R	5.4	40	-40	54
Middle Temporal Gyrus	hOC5 (V5)	R	5.15	46	-64	0

MNI coordinates,  $p < .05$  FDR corrected. \* $p < .05$  FWE small volume corrected.