Insula

Marie Arsalidou

NUG seminar

02 July, 2018

NEUROPSY LAB

https://social.hse.ru/en/psy/brainresponses/about

https://social.hse.ru/en/psy/brainresponses/news

www.neuropsylab.com

Etymology

insula

Origin

LATIN

insula → insula
island

Latin, literally 'island'.

Anatomy

Copyright material

Etymology

operculum

Origin

LATIN	LATIN	
operire →	operculum →	operculum
to cover	lid, covering	*early 18th century*

early 18th century: from Latin, literally 'lid, covering', from *operire* 'to cover'.

Topography

Copyright material

Copyright material

Functions

Fig. 3 Insular activations by the chemical sensory domain. **a** Activations by olfaction, **b** activations by gustation. Conventional results are displayed on the *left*, specific results on the *right*

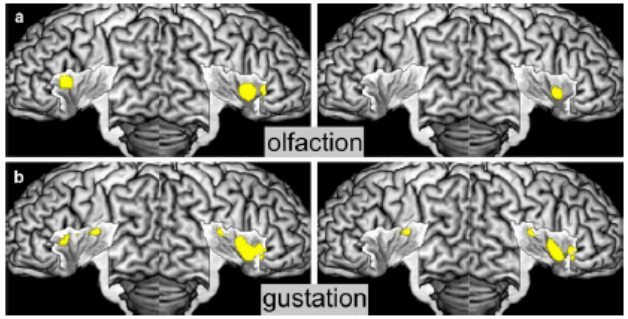


Fig. 4 Insular activations by the sensorimotor domain. **a** Activations by interoception, **b** activations by pain, **c** activations by somatosensation, **d** activations by motion. Conventional results are displayed on the *left*, specific results on the *right*

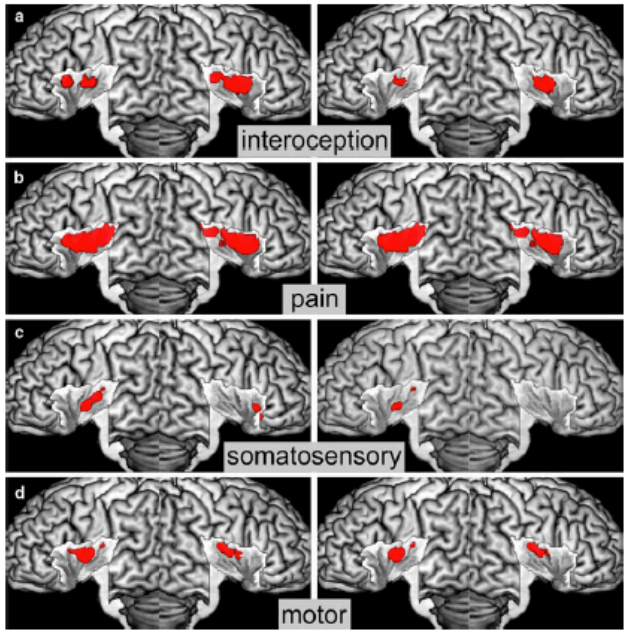


Image from Kurth et al., 2010

More functions

Fig. 5 Insular activations by the cognitive domain. **a** Activations by attention, **b** activations by language, **c** activations by speech **d** activations by working memory, **e** activations by memory. Conventional results are displayed on the *left*, specific results on the *right*

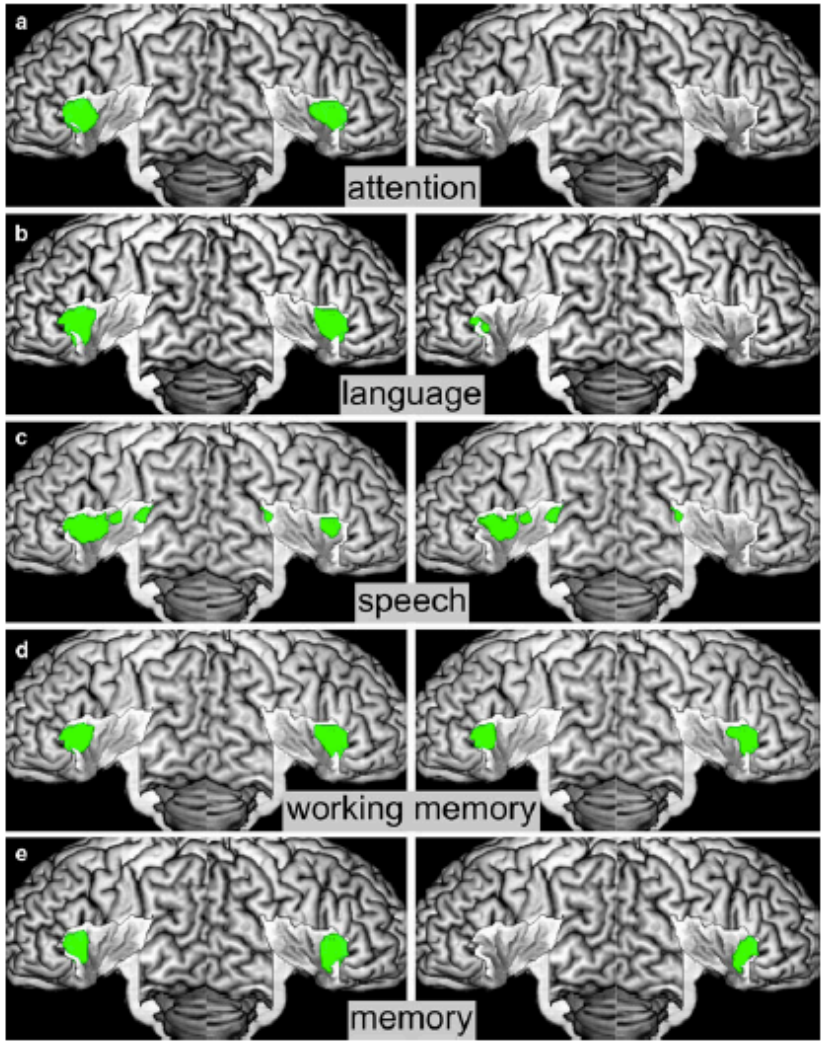
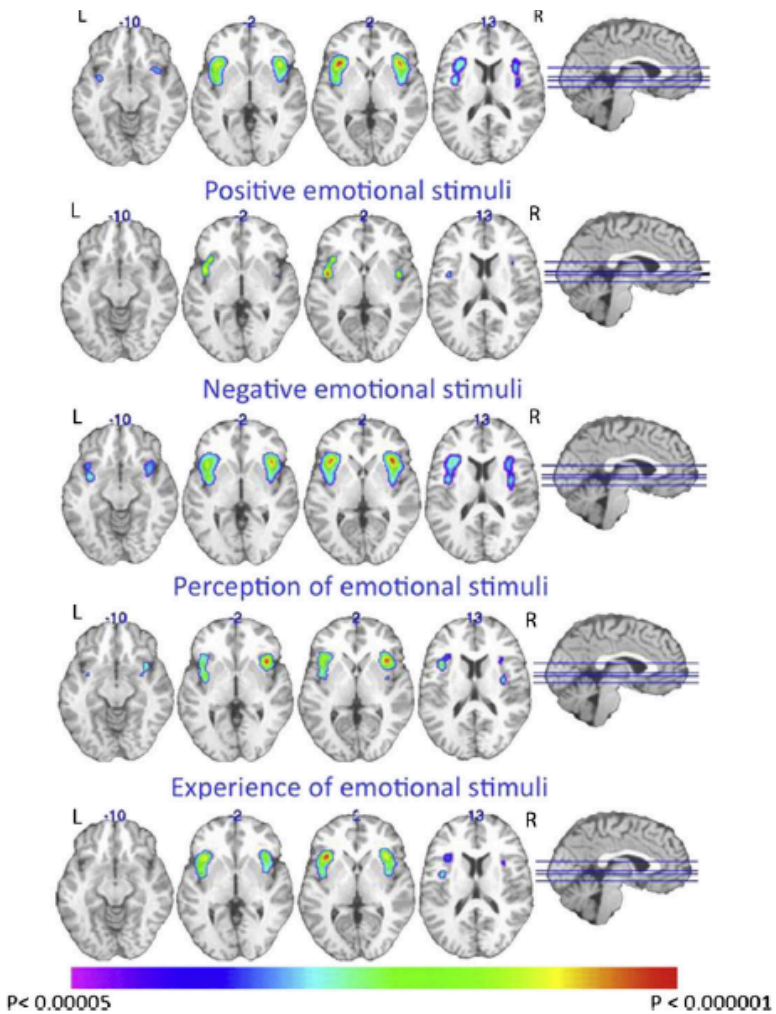
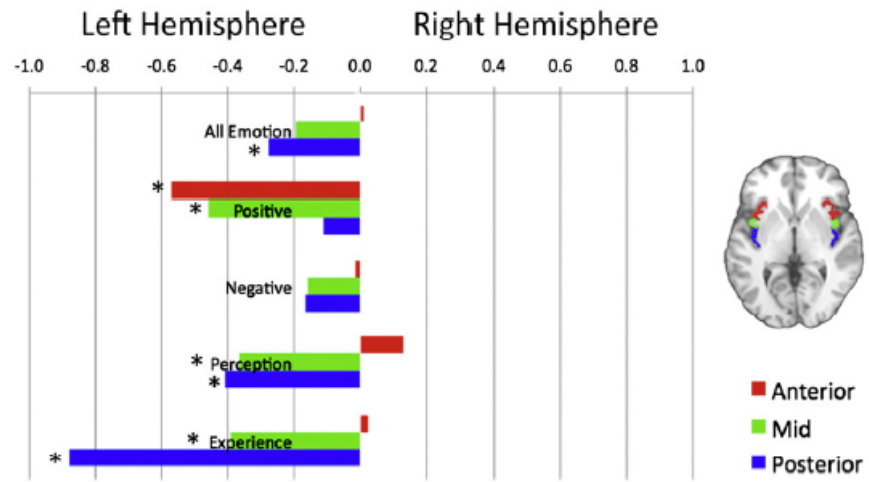


Image from Kurth et al., 2010

Emotion – our data





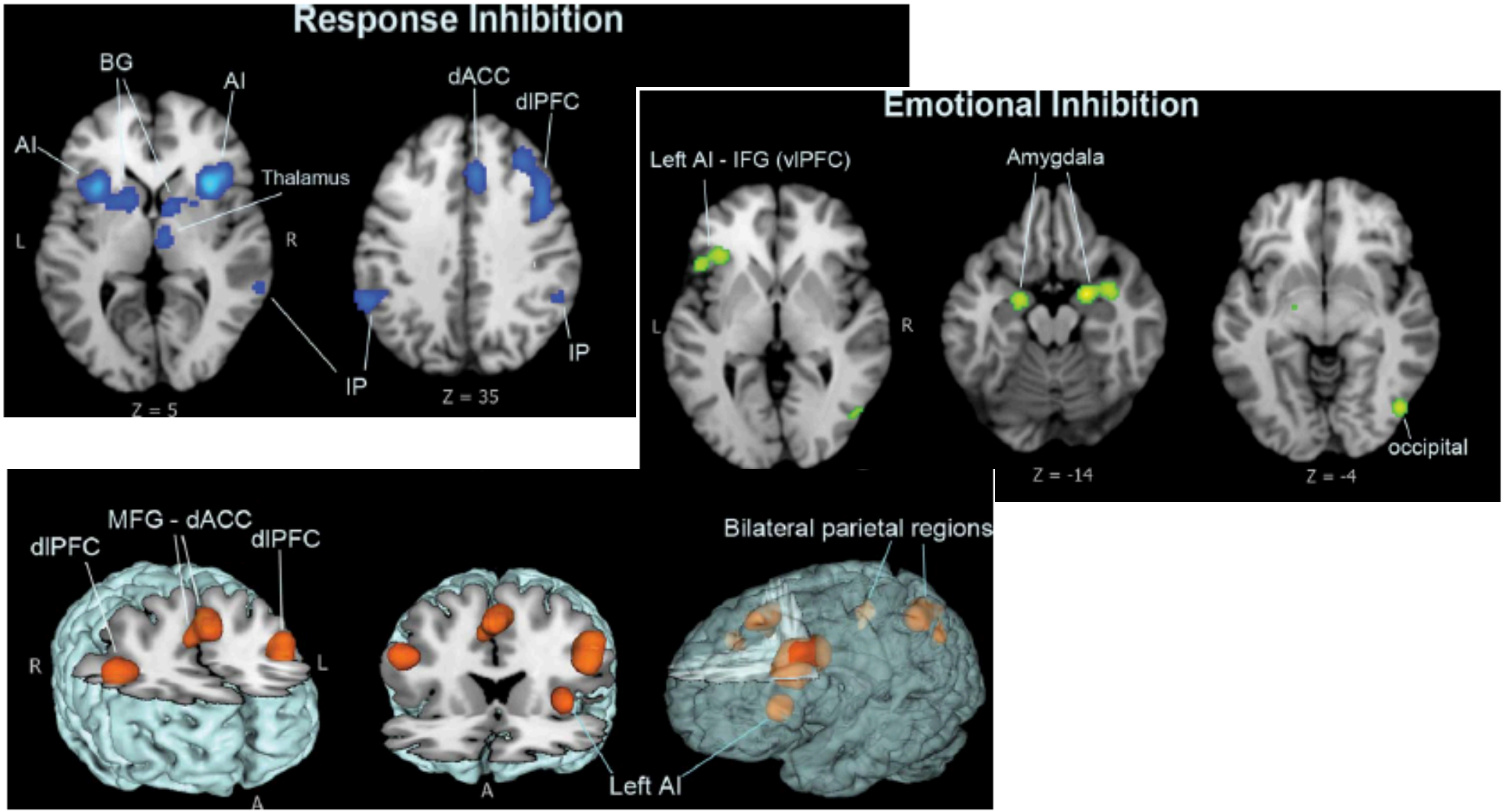
Images from Duerden, Arsalidou, et al. 2013

Cognitive load – our data

volume (mL)	*x*	*y*	*z*	*t*-value	Hemisphere	Area	BA
Task activations: working memory							
94.26	14	26	26	3.76	R	Cingulate gyrus	32
X	−5	20	36		L	Cingulate gyrus	32
X	40	6	23		R	Inferior frontal gyrus	9
X	−39	8	28		L	Inferior frontal gyrus	9
X	39	30	31		R	Middle frontal gyrus	9
X	34	45	24		R	Middle frontal gyrus	10
X	−39	49	13		L	Middle frontal gyrus	10
X	42	28	22		R	Middle frontal gyrus	46
X	−40	39	18		L	Middle frontal gyrus	46
X	31	4	47		R	Middle frontal gyrus	6
X	−40	4	34		L	Precentral gyrus	6
X	32	20	1		R	Insula	13
X	−29	23	9		L	Insula	13
59.00	−3	−63	−11	3.57	L	Declive	
X	−36	−56	−13		L	Fusiform gyrus	37
X	25	−58	−9		R	Fusiform gyrus	39
14.20	21	−61	43	3.91	R	Precuneus	7
X	35	−48	41		R	Inferior parietal lobule	40
7.88	−22	−60	42	3.82	L	Precuneus	7
6.62	7	−21	6	3.30	R	Thalamus	
0.08	−8	−84	−20	3.23	L	Declive	
0.05	−3	−86	−16	3.07	L	Declive	

Table from Arsalidou, et al. 2013

Inhibition – our data



Images from: Hung, Gaillard, Yarmak, Arsalidou, 2018

N-back in children – our data

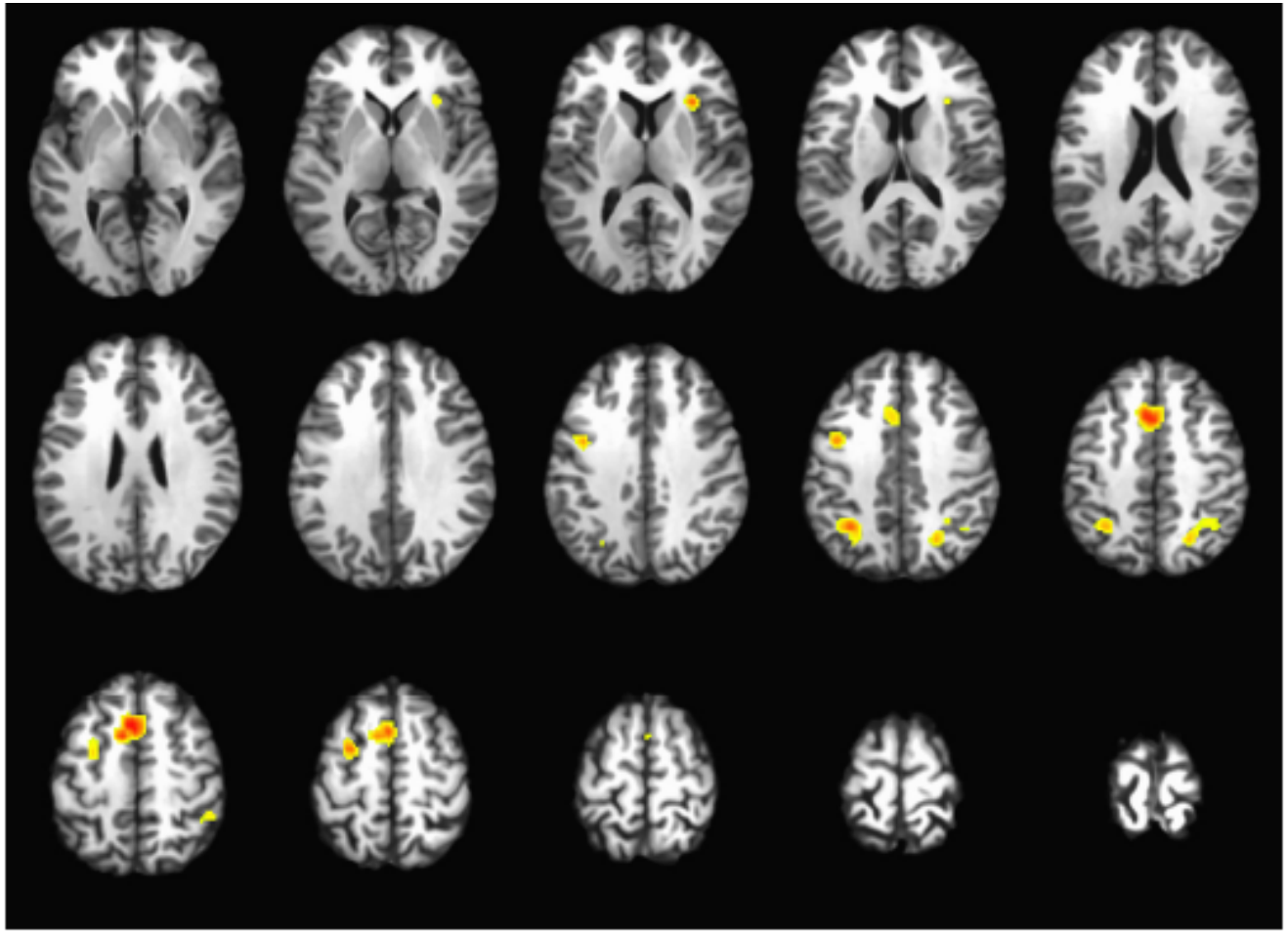


Image from Yaple & Arsalidou, in press

Social cognition – our data

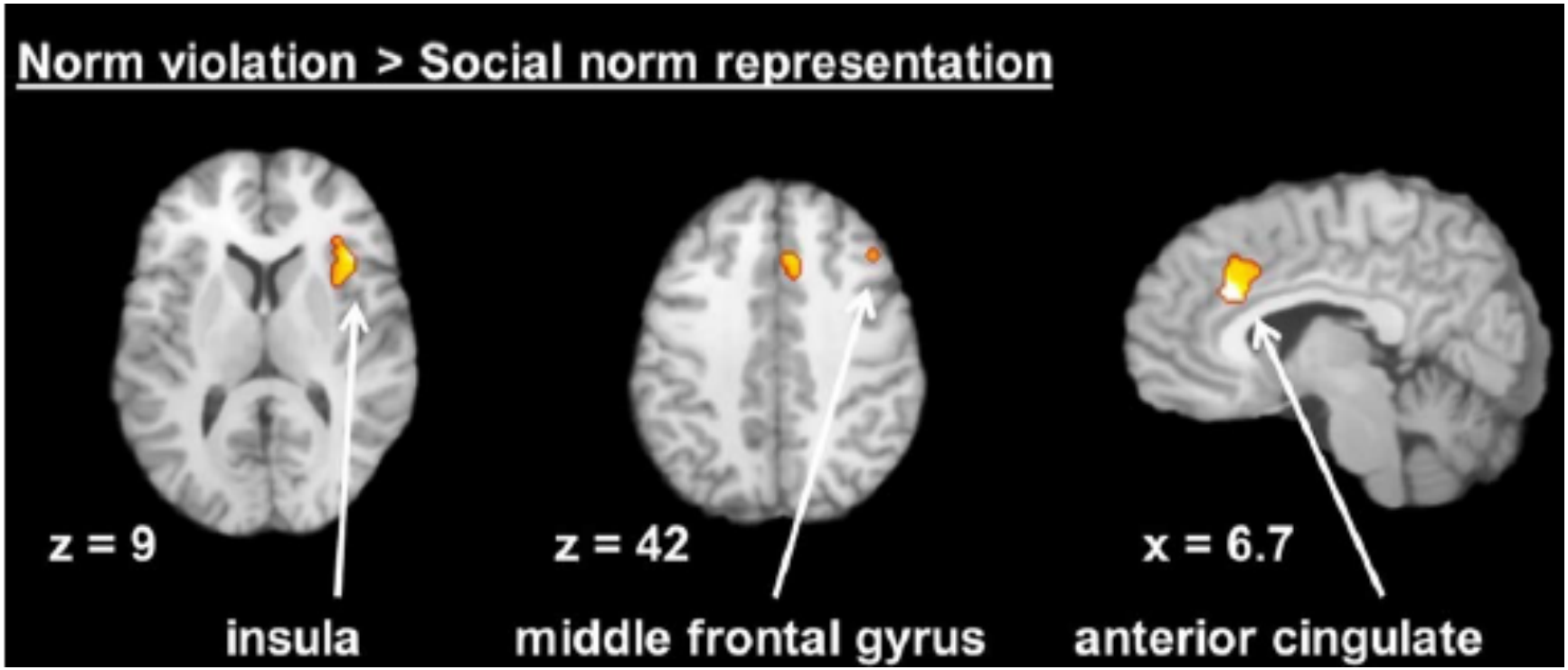


Image from: Zinchenko & Arsalidou, 2018

Social cognition – our data

Partner's faces minus unfamiliar faces					
Anterior cingulate	BA 32	R	5	33	24
		L	−3	31	24
Cingulate gyrus	BA 32	R	5	31	29
		L	−2	31	28
Medial frontal gyrus	BA 10	R	7	59	8
		L	−6	49	8
Middle frontal gyrus	BA 8	L	−23	36	38
Inferior frontal gyrus	BA 47	L	−22	17	−14
Middle temporal gyrus	BA 20/21	L	−49	−11	−14
Insula	BA 13	L	−28	15	−4
Amygdala	BA 34	L	−25	−2	−10
Thalamus		L	−20	−26	5
Parahippocampal gyrus	BA 34/28	L	−14	−9	−14
Precuneus	BA 7	L	−6	−56	41

Table from: Taylor, Arsalidou, et al. 2009

Math cognition – our data

Concordant areas for calculation tasks.

Hem.	Brain area	BA	x	y	z	ALE	Vol./mm³
L	Precuneus	7	−28	−68	32	0.033	10,264
L	Superior parietal lobule	7	−26	−60	46	0.027	
L	Inferior parietal lobule	40	−44	−40	42	0.027	
L	Inferior frontal gyrus	9	−42	4	30	0.040	8888
L	Middle frontal gyrus	9	−44	32	28	0.024	
R	Superior parietal lobule	7	30	−62	44	0.037	6424
R	Inferior parietal lobule	40	38	−46	42	0.024	
R	Inferior parietal lobule	40	46	−34	46	0.017	
R	Sub-gyral	39	30	−58	32	0.016	
R	Inferior frontal gyrus	9	46	10	28	0.033	5960
R	Middle frontal gyrus	46	40	34	22	0.022	
R	Middle frontal gyrus	9	42	46	26	0.013	
R	Precentral gyrus	9	38	14	40	0.011	
L	Superior frontal gyrus	6	−6	8	48	0.027	4712
R	Cingulate gyrus	32	4	22	36	0.016	
L	Fusiform gyrus	37	−44	−60	−14	0.022	2960
L	Inferior occipital gyrus	19	−40	−74	−6	0.018	
L	Sub-gyral	6	−28	−2	56	0.026	2304
R	Insula	13	32	22	4	0.025	1600
L	Insula	13	−30	24	2	0.019	1328
L	Middle occipital gyrus	18	−22	−84	−2	0.019	1232
L	Inferior occipital gyrus	18	−28	−90	−10	0.014	
R	Caudate body		10	6	6	0.020	824
R	Cerebellum/declive		36	−58	−20	0.015	624
R	Middle frontal gyrus	6	30	−4	54	0.016	392
L	Superior frontal gyrus	10	−34	50	22	0.013	280
L	Cerebellum/posterior lobe		−38	−64	−36	0.013	264
L	Cerebellum/tuber		−38	−58	−28	0.012	
R	Thalamus		20	−28	8	0.013	112
R	Inferior occipital gyrus	18	32	−88	−6	0.013	104

Table from: Arsalidou & Taylor, 2011

Math cognition – our data

Table 2
Concordant areas for number tasks.

Hem.	Brain area	BA	x	y	z	ALE	Vol./mm³
L	Inferior parietal lobule	40	−34	−48	40	0.029	10,952
L	Superior parietal lobule	7	−26	−56	42	0.024	
L	Superior parietal lobule	7	−30	−64	54	0.016	
R	Inferior parietal lobule	40	36	−46	46	0.027	10,464
R	Superior parietal lobule	7	26	−58	42	0.023	
R	Inferior parietal lobule	40	44	−32	46	0.019	
R	Superior parietal lobule	7	32	−56	60	0.010	
R	Superior parietal lobule	7	28	−56	58	0.010	
R	Superior frontal gyrus	6	2	10	48	0.016	3264
L	Cingulate gyrus	24	−8	8	46	0.016	
L	Medial frontal gyrus	6	0	−2	60	0.012	
L	Middle frontal gyrus	6	−50	0	40	0.014	2096
L	Precentral gyrus	6	−42	−2	42	0.014	
L	Precentral gyrus	6	−48	0	32	0.013	
R	Insula	13	34	16	12	0.016	2024
R	Claustrum		28	20	0	0.014	
R	Precentral gyrus	6	48	0	36	0.016	1672
R	Inferior frontal gyrus	9	50	4	28	0.012	
L	Insula	13	−32	12	8	0.015	1336
R	Precentral gyrus	6	28	−14	56	0.019	1328
R	Cerebellum/anterior lobe		24	−56	−28	0.019	1160
L	Middle frontal gyrus	6	−26	−10	54	0.017	1080
R	Middle frontal gyrus	6	28	−4	42	0.013	736
R	Middle frontal gyrus	6	26	0	48	0.012	
R	Cingulate gyrus	32	8	24	40	0.012	640
R	Cingulate gyrus	32	12	18	34	0.011	
L	Fusiform gyrus	37	−38	−56	−10	0.013	520
L	Precentral Gyrus	6	−58	2	20	0.014	504
R	Supramarginal gyrus	40	54	−42	32	0.013	336
L	Lentiform nucleus/putamen		−20	6	14	0.012	272
L	Postcentral gyrus	3	−48	−18	44	0.010	256
L	Postcentral gyrus	3	−50	−18	52	0.008	
L	Cerebellum/pyramis		−26	−64	−28	0.012	184
R	Middle occipital gyrus	18	40	−80	−10	0.012	184
L	Cingulate gyrus	23	0	−20	30	0.012	168

Table from: Arsalidou & Taylor, 2011

Math cognition in children – our data

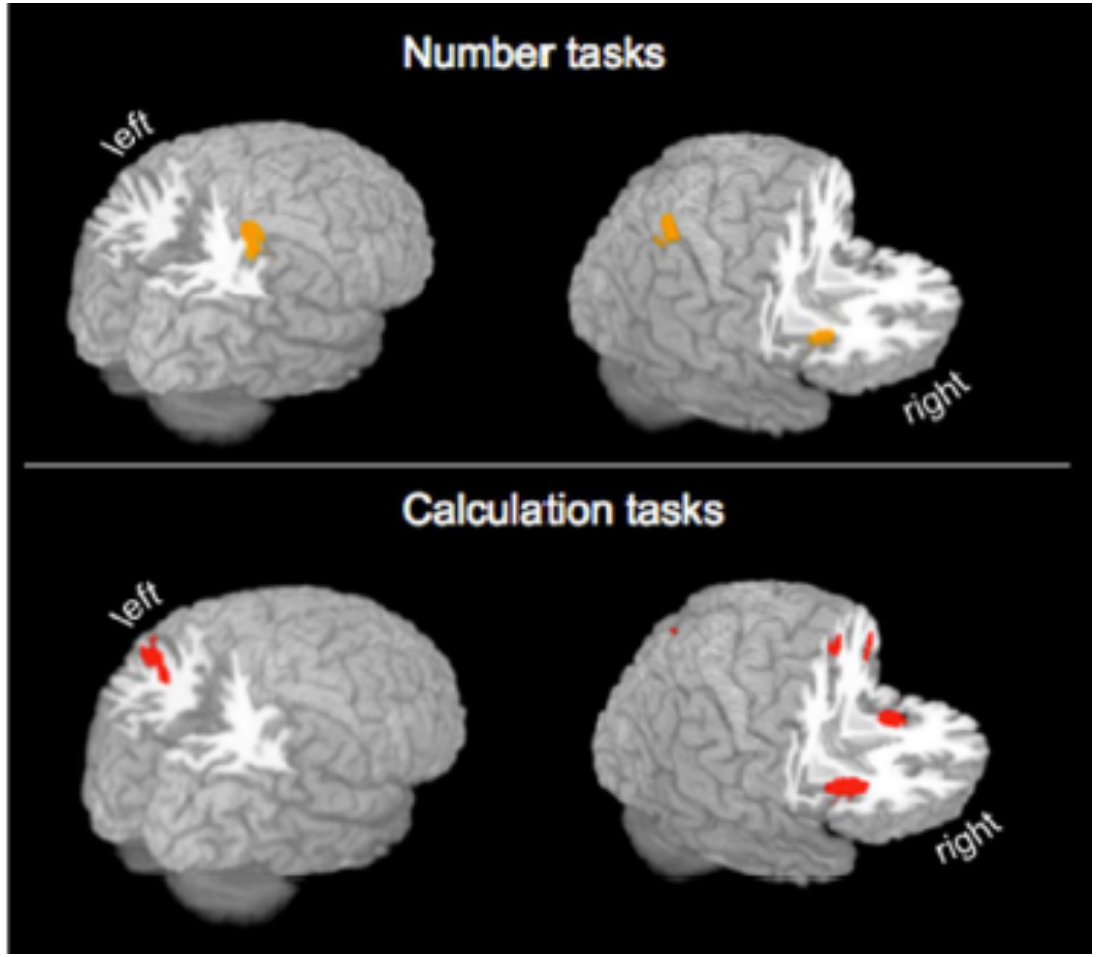


Image from: Arsalidou et al., 2018

Generic role

- switching between central-executive and default-mode networks Sridharan, Levitin, Menon, 2008
- salience network Menon & Uddin, 2010
- cingulo-opercular network (emerging term)

THANK YOU

СПАСИБО