

Table S1: Demographic and clinical characteristics of patients with bipolar disorder (bipolar patients, BD), unaffected relatives (relatives, Rel), healthy participants with hypomanic personality (hypomanic personality, Hyp) and 22 selected control participants (Controls, Con).

	Bipolar patients		Relatives		Hypomanic personality		Controls		p-value	significant contrasts
	N = 22		N = 17		N = 22		N = 22			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Age	39.4	11.8	36.6	16.2	21.0	1.6	32.4	13.2	p < .001**	BD, Rel, Con > Hyp
Years of Education	11.3	1.6	12.5	1.2	13	0	12.6	1.1	p < .001**	Rel, Hyp, Con > BD
Intelligence score	105.4	12.6	103.1	11.8	97.7	5.2	104.2	10.0	p = .119	
Handedness: LQ-Scores	83.8	13.8	57.7	64.8	82.7	16.9	82.4	35.3	p = .090	
Current symptoms										
YMRS	1.0	1.6	0	0	0	0	0	0	p < .001**	BD > Rel, Hyp, Con
HAMD	.7	1.2	0.3	1.0	.1	.5	0	0	p = .016*	BD > Con
BDI	6.7	6.0	3.0	3.3	3.5	4.2	1.5	2.3	p < .001**	BD > Rel, Hyp, Con
	N	%	N	%	N	%	N	%		
Gender Ratio										
Female	14	63.6	8	47.1	13	59.1	13	59.1	p = .587	
Male	8	36.4	9	52.9	9	40.9	9	40.9		
Married lifetime	12	55.0	11	64.7	0	0	7	31.8	p < .001**	BD, Rel, Con > Hyp
Currently employed	13	59.1	15	88.2	19	86.4	21	95.5	p < .05*	Rel, Hyp > BD
Substances										
Caffeine	14	66.7	10	62.5	14	63.6	14	63.6	p = .990	
Nicotine	6	28.6	2	12.5	9	40.9	1	4.5	p < .05*	Hyp > Con
Alcohol	7	31.8	6	35.3	20	90.9	11	50.0	p < .001**	BD, Rel, Con > Hyp

* p < .05

** p < .01

Supplementary Analysis S2

Behavioral data

Task 1

Accuracy was higher in the number detection condition compared to the arithmetical task (supplement Table S3), which was evident in a main effect of task condition across all groups ($F(1,77)=12.4$, $p<.001$). Regarding reaction times, there were significant main effects of task condition across all groups ($F(1,77)=53.3$, $p<.001$), with prolonged reactions in the arithmetic compared to the number detection task. We found no group effects or interactions with group (all $p>.10$).

Task 2

Comparing the three experimental groups and healthy controls, a significant main effect of distractor condition on reaction times ($F(1,77)=40.6$, $p<.001$) was observed, indicating that participants were slower in solving arithmetical problems presented on emotional compared to neutral background images (supplement Table S3).

Additionally, there was an interaction effect of group and distractor condition ($F(1,77)=7.4$, $p<.01$) which indicated an increased effect of emotional distractors in bipolar patients compared to healthy controls and to the other experimental groups (Relatives, Hypomanic personality; all $p<.05$), while there were no further differences between these groups (all $p>.20$).

fMRI analyses

Task 1

The three experimental groups and healthy controls were not significantly different from one another with respect to the contrast of arithmetical task with the number detection task. Therefore, for further

analyses of Task 2, we averaged across all groups to yield one mask image with task-specific activations (supplement Table S5).

Task 2

The analysis across all groups corroborated the results of separate analyses comparing each of the experimental groups (bipolar patients, relatives, hypomanic personality) to a matched healthy control group, showing a significant cluster in a right parietal region for the group by condition interaction (supplement Table S5 and Figure S6). Analysis of the extracted % signal change also yielded a significant interaction of emotional distractor condition and group ($F(3,77) = 3.5, p < .05$) as well as a condition main effect ($F(1,77)=4.3, p<.05$). Interaction contrasts showed that the effect of emotional distractors was larger in bipolar patients compared to all other groups (all $p<.05$), while there were no further differences between these groups (all $p>.35$).

Table S3: Reaction times and accuracy in Task 1 and Task 2 for bipolar patients, unaffected relatives of bipolar patients, individuals with hypomanic personality, and their respective controls, as well as the 22 selected control participants.

		Task 1		Task 2		
		% correct	Reaction time		% correct	Reaction time
Bipolar patients	detection	94.6 (11.2)	1.38 (0.36)	neutral	80.1 (16.8)	3.6 (0.6)
	arithmetic	73.9 (15.8)	3.89 (1.04)	emotional	80.7 (14.2)	4.0 (0.6)
Controls	detection	96.4 (4.9)	1.25 (0.31)	neutral	90.2 (10.0)	3.5 (0.5)
	arithmetic	77.7 (13.7)	3.86 (0.48)	emotional	88.2 (8.6)	3.6 (0.5)
Relatives	detection	97.6 (3.1)	1.38 (0.46)	neutral	85.7 (12.5)	3.5 (0.6)
	arithmetic	78.2 (12.4)	3.89 (0.47)	emotional	85.8 (11.0)	3.6 (0.5)
Controls	detection	95.3 (15.7)	1.03 (1.48)	neutral	89.0 (9.3)	3.5 (0.5)
	arithmetic	77.9 (14.0)	3.77 (0.47)	emotional	89.0 (7.1)	3.6 (0.5)
Hypomanic Personality	detection	99.1 (2.0)	1.10 (0.19)	neutral	89.2 (13.2)	3.2 (0.5)
	arithmetic	80.5 (13.3)	3.35 (1.21)	emotional	87.8 (11.2)	3.4 (0.6)
Controls	detection	98.3 (3.5)	0.87 (0.97)	neutral	91.8 (8.6)	3.4 (0.4)
	arithmetic	76.0 (19.2)	3.63 (0.44)	emotional	90.8 (5.9)	3.5 (0.4)
Controls	detection	98.5 (2.7)	1.18 (0.28)	neutral	90.8 (8.4)	3.5 (0.4)
	arithmetic	83.1 (6.2)	3.62 (0.39)	emotional	89.6 (5.5)	3.6 (0.4)

Table S4: Activations in Task 1 for mental arithmetic vs. number detection for bipolar patients, unaffected relatives of bipolar patients, individuals with hypomanic personality, and their respective controls.

	H	BA	MNI coordinates			Cs	CI	Z
			x	y	z			
<i>Bipolar patients + Controls: arithmetic > number detection</i>								
dorsolateral prefrontal	L	44	-42	5	28		a	7.44
	R	6	30	-1	52		a	6.57
dorsomedial prefrontal	L	6	-6	11	52	2423	a	>8.21
	R	32	9	23	34		a	6.14
Insula	L	48	-33	20	-2		a	7.48
	R	48	33	23	-2	316	c	7.48
superior/inferior parietal	L	7	-24	-64	40	4710	d	>8.21
	R	7	21	-70	49		d	7.40
occipital/ventral temporal	L	19	-45	-70	-8		d	7.18
	R	19	-42	-82	4		d	6.56
<i>Relatives + Controls: arithmetic > number detection</i>								
dorsolateral prefrontal	L	6	-27	-1	52		a	5.47
	R	6	30	2	55	182	b	6.78
dorsomedial prefrontal	L	32	-3	11	49		c	5.85
	R	32	6	17	46	503	c	7.38
Insula	L	48	-33	20	1	1242	a	7.19
	R	48	36	23	1	629	d	>8.21
superior/inferior parietal	L	7	-24	-61	43	3467	e	7.58
	R	40	35	-46	43		e	7.10
occipital/ventral temporal	L	19	-45	-76	-2		e	5.73
	R	19	30	-76	7	179	f	5.67
<i>Hypomanic personality + Controls: arithmetic > number detection</i>								
dorsolateral prefrontal	L	6	-48	2	45		a	5.89
	R	6	30	2	61	239	b	7.49
dorsomedial prefrontal	R	32	6	17	49	2483	c	>8.21
insula	L	48	-30	20	-2		c	>8.21
	R	48	36	23	-5	650	d	>8.21
superior/inferior parietal	L	7	-24	-70	41	5122	a	>8.21
	R	40	39	-43	43		a	>8.21
occipital/ventral temporal	L	19	-42	-79	4		a	5.85
	R	19	27	-79	7		a	5.05

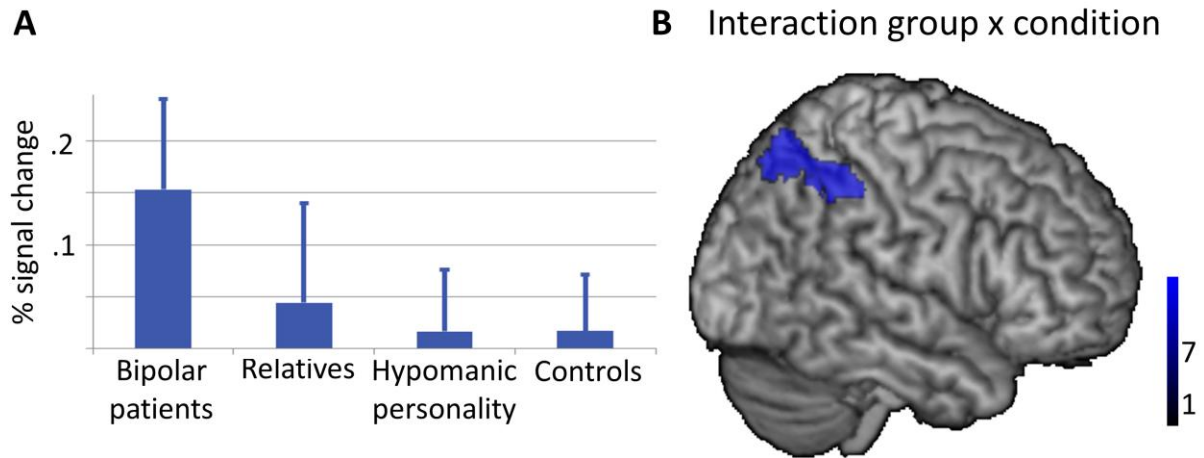
H = Hemisphere; BA = Brodmann area; CS = Cluster size in number of activated voxels; CI = cluster index (all peaks of an activation cluster are identified by the same letter; the cluster peaks are displayed in bold letters)

Table S5: Activations in Task 1 for mental arithmetic vs. number detection and Task 2 for mental arithmetic on emotional vs. neutral distractor images for bipolar patients, unaffected relatives of bipolar patients, individuals with hypomanic personality, and the 22 selected control participants.

	H	BA	MNI coordinates			Cs	CI	Z
			x	y	z			
<i>arithmetic > number detection</i>								
dorsolateral prefrontal	L	44	-42	5	28		a	>8.21
	R	44	45	5	31		a	7.49
dorsomedial prefrontal	L	32	-3	11	52		a	>8.21
	R	32	6	17	49		a	>8.21
insula	L	48	-33	20	-2		a	>8.21
	R	48	36	20	-2	1638	a	>8.21
superior/inferior parietal	L	7	-24	-64	40		a	>8.21
	R	7	27	-61	46		a	>8.21
occipital/ventral temporal	L	19	-47	-70	-11		a	>8.21
	R	19	48	-70	-14		a	6.51
<i>emotional > neutral distractors</i>								
dorsolateral prefrontal	R	46	39	38	31	43	a	5.07
	L	45	-42	29	28	58	b	5.19
dorsomedial prefrontal	R	32	3	17	49	435	c	7.61
insula	L	48	-30	23	1	203	d	6.79
	R	48	33	20	4	219	e	6.89
superior/inferior parietal	L	7	-24	-64	43	4953	f	7.77
	R	7	27	-61	49		f	7.35
<i>Interaction group x condition</i>								
superior/inferior parietal	R	7	27	-58	49	324	a	5.83

H = Hemisphere; BA = Brodmann area; CS = Cluster size in number of activated voxels; CI = cluster index (all peaks of an activation cluster are identified by the same letter; the cluster peaks are displayed in bold letters)

Figure S6: Activations in the right parietal cortex for the interaction of group and distractor condition (A) as well as the respective difference in % signal change for mental arithmetic on emotional vs. neutral background images for all groups (B).



Supplementary Analysis S7

To probe the influence of age on the effect in the unaffected first-degree relatives of bipolar patients, we conducted a series of analyses. We first split the group of relatives in those above and below 30 years of age. This yielded two relatively equally sized groups of $N = 9$ (< 30) and $N = 8$ (> 30). We then directly contrasted the two age groups, which did not yield any significant differences (even when lowering the threshold to an uncorrected $p < .001$).

We then compared each of the two age groups to their respective healthy control participants. If the effect reflects a resilience characteristic, it should only be observed in the comparison of the older relatives to their controls, not in the younger group that is still at risk. This was, however, not the case. As the power of this small sample is limited, we also compared the size of the effect to that in bipolar patients. The effect size of these comparisons (young relatives $\eta^2 = .070$; old relatives $\eta^2 = .050$) calculated on the extracted % signal change was less than half the size of that found in bipolar patients and their controls ($\eta^2 = .157$).

We also correlated the parietal activation increase for emotional over neutral background images with age in the group of relatives, but observed no significant correlation ($p > .20$). Furthermore, we included age as a covariate in the analysis of Sample 2, which did not yield different results.

Table S8: Correlation of the reaction time and right parietal activation distraction effect with clinical and other characteristics in bipolar patients.

	Reaction time (emo - neu)		r parietal activation (emo - neu)	
	r	p	r	p
medication load	.047	.835	-.002	.994
time in remission	.291	.189	.057	.802
age at disease onset	.346	.115	-.327	.138
# of illness episodes	.104	.646	.089	.692
age at first hospitalization	.319	.170	-.299	.201
# of previous hospitalizations	-.241	.293	.191	.406
BDI	-.011	.962	.110	.624
HAMD	-.249	.276	-.249	.277
YMRS	.183	.428	-.156	.500
intelligence	-.124	.591	.083	.720
years of education	-.322	.144	-.111	.623