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**Table S1**. Participant demographics

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | | **Abuse group (*n*=70)** | | | | **Neglect group (*n*=87)** | | | | **Combined group (*n*=50)** | | | | **Non-maltreated group (*n*=207)** | | | |
| **Measure** |  | | *mean* | | *sd* | | *mean* | | *sd* | | *mean* | | *sd* | | *mean* | | *sd* | |
| Age (years) |  | | 19.93 | | 1.38 | | 19.51 | | 1.26 | | 19.74 | | 1.12 | | 19.59 | | 1.84 | |
| Range |  | | 18-22 | | | | 18-22 | | | | 18-22 | | | | 18-22 | | | |
| IQ |  | | 120.21 | | 7.80 | | 120.80 | | 9.02 | | 119.04 | | 9.09 | | 119.65 | | 12.29 | |
| SES |  | | 7.74 | | 1.38 | | 7.54 | | 1.97 | | 6.9 | | 2.13 | | 7.53 | | 1.7 | |
|  |  | |  | |  | |  | |  | |  | |  | |  | |  | |
|  |  | | *n* | | *%* | | *n* | | *%* | | *n* | | *%* | | *n* | | *%* | |
| Gender (% female) | | | | 52 | | 74% | | 46 | | 53% | | 26 | | 52% | | 126 | | 61% |
| Ethnicity (% Caucasian) | | | | 16% | | 23% | | 28 | | 32% | | 14 | | 28% | | 59 | | 29% |
|  | |  | |  | |  | |  | |  | |  | |  | |  | |  |
|  | |  | | *mean* | | *sd* | | *mean* | | *sd* | | *mean* | | *sd* | | *mean* | | *sd* |
| **Type of maltreatment (CTQ score)** | | | |  | |  | |  | |  | |  | |  | |  | |  |
|  | | Emotional abuse | | 11.66 | | 4.01 | | 8.17 | | 2.30 | | 13.56 | | 4.39 | | 5.60 | | 0.84 |
|  | | Physical abuse | | 9.20 | | 3.65 | | 5.98 | | 1.37 | | 9.30 | | 3.82 | | 5.26 | | 0.57 |
|  | | Sexual abuse | | 7.40 | | 3.94 | | 5.15 | | 0.52 | | 6.58 | | 3.11 | | 5.00 | | 0.00 |
|  | | Emotional neglect | | 10.41 | | 2.80 | | 13.37 | | 3.24 | | 15.44 | | 3.66 | | 6.16 | | 1.40 |
|  | | Physical neglect | | 6.74 | | 1.40 | | 10.22 | | 2.29 | | 11.08 | | 3.45 | | 5.13 | | 0.43 |
|  | | Total score | | 45.41 | | 6.60 | | 42.89 | | 4.458 | | 55.96 | | 9.75 | | 27.15 | | 1.883 |
|  | |  | |  | |  | |  | |  | |  | |  | |  | |  |
| **Psychopathology** | | | | *n* | | *%* | | *n* | | *%* | | *n* | | *%* | | *n* | | *%* |
|  | | Any | | 22 | | 31 | | 23 | | 29 | | 15 | | 30 | | 53 | | 26 |
|  | | MDD | | 9 | | 13 | | 9 | | 12 | | 7 | | 14 | | 8 | | 4 |
|  | | Bipolar | | 4 | | 6 | | 3 | | 4 | | 6 | | 12 | | 6 | | 3 |
|  | | Panic | | 6 | | 9 | | 5 | | 6 | | 1 | | 2 | | 7 | | 3 |
|  | | SAD | | 2 | | 3 | | 2 | | 3 | | 2 | | 4 | | 1 | | 0 |
|  | | OCD | | 3 | | 4 | | 1 | | 1 | | 1 | | 2 | | 2 | | 1 |
|  | | PTSD | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 |
|  | | Alcohol Dependence | | 5 | | 7 | | 5 | | 6 | | 0 | | 0 | | 14 | | 7 |
|  | | Alcohol Abuse | | 4 | | 6 | | 6 | | 8 | | 3 | | 6 | | 17 | | 8 |
|  | | Any Alcohol Abuse | | 9 | | 13 | | 11 | | 14 | | 3 | | 6 | | 31 | | 15 |
|  | | Substance Abuse | | 6 | | 9 | | 1 | | 1 | | 3 | | 6 | | 10 | | 5 |
|  | | Eating Disorder | | 0 | | 0 | | 1 | | 1 | | 1 | | 2 | | 4 | | 2 |
|  | | Asperger syndrome | | 0 | | 0 | | 0 | | 0 | | 1 | | 2 | | 0 | | 0 |
|  | | Borderline Personality Disorder | | 1 | | 1 | | 0 | | 0 | | 1 | | 2 | | 0 | | 0 |
|  | | Psychosis | | 0 | | 0 | | 0 | | 0 | | 1 | | 2 | | 0 | | 0 |

SD, Standard Deviation; IQ, intelligence quotient measures with the 2-subtest version of the Wechsler Abbreviated Scales of Intelligence (1), SES, Socioeconomic status measured as highest level education rated on 9-point scale from 0= no formal qualifications to 9= MD/PhD/JD/PharmD; CTQ, Childhood Trauma Questionnaire.

*Childhood Trauma Questionnaire*

Between group comparison of total Childhood Trauma Questionnaire (CTQ (Bernstein & Fink, 1998)) revealed significantly elevated total scores in in the NO and AO groups compared to NMT participants (AO vs. NMT: Mean difference: -18.26, *p*< .001 NO vs NMT: -15.74, *p*< .001; COM vs. NMT -28.81, *p*< .001). Across the maltreatment groups, the COM group had the highest CTQ total score (COM vs. AO: Mean Difference -10.55, *p*< .001; COM vs. NO: Mean Difference -13.07, < .001), followed by the AO group (AO vs. NO: 2.52, *p*= .010, all comparisons Bonferroni-corrected).

*Propensity Score Matching*

The R software package MatchIT (Ho et al., 2011) was used to implement two PSM methods that use different algorithms to match participants. “Nearest neighbour”, a 1:1 matching approach – i.e. for each participant in the maltreated group one or more participants with the closest propensity score (i.e. smallest distance) is selected from the non-maltreated group - and “full matching”, which enables flexible matching within subclasses by applying weighting. The following variables were selected for the PSM analyses: age, gender, handedness, IQ, ethnicity, socio-economic status (measured by parental level of education), and psychopathology (assessed by measuring current and past history of any psychiatric conditions).

*Group categorization*

Maltreated groups were created using the CTQ according to the following criteria:

Maltreated groups: Individuals who scored above the 75th percentile on the CTQ Total Score and additionally scored in the moderate-severe category in at least one domain. This group was then subdivided into three further groups, depending on the type of maltreatment experiences (see figure S3):

* + 1. Abuse-only group (AO): Individuals who scored within the moderate to severe category on at least one abuse subscale (Emotional Abuse; Physical Abuse; Sexual Abuse) and below the moderate to severe category on both neglect subscales (Emotional and Physical Neglect).
    2. Neglect-only group (NO): Individuals who scored within the moderate to severe category on at least one neglect subscale (Emotional and/or Physical Neglect) and below the moderate to severe category on both abuse subscales (Emotional Abuse; Physical Abuse; Sexual Abuse).
    3. Combined Abuse and Neglect group (COM): Individuals who scored within the moderate to severe category on at least one neglect subscale (Emotional and/or Physical Neglect) and within the moderate to severe category on at least one abuse subscale (Emotional Abuse; Physical Abuse; Sexual Abuse).

This screening procedure yielded a total of *n*=207 individuals who were assigned to the maltreated groups (AO=70; NO=87; COM=50). There were a total of *n*=520 individuals who did meet threshold for any form of maltreatment while *n*=417 participants were excluded from further consideration because their total CTQ score fell above the 75th percentile while no single subscale reached the moderate-severe threshold or vice versa.

Non-Maltreated Control Participants and Propensity Score Matching:

In order to match the *n*=207 individuals with maltreatment experiences as closely as possible to a non-maltreated sample, 1:1 propensity score matching (PSM) procedures were applied to the 520 eligible non-maltreated participants (see ‘Propensity Score Matching’ below). This yielded a total sample size of *n*=207 matched non-maltreated control participants with respect to age, gender, handedness, socio-economic status and psychopathology (60.4% female; age range: 18-22). That is, *n*=207 participants were selected and formed the non-maltreated control group (NMT group, see Table S2 for Demographics). There was a significant gender difference in the Abuse Only (AO) group, so the analyses of valence by group interactions for the AO group vs. NMT group were subsequently controlled for gender.

**Table S2.** Exploratory whole brain and ROI within-maltreatment group results from the contrast Angry-Neutral faces

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  | Brain region | **R/L** | **x** | **y** | **z** |  | ***ke*** | ***t*** | ***Z*** |
|  |  |  |  |  |  |  |  |  |  |
|  | ***NO vs. AO*** |  |  |  |  |  |  |  |  |
| *Whole brain* | |  |  |  |  |  |  |  |  |
|  | Hippcampus (Dentate gyrus) | R | 30 | -14 | -18 |  | 19 | 4.26 | 4.21 |
|  | Subgenual anterior cingulate | L | -12 | 30 | 0 |  | 88 | 4.18 | 4.13 |
|  | Somatosenory cortex | L | -8 | 26 | -6 |  |  | 3.66 | 3.63 |
|  | Fusiform gyrus | L | -40 | -46 | -8 |  | 36 | 3.94 | 3.91 |
|  |  | L | -40 | -42 | -18 |  | 17 | 3.8 | 3.77 |
|  | Superior temporal sulcus | R | 50 | -30 | -10 |  | 66 | 3.58 | 3.56 |
|  | Superior temporal sulcus | R | 54 | -26 | 2 |  |  | 3.3 | 3.28 |
|  | Superior temporal sulcus | R | 50 | -22 | -6 |  |  | 3.3 | 3.27 |
|  | White Matter / Caudate | L | -22 | -28 | 24 |  | 12 | 3.3 | 3.28 |
| *ROI* |  |  |  |  |  |  |  |  |  |
|  | *Ventral amygdala* | *-* | - | - | - |  | - | - | - |
|  | *Dorsal amygdala* | *-* | - | - | - |  | - | - | - |
|  |  |  |  |  |  |  |  |  |  |
|  | ***AO vs. NO*** |  |  |  |  |  |  |  |  |
| *Whole brain* | | *-* | - | - | - |  | - | - | - |
| *ROI* | |  |  |  |  |  |  |  |  |
|  | *Ventral amygdala* | *-* | - | - | - |  | - | - | - |
|  | *Dorsal amygdala* | *-* | - | - | - |  | - | - | - |
|  |  |  |  |  |  |  |  |  |  |
|  | Brain region | **R/L** | **x** | **y** | **z** |  | ***ke*** | ***t*** | ***Z*** |
|  |  |  |  |  |  |  |  |  |  |
|  | ***NO vs. COM*** |  |  |  |  |  |  |  |  |
| *Whole brain* | |  |  |  |  |  |  |  |  |
|  | Middle temporal gyrus | R | 50 | -32 | -12 |  | 229 | 3.49 | 3.46 |
|  |  | R | 54 | -16 | -18 |  |  | 2.61 | 2.6 |
|  | Hippocampus | R | 24 | -16 | -20 |  | 102 |  |  |
|  | Amygdala | R | 18 | -8 | -18 |  |  | 3.73 | 3.69 |
|  | Visual cortex | R | 2 | -74 | 28 |  | 255 | 2.92 | 2.9 |
|  |  | L | -6 | -72 | 22 |  |  |  |  |
|  |  | R | 8 | -60 | 28 |  |  |  |  |
|  | Hypothalamus | R | 2 | 4 | -14 |  | 46 | 4.32 | 4.27 |
|  |  | R | 2 | 10 | -6 |  |  | 3.75 | 3.72 |
|  | Superior parietal cortex | R | 28 | -28 | 56 |  | 73 | 4.15 | 4.11 |
|  |  | R | 24 | -22 | 64 |  |  | 3.98 | 3.94 |
|  | Ventromedial prefrontal cortex | R | 4 | 54 | 16 |  | 187 | 4.04 | 4 |
|  |  | R | 6 | 52 | 24 |  |  | 3.58 | 3.55 |
|  |  | R | 12 | 50 | 18 |  |  | 3.32 | 3.29 |
|  | Inferior parietal cortex | R | 46 | -6 | 24 |  | 307 | 4.03 | 3.99 |
|  |  | R | 56 | -6 | 18 |  |  | 3.69 | 3.66 |
|  |  | R | 36 | -14 | 14 |  |  | 3.95 | 3.91 |
|  | Somatosensory cortex | L | -56 | -10 | 20 |  | 70 | 3.17 | 3.14 |
|  |  | L | -54 | -8 | 34 |  |  | 3.87 | 3.83 |
|  | Visual cortex | R | 50 | -72 | 6 |  | 31 | 3.76 | 3.73 |
|  | Amygdala ext. Hippocampus | L | -28 | -6 | -22 |  | 104 | 3.61 | 3.58 |
|  |  | L | -26 | -16 | -22 |  |  | 3.74 | 3.71 |
|  | Superior parietal cortex | L | -38 | -18 | 44 |  | 75 | 3.73 | 3.69 |
|  |  | L | -44 | -14 | 56 |  |  | 3.66 | 3.63 |
|  | Superior parietal cortex | R | 34 | -10 | 64 |  | 66 | 3.67 | 3.64 |
|  |  | R | 40 | -6 | 58 |  |  | 3.62 | 3.59 |
|  |  | R | 36 | -12 | 54 |  |  | 3.65 | 3.62 |
|  | Superior parietal cortex | L | -24 | -34 | 60 |  | 51 | 3.64 | 3.61 |
|  | Superior parietal cortex | L | -28 | -20 | 70 |  | 30 | 3.61 | 3.58 |
|  | Occipitotemporal cortex | L | -42 | -42 | -10 |  | 11 | 3.63 | 3.6 |
|  | Superior parietal cortex | L | -34 | -30 | 50 |  | 19 | 3.46 | 3.43 |
|  | Posterior cingulate cortex | R | 4 | -44 | 28 |  | 32 | 3.59 | 3.56 |
|  | Dorsomedial prefrontal cortex | R | 6 | 44 | 44 |  | 31 | 3.37 | 3.34 |
|  | Superior Temporal Sulcus | L | -52 | -22 | -12 |  | 23 | 3.35 | 3.32 |
|  | Posterior Insula | L | -34 | -30 | 16 |  | 16 | 3.55 | 3.53 |
|  |  |  |  |  |  |  |  |  |  |
| *ROI* |  |  |  |  |  |  |  |  |  |
|  | *Ventral amygdala* | R | 18 | -6 | -18 |  | 15 | 3.73 | 3.69 |
|  |  | L | -24 | -6 | -20 |  | 6 | 3.06 | 3.04 |
|  | *Dorsal amygdala* | L | -22 | -8 | -16 |  | 45 | 3.13 | 3.11 |
|  |  | R | 20 | -8 | -16 |  | 27 | 3.85 | 3.81 |
|  |  |  |  |  |  |  |  |  |  |
|  | ***COM vs. NO*** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| *Whole brain* | | *-* | *-* | - | - |  | - | - | - |
| *ROI* |  |  |  |  |  |  |  |  |  |
|  | *Ventral amygdala* | *-* | *-* | - | - |  | - | - | - |
|  | *Dorsal amygdala* | *-* | *-* | - | - |  | - | - | - |
|  |  |  |  |  |  |  |  |  |  |
|  | Brain region | **R/L** | **x** | **y** | **z** |  | ***ke*** | ***t*** | ***Z*** |
|  |  |  |  |  |  |  |  |  |  |
|  | ***AO vs. COM*** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  | Left amygdala | L | -28 | -6 | -24 |  | 55 | 4.25 | 4.2 |
|  | Medial prefrontal cortex | R | 4 | 58 | 18 |  | 113 | 3.98 | 3.94 |
|  |  | R | 10 | 56 | 26 |  |  | 3.44 | 3.41 |
|  | Motor cortex (SMA) | R | 16 | -16 | 60 |  | 21 | 3.78 | 3.74 |
|  | Hippocampus | R | 24 | -10 | -26 |  | 44 | 3.74 | 3.71 |
|  | Middle temporal gyrus | R | 52 | -8 | -22 |  | 43 | 3.67 | 3.64 |
|  |  | R | 56 | -4 | -16 |  |  | 3.39 | 3.36 |
|  | Dorsomedial prefrontal cortex | R | 12 | 42 | 44 |  | 27 | 3.54 | 3.51 |
|  |  | L | -14 | -8 | 52 |  | 13 | 3.54 | 3.51 |
|  | Retrosplenial cortex | R | 10 | -38 | 2 |  | 16 | 3.53 | 3.5 |
|  | Superior temporal sulcus | R | 56 | -16 | -18 |  | 17 | 3.49 | 3.46 |
|  | Dorsomedial prefrontal cortex | L | -16 | 4 | 66 |  | 25 | 3.45 | 3.43 |
|  | Retrosplenial cortex | R | 8 | -54 | 14 |  | 39 | 3.41 | 3.39 |
|  | Thalamus | L | -10 | -18 | -8 |  | 10 | 3.39 | 3.37 |
|  |  |  |  |  |  |  |  |  |  |
| *ROI* |  |  |  |  |  |  |  |  |  |
|  | *Ventral amygdala* | R | 24 | -6 | -24 |  | 9 | 3.47 | 3.45 |
|  |  | L | -26 | -6 | -24 |  | 21 | 4.06 | 4.02 |
|  | *Dorsal amygdala* | *-* | - | - | - |  | - | - |  |
|  |  |  |  |  |  |  |  |  |  |
|  | ***COM vs. AO*** |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| *Whole brain* | |  | *-* | - | - |  | - | - | - |
| *ROI* |  |  | *-* | - | - |  | - | - | - |
|  |  |  |  |  |  |  |  |  |  |

../../../Desktop/GR_Hammer_Fig_1%20(dragged).pdf

**Fig. S1.** Screening protocol and group categorization into the Abuse only group (AO), Neglect only group (NO) and Combined Abuse and Neglect group (COM) and propensity score matched (PSM) Non-Maltreated Control Group (NMT).

**Propensity Score Matching (PSM)**

Propensity Score Matching (PSM) refers to a group of statistical methods that can be used to reduce biases caused by potentially confounding variables when comparing outcomes for a treatment and a non-maltreated control group (in this case, maltreated vs non-maltreated individuals). PSM is applied before inferential statistical analyses in order to balance (i.e. equate) the distribution of covariates across the groups (Stuart, 2010). Unlike traditional regression methods (such as multiple regression), PSM can be used with a large number of control variables without incurring in issues of collinearity and over-fitting (Stuart, 2010; Ho et al., 2011). Moreover, unlike regression analysis, PSM can be used reliably to control for variables that present substantial distribution differences across groups (Pingault et al., 2015; Rubin, 2001). The most common methods rely on 1:1 matching, weighting or sub-classification. When applying PSM, several matching methods can and should be used to identify which one decreases the most the distance between the groups (i.e. reduces the distribution of covariates, (Stuart, 2010; Ho et al., 2011) . After matching, in order to assess the outcome of the matching procedure (i.e. assess the balance between the two groups), often a standardized mean difference (i.e. effect size) of the propensity score is used (Stuart, 2010; Ho et al., 2011). Although there is not a consensus on the cut-off (Pingault et al., 2015), it has been suggested that the overall mean difference, post-matching, should be smaller than .05 (Caliendo & Kopeinig, 2008).

**fMRI data processing**

Pre-processing was conducted using SPM8 (www.fil.ion.ucl.ac.uk/spm). Images for each participant were realigned to the first volume in the time series to correct for head motion, spatially normalized into a standard stereotactic space (Montreal Neurological Institute template) using a 12-parameter affine model (final resolution of functional images = 2 mm isotropic voxels) and smoothed to minimize noise and residual differences in gyral anatomy with a Gaussian filter set at 6 mm full width at half maximum. Voxel-wise signal intensities were ratio normalized to the whole-brain global mean.

Because of the relatively extensive signal loss and noise typically observed in the amygdala and VS, single-subject BOLD fMRI data were included in subsequent analyses only if there was a minimum of 90% signal coverage in the amygdala bilaterally and in the VS bilaterally (see Nikolova et al., 2011)).

Variability in single-subject whole-brain functional volumes was determined using the Artifact Recognition Toolbox (http://www.nitrc.org/projects/ artifact\_detect). Individual whole-brain BOLD fMRI volumes meeting at least one of two criteria were assigned a lower weight in the determination of task- specific effects: (1) significant mean volume signal intensity variation (i.e., within-volume mean signal greater or less than 4 SD of mean signal of all volumes in time series) and (2) individual volumes where scan-to-scan movement exceeded 2 mm translation or 2 degrees rotation in any direction.



**Fig.S2.** Plot showing negative association between amygdala reactivity during Anger vs. Neutral face processing against cumulative number of maltreatment subtypes for the left amygdala. Blue line indicates mean amygdala response in the control group. Note that a similar negative association has been observed for the right amygdala.

**Additional Within-maltreatment group comparisons**

1. Neglect only group (NO) vs. Combined Abuse and Neglect (COM) group

Exploratory whole brain analyses of regions more active in the NO relative to the COM group during the perceptual processing of angry faces vs. neutral included a wide network of brain areas including parts of the middle temporal lobe (amygdala, hippocampus, middle temporal gyrus) as well as the somatosensory and superior parietal cortex and the ventromedial prefrontal cortex (vmPFC). No areas were found to be more active in the COM vs. NO group.

1. Abuse only group (AO) vs. Combined Abuse and Neglect (COM) group

Between group exploratory whole-brain comparisons between the AO and COM group revealed significantly greater activation in the medial and dorsomedial prefrontal cortex, parts of the temporal lobe (bilateral amygdala, right hippocampus and middle temporal gyrus) and bilateral retrosplenial cortex. No areas were found to be more active in the COM vs. AO group. See online data supplement table S2 in Appendix for a complete list.

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