Supplementary Material for:

Beautiful friendship: Social sharing of emotions improves subjective feelings and activates the neural reward circuitry

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Supplementary Results

Arousal

Although our hypothesis referred to the valence dimension of emotion, we also obtained after each picture subjective ratings of arousal as the second primary emotion dimension commonly assessed in emotion research (Lang et al., 2005). Regarding arousal ratings, we did not observe any social sharing effects overall (emotional: M=-0.035, SEM=0.078; t(57)=-0.451, p=0.654; including neutral: M=0.032, SEM=0.072; t(57)=0.456, p=0.650) or when considering positive, negative, and neutral pictures separately (positive: M=-0.060, SEM=0.111; t(57)=-0.548, p=0.586; negative: M=-0.010, SEM=0.079; t(57)=-0.126, p=0.90; neutral: M=0.169, SEM=0.103; t(57)=1.638, p=0.107). (See Supplementary Table S2 for all raw data on subjective ratings of valence and arousal).

Supplementary Tables

(Supplementary Tables S1, S2, S3)

Table S1. Stimulus details. Valence ratings, difference to midpoint of valence scale, and arousal ratings from (Lang et al., 2005). Scales ranging from 1 to 9.

		Valence	**Arousal**
		Difference to midpoint	
	Mean (SD)	Mean (SD)	Mean (SD)
negative face	1.67 (1.19)	3.33 (0.08)	6.1 (2.4)
negative nonface	2.5 (1.55)	2.5 (0.34)	5.74 (2.16)
negative inanimate	2.7 (1.58)	2.3 (0.53)	5.5 (2.2)
negative total	**2.29 (1.44)**	**2.71 (0.32)**	**5.78 (2.26)**
neutral face	5 (1.28)	0 (0.11)	3.28 (1.94)
neutral nonface	4.98 (1.5)	-0.02 (0.5)	4.29 (2.09)
neutral inanimate	5 (1.01)	0 (0.05)	2.79 (1.91)
neutral total	**4.99 (1.26)**	**-0.01 (0.22)**	**3.45 (1.98)**
positive face	8.32 (1.16)	3.32 (0.17)	4.74 (2.58)
positive nonface	7.56 (1.47)	2.56 (0.55)	5.67 (2.31)
positive inanimate	7.37 (1.59)	2.37 (0.21)	4.41 (2.41)
positive total	**7.75 (1.41)**	**2.75 (0.31)**	**4.94 (2.44)**

Table S2. Subjective ratings of valence and arousal (scale range 0 -12).

Valence Mean (SEM)

	shared	unshared	raw sharing effect	sharing effect corrected
negative	3.457 (0.146)	3.288 (0.155)	0.168 (0.063)	0.088 (0.056)
positive	8.015 (0.134)	7.921 (0.136)	0.093 (0.071)	0.136 (0.073)
emotional (neg and pos)	5.736 (0.059)	5.604 (0.074)	0.131 (0.045)*	0.112 (0.045)*
neutral	6.196 (0.086)	6.119 (0.082)	0.076 (0.066)	0.064 (0.068)
all	5.888 (0.060)	5.776 (0.069)	0.112 (0.035)*	0.095 (0.037)*

Arousal Mean (SEM)

	shared	unshared	raw sharing effect	sharing effect corrected
negative	6.817 (0.242)	6.865 (0.245)	-0.048 (0.087)	-0.010 (0.079)
positive	5.545 (0.236)	5.500 (0.216)	0.044 (0.094)	-0.060 (0.111)
emotional (neg and pos)	6.181 (0.210)	6.183 (0.203)	-0.001 (0.072)	-0.035 (0.078)
neutral	4.080 (0.242)	3.989 (0.223)	0.090 (0.114)	0.169 (0.103)
all	5.481 (0.208)	5.451 (0.192)	0.029 (0.073)	0.032 (0.072)

* significant effect of social sharing ($p<0.05$) . The corrected sharing effect takes into account that standard ratings for picture sets used in shared vs. unshared experimental conditions cannot be totally matched within subjects and therefore corrects the raw sharing effect of each participant accordingly (see Methods). Overall statistical patterns are the same for raw sharing effects.

Table S3. Regional activation during picture phase. Peak voxels in MNI space, p<0.001 uncorr., k>10.

Region	Hem.	BA	Coordinates peak voxel			T-value	Cluster size
			x	y	Z		
unshared_emo > shared_emo							
Lingual gyus	R	18	12	-76	-5	4.03	40
	L	18	-9	-82	-8	3.8	27
unshared_neu > shared_neu							
Lingual gyrus	R	18	12	-57	1	3.97	231
	R	18	9	-61	-5	3.85	
	R	18	12	-76	-5	3.68	
emo > neu							
Frontopolar cortex	L	10	-3	62	-2	3.87	13
	L	10	0	56	16	3.8	30
	L	10	-9	65	25	3.58	
Anterior cingulate gyrus	L/R	32	0	38	7	3.73	17
Lingual gyrus	R	18	18	-91	-5	3.36	13
Middle temporal gyrus	R	37	54	-70	13	5.95	377
	R	37	54	-58	4	4.34	
Amygdala	L		-21	-4	-14	4.39	157
	R		21	-4	-14	3.94	
Fusiform gyrus	R	37	42	-43	-14	3.79	19
	R	37	30	-73	-5	3.56	21
Precuneus	L/R	23	0	-52	31	4.68	167
	R		3	-49	13	3.92	
Lingual gyrus /Cuneus	L	18	-12	-94	-2	3.88	31
	R	18	18	-91	-5	3.36	13
Middle occipital gyrus	L	19	-48	-76	16	5.47	234
Superior occipital gyrus	R	19	39	-82	31	3.53	
Midbrain	R		3	-16	-14	3.7	11
neg > pos							
Inferior/medial frontal gyrus	R	48	51	23	16	6.34	2365
	R	44	39	5	31	6.2	
	R	46	57	29	16	6.16	
	L	6	-48	2	31	4.73	95
	L	44	-54	14	37	4.01	
	L	48	-45	11	19	3.18	
Superior frontal gyrus	R	10	12	65	28	5.76	45
	R	10	15	68	19	5.35	

	L	32	-6	50	25	4.8	75
	L	9	-6	56	40	4.17	
	L	8	-6	41	55	3.3	
	L	10	-12	62	31	4.26	11
Inferior temporal /	L	37	-42	-58	-8	8.92	6107
inferior occipital gyrus	R	37	45	-67	-8	8.8	
	L	18	-36	-88	4	8.16	
cluster also including:							
Amygdala	R		21	-4	-11	5.16	
	L		-21	-4	-14	4.3	
Hippocampus	L		-27	-10	-11	4.83	
Temporal pole	R	38	48	14	-26	3.74	
Middle temporal gyrus	R	21	51	-4	-17	4.23	61
Brainstem			0	-37	-35	3.93	34
pos > neg							
Medial orbitofrontal gyrus	R	11	9	56	-5	4.77	24
	R	47	39	50	-5	3.79	
	R	46	39	47	7	3.71	
Anterior cingulate gyrus	L	25	-6	35	4	4.98	476
	L	11	-15	44	-2	4.89	
Cingulate gyrus	R	23	9	-13	31	4	59
Hippocampus	R		21	-34	7	4.08	
Precuneus	R	7	9	-73	37	5.26	387
	L	7	-9	-67	31	4.71	
Paracentral lobule	L	4	-6	-19	67	4	153
	R	4	3	-19	67	3.92	
Posterior cingulate gyrus	L	23	-6	-31	25	3.97	
Angular gyrus	R	39	42	-64	43	3.68	10

Table S4. Activation peaks in OFC used for ROI creation.

Source	x	y	z	atlas-type
(Rothkirch, Schmack, Schlagenhauf, & Sterzer, 2012)	0	26	-14	MNI
	30	38	-14	MNI
(Schlagenhauf et al., 2009)	0	45	-12	MNI
	-3	42	-18	MNI
	-6	45	-18	MNI
(Walter et al., 2010)	39	21	-15	MNI
	33	30	-9	MNI
(Diaconescu et al., 2011)	20	20	-24	MNI
(Bunzeck, Dayan, Dolan, & Duzel, 2010)	10	-24	-18	MNI
(Bunzeck, Doeller, Dolan, & Duzel, 2012)	6	48	-20	MNI
	0	46	-26	MNI
	-4	36	-26	MNI
	4	40	-28	MNI
(Liu, Hairston, Schrier, & Fan, 2011)	-46	42	-4	MNI
	-42	52	-6	MNI
(Wagner, Boswell, Kelley, & Heatherton, 2012)	-27	36	-12	MNI
(Diekhof, Falkai, & Gruber, 2011)	21	21	-21	MNI
	-24	27	-21	MNI
	15	18	-18	MNI
	-21	39	-18	MNI
(Bermpohl et al., 2010)	-30	42	-9	MNI
(O'Doherty, Critchley, Deichmann, & Dolan, 2003)	-39	42	-15	MNI
(O'Doherty, Kringelbach, Rolls, Hornak, & Andrews, 2001)	6	42	-24	Tal
	-10	40	-22	Tal
	-4	28	-18	Tal
	36	58	-12	Tal

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