What's in a child's face? : effects of facial resemblance, love withdrawal, empathy and context on behavioral and neural responses

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Chapter 6

Supplementary material

Supplementary material Chapter 2

Preliminary analyses

To confirm that our facial stimuli reliably activated face processing areas, we contrasted brain activity in response to familiar-looking and unfamiliar-looking faces with brain activity in response to scrambled faces. Group means were tested using one-sample t-tests. All statistical images were thresholded using clusters determined by $Z > 2.3$ (t-values are automatically converted to z-statistics) and a cluster-corrected significance threshold of $p < 0.05$ (Worsley, 2001). As shown in Table S2.1, faces elicited heightened brain activity in bilateral occipital and temporal areas known to be particularly involved in face processing, including the infero-lateral occipital cortex and occipito-temporal fusiform gyrus (clusters 3 and 4). In addition, faces elicited heightened activity in bilateral intracalcarine and supracalcarine cortex (cluster 2), and in several right hemisphere areas that are part of the brain's socio-emotional networks, including a cluster encompassing parts of the MFG, IFG, insular cortex, and precentral gyrus (cluster 6), as well as in a right occipito-parietal cluster (cluster 5, including the superior lateral occipital cortex, and angular gyrus, extending into superior parietal areas), and in a cluster including parts of the right orbitofrontal cortex, amygdala, putamen, and brain stem (cluster 1).

Table S2.1. MNI coordinates and Z-max values for clusters significantly activated in response to unfamiliar- and familiar-looking faces compared to scrambled stimuli (contrast: face > scrambled).

Cluster	Size	Region	*Z-max*	MNI coordinates for Z-max		
				x	y	z
6	4369	Right MFG and IFG	5.12	48	30	20
5	2746	Right superior parietal lobe	5.25	36	-52	46
4	2576	Right temporal occipital fusiform	5.64	44	-52	-22
3	1381	Left infero-lateral occipital cortex	6.29	36	-82	-2
2	1188	Bilateral intracalcarine cortex	5.06	-14	-64	6
1	1073	Right amygdala	4.18	14	-6	-16

Supplementary material Chapter 4

Test-retest reliability structural MRI

Table S4.1. MRI volumetric measures of the structural analyses for the whole sample (N = 41) and test-retest reliability for the whole sample and for left-handed (N = 20) and right-handed (N = 21) participants separately.

Area	Volume s1 in ml		Volume s2 in ml		ICCs			Fisher's r to z	
	Mean	SD	Mean	SD	Total	Left-handed	Right-handed	Z	p
Gray matter	585.06	41.88	587.30	42.14	0.98	0.96	0.99	-1.68	0.09
White matter	617.67	49.57	614.40	48.08	0.97	0.98	0.97	0.87	0.38
Left amygdala	1.40	0.15	1.41	0.16	0.88	0.94	0.81	1.84	0.07
Right amygdala	1.29	0.20	1.28	0.24	0.80	0.74	0.85	-0.85	0.40
Left thalamus	8.06	0.58	8.07	0.54	0.96	0.97	0.95	0.73	0.47
Right thalamus	7.67	0.54	7.63	0.54	0.93	0.93	0.92	0.33	0.74

*Structural MRI data was available for one of the participants who provided no usable fMRI data.

Test-retest reliability, anatomically defined ROIs

Reliabilities obtained for maximum values within the anatomical ROIs were comparable to the test-retest reliabilities established for maximum values within the functional ROIs (see Table S4.2). Reliabilities for the contrast familiar vs. unfamiliar were poor for the whole sample, and for left-handed and right-handed participants separately, in all ROIs (FFA, IFG, STG; -.33 ≤ ICC ≤ .35, with the exception of FFA activity for left-handed participants ICC= .44). FFA activity related to face processing (contrast: face vs. scrambled) was fair to good both across the entire sample and for left- and right handed participants separately (.41 ≤ ICC ≤ .62). For V1, reliability was poor for all contrasts vs. fixation cross for the entire sample (.24 ≤ ICC ≤.36) and for right-handed participants (.08 ≤ ICC ≤ .20). For left-handed participants reliability was fair (.40 ≤ ICC ≤ .56; with the exception of NeutralUnfamiliar vs. fixation cross: ICC = .29). Similar to the results obtained for maximum values within the functional masks, increasing the number of trials did not clearly increase reliability values, and even seemed associated with decreasing reliabilities for

V1 (note the usually fair reliabilities for 78 trials, .39 ≤ ICC ≤ 51). In general, test-retest reliabilities for left-handed participants were slightly higher than for right-handed participants, but differences were not significant.

Table S4.2. Test-retest reliabilities for the anatomical masks with maximum values for the whole sample for the first third (78 trials N= 42[1]), the first two thirds of the task (156 trials N= 42[1]), and the complete task (234 trials N = 41), and for left- (N= 20) and right-handed (N= 21) participants separately.

ROI	Contrast	Number of trials			Left-handed	Right-handed	Fisher's r to z	
		78	156	234			Z	p
V1	ThreatFamiliar vs. fix	0.39	0.36	0.36	0.56	0.12	1.49	0.14
	ThreatUnfamiliar vs. fix	0.40	0.39	0.34	0.48	0.14	1.12	0.26
	ThreatScrambled vs. fix	0.51	0.37	0.34	0.51	0.14	1.24	0.22
	NeutralFamiliar vs. fix	0.47	0.47	0.30	0.47	0.08	1.29	0.20
	NeutralUnfamiliar vs. fix	0.44	0.40	0.24	0.29	0.20	0.27	0.79
	NeutralScrambled vs. fix	0.44	0.28	0.27	0.40	0.11	0.96	0.34
FFA	Familiar vs. Unfamiliar	0.27	0.37	0.35	0.44	0.23	0.70	0.48
	Face vs. Scrambled	0.50	0.58	0.54	0.41	0.62	-0.82	0.41
IFG	Familiar vs. Unfamiliar	0.16	0.03	-0.25	-0.22	-0.30	0.24	0.81
STG	Familiar vs. Unfamiliar	0.06	-0.11	-0.10	-0.05	-0.33	0.87	0.38

[1]For one participant, data was only available for the first and the second part of the task, since this participant fell asleep during the third part.
fix = fixation cross

Test-retest reliability, mean and median cope values

As shown in Tables S4.3 and S4.4, test-retest reliability for mean and median values within the functionally defined ROIs were lower than reliability scores obtained for maximum values. Good test-retest reliabilities were obtained only for activity related to face processing within the FFA (.54 ≤ ICC ≤ .72 [contrast face vs. scrambled]). All other ROIs and contrasts showed poor reliability (ICCs ≤ .39, with three exceptions among left-handed participants: ICC = .54 [median, IFG] ICC = .51 [mean, IFG], ICC = .43 [mean, FFA, familiar vs. unfamiliar]) Comparable to the results for maximum values, ICCs did not consistently increase with increasing numbers of trials and ICCs obtained for 78, 156, and 234 trials differed only slightly from each other (see Tables S4.3 and S4.4). Again, test-retest reliabilities for left-handed participants were higher than for right-handed participants, but after correcting for multiple testing, differences were not significant.

Table S4.3 Test-retest reliabilities for the functional masks with mean values for the whole sample for the first third (78 trials N= 42[1]), the first two thirds of the task (156 trials N= 42[1]), and the complete task (234 trials N = 41), and for left- (N= 20) and right-handed (N= 21) participants separately.

ROI	Contrast	Number of trials			Left-handed	Right-handed	Fisher's r to z	
		78	156	234			Z	p
V1	ThreatFamiliar vs. fix	0.11	0.09	0.05	0.11	-0.01	0.36	0.72
	ThreatUnfamiliar vs. fix	0.12	0.05	0.09	0.17	0.00	0.53	0.60
	ThreatScrambled vs. fix	0.28	0.10	0.09	0.16	0.02	0.42	0.68
	NeutralFamiliar vs. fix	0.11	0.09	0.07	0.10	0.04	0.16	0.87
	NeutralUnfamiliar vs. fix	0.14	0.14	0.11	0.20	0.04	0.48	0.63
	NeutralScrambled vs. fix	0.13	0.10	0.07	0.12	0.02	0.29	0.77
FFA	Familiar vs. Unfamiliar	0.19	0.23	0.21	0.43	-0.09	1.60	0.11
	Face vs. Scrambled	0.54	0.61	0.65	0.56	0.71	-0.76	0.45
IFG	Familiar vs. Unfamiliar	0.07	0.07	0.02	0.51	-0.23	2.34	0.02*
STG	Familiar vs. Unfamiliar	-0.02	0.15	0.23	0.27	0.16	0.35	0.73

[1]For one participant, data was only available for the first and the second part of the task, since this participant fell asleep during the third part.

*Difference was not significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.

fix = fixation cross

Table S4.4 Test-retest reliabilities for the functional masks with median values of the whole sample for the first third (78 trials N= 42[1]), the first two thirds of the task (156 trials N= 42[1]), and the complete task (234 trials N = 41), and for left- (N= 20) and right-handed (N= 21) participants separately.

ROI	Contrast	Number of trials			Left-handed	Right-handed	Fisher's r to z	
		78	156	234			Z	p
V1	ThreatFamiliar vs. fix	0.11	0.10	0.04	0.10	0.00	0.32	0.75
	ThreatUnfamiliar vs. fix	0.10	0.04	0.08	0.17	0.00	0.50	0.62
	ThreatScrambled vs. fix	0.22	0.07	0.05	0.10	0.00	0.30	0.76
	NeutralFamiliar vs. fix	0.07	0.09	0.07	0.08	0.06	0.05	0.96
	NeutralUnfamiliar vs. fix	0.10	0.14	0.13	0.23	0.05	0.53	0.60
	NeutralScrambled vs. fix	0.05	0.09	0.05	0.07	0.03	0.10	0.92
FFA	Familiar vs. Unfamiliar	0.23	0.20	0.17	0.39	-0.11	1.53	0.13
	Face vs. Scrambled	0.60	0.63	0.66	0.57	0.72	-0.80	0.42
IFG	Familiar vs. Unfamiliar	0.10	0.06	0.04	0.54	-0.22	2.42	0.02*
STG	Familiar vs. Unfamiliar	-0.01	0.10	0.25	0.28	0.17	0.34	0.73

[1]For one participant, data was only available for the first and the second part of the task, since this participant fell asleep during the third part.
*Difference was not significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.
fix = fixation cross

Test-retest reliability for consistency

Table S4.5 displays test-retest reliabilities for consistency, calculated for maximum cope values within functional ROIs. ICCs for consistency were generally comparable to ICCs for absolute agreement (see Table S4.5). For the contrast familiar vs. unfamiliar (FFA, IFG, STG), ICCs for consistency were poor (-.16 ≤ ICC ≤ .34), with the exception of fair reliability for FFA activity obtained for left-handed participants (ICC = .53). FFA activity related to face processing (contrast: face vs. scrambled) showed good test-retest reliability (.65 ≤ ICC ≤ .74). For V1, ICCs for right-handed participants were poor (.02 ≤ ICC ≥ .18), but ICCs for left-handed participants were fair to excellent (.52 ≤ ICC ≤ .84) and thus somewhat higher than ICCs obtained for absolute agreement. Across the entire sample, ICCs were poor to fair for V1 activity (.28 ≤ ICC ≥ .53). ICCs were generally higher for left-handed than for right-handed participants,

with significant differences obtained in V1 for the contrasts ThreatFamilar vs. fixation cross, ThreatScrambled vs. fixation cross, and NeutralScrambled vs. fixation cross after correcting for multiple testing.

Table S4.5. Test-retest reliabilities for maximum values of the whole sample for the first third (78 trials N= 42[1]), the first two thirds of the task (156 trials N= 42[1]), and the complete task (234 trials N = 41), and for left- (N= 20) and right-handed (N= 21) participants separately (234 trials).

ROI	Contrast	Number of trials			Left-handed	Right-handed	Fisher's r to z	
		78	156	234			Z	p
V1	ThreatFamiliar vs. fix	0.44	0.41	0.43	0.77	0.07	2.81	0.01**
	ThreatUnfamiliar vs. fix	0.41	0.43	0.38	0.64	0.06	2.06	0.04*
	ThreatScrambled vs. fix	0.55	0.49	0.53	0.84	0.18	3.07	0.00**
	NeutralFamiliar vs. fix	0.48	0.50	0.34	0.65	0.02	2.23	0.03*
	NeutralUnfamiliar vs. fix	0.45	0.46	0.28	0.52	0.18	1.17	0.24
	NeutralScrambled vs. fix	0.49	0.38	0.44	0.82	0.10	3.12	0.00**
FFA	Familiar vs. Unfamiliar	0.13	0.25	0.29	0.53	0.04	1.63	0.10
	Face vs. Scrambled	0.65	0.65	0.71	0.66	0.74	-0.47	0.64
IFG	Familiar vs. Unfamiliar	0.06	0.11	0.01	0.27	-0.16	1.3	0.19
STG	Familiar vs. Unfamiliar	0.12	0.08	0.18	0.34	-0.04	1.17	0.24

[1]For one participant, data was only available for the first and the second part of the task, since this participant fell asleep during the third part.
fix = fixation cross
*Difference was not significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.
**Difference was significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.

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Within-session reliability

Table S4.6 presents within-session reliabilities for maximum values (functional ROIs). In session 1, reliability of V1 activity was fair to excellent across the entire sample (.49 ≤ ICC ≤ .77) and for left- and right-handed participants separately (.47 ≤ ICC ≤ .80). In session 2, reliability of V1 activity was fair to excellent for left-handed participants (.41 ≤ ICC ≤ .77), but poor for right-handed participants (ICC ≤ .31, except NeutralScrambled vs. fixation: ICC

= .46), resulting in poor to good reliabilities across the entire sample (.34 ≤ ICC ≤ .61). Reliability of FFA activity related to face processing (contrast face vs. scrambled) was clearly higher in session 1 (.51 ≤ ICC ≤ .67; fair to good) compared to session 2 (.24 ≤ ICC ≤ .49; poor to fair). For the contrast familiar vs. unfamiliar, we obtained poor reliability values in both sessions for all ROIs (session 1: .01 ≤ ICC ≤ .34; except for IFG activity in right-handed participants, ICC= .42; session 2: -.14 ≤ ICC ≤ .25). With respect to handedness, we did not obtain systematic differences in ICC values between left-handed and right-handed participants in session 1. However, in session 2 reliabilities were systematically higher for left-handed than for right-handed participants, although differences were significant only for V1 activity for the contrast NeutralUnfamiliar vs. fixation cross (p < .01) after correcting for multiple testing using the Benjamini-Hochberg procedure.

Table S4.6. Test-retest reliabilities for the functional masks with max values for the whole group, and for left- (N = 20) and right-handed (N= 21) participants separately within session 1 and within session 2.

ROI	Contrast	Session 1			Session 2		
		Whole sample	Left-handed	Right-handed	Whole sample	Left-handed	Right-handed
V1	ThreatFamiliar vs. fix	0.65	0.64	0.66	0.34	0.44	0.24
	ThreatUnfamiliar vs. fix	0.49	0.52	0.48	0.45	0.73*	0.15
	ThreatScrambled vs. fix	0.69	0.64	0.74	0.52	0.73	0.31
	NeutralFamiliar vs. fix	0.67	0.77	0.58	0.35	0.41	0.28
	NeutralUnfamiliar vs. fix	0.61	0.47	0.77	0.38	0.77**	0.13
	NeutralScrambled vs. fix	0.77	0.72	0.80	0.61	0.77	0.46
FFA	Familiar vs. Unfamiliar	0.16	0.11	0.22	0.08	0.13	0.02
	Face vs. Scrambled	0.60	0.51	0.67	0.36	0.24	0.49
IFG	Familiar vs. Unfamiliar	0.34	0.17	0.42	0.00	0.13	-0.12
STG	Familiar vs. Unfamiliar	0.17	0.01	0.28	0.13	0.25	-0.14

Effects for Handedness are calculated with Fisher's r to z transformation.
*Difference was not significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.
**Difference was significant after applying the Benjamini-Hochberg procedure to correct for multiple testing.