Multisensory Research

The Detached Self: Investigating the Effect of Depersonalisation on Self-Bias in the Visual Remapping of Touch

Harry Farmer [1,2,3,*], **Antonio Cataldo** [4], **Nagela Adel** [1], **Emma Wignall** [1], **Vittorio Gallese** [4,5], **Ophelia Deroy** [4,6,7], **Antonia Hamilton** [1] **and Anna Ciaunica** [1,8]

[1] Institute of Cognitive Neuroscience, University College London, Gower Street, London, WC1E 6BT, UK

[2] School of Human Sciences, University of Greenwich, Dreadnought Building, London, SE10 9LS, UK

[3] Institute for Lifecourse Development, University of Greenwich, Dreadnought Building, Greenwich, London SE10 9LS, UK

[4] Institute of Philosophy, School of Advanced Study, University of London, Senate House, Malet Street, London, WC1E 7HU, UK

[5] Department of Medicine and Surgery, Unit of Neuroscience, University of Parma, Via Volturno 39, 43100 Parma, Italy

[6] Munich Center for Neuroscience, Ludwig Maximilian University, Ludwigstraße 31, 80539 Munich, Germany

[7] Faculty of Philosophy and Philosophy of Science, Ludwig Maximilian University, Geschwister-Scholl-Platz 1, 80539 Munich, Germany

[8] Department of Philosophy, University of Porto, Via Panorâmica s/n, 4150-564 Porto, Portugal

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* To whom correspondence should be addressed. E-mail: h.farmer@gre.ac.uk

Supplementary material

Supplementary Methods

Materials

Individual Difference Questionnaires

DASS-21 The Depression Anxiety and Stress Subscale (Lovibond and Lovibond, 1995) was used to measure participants' levels of depression, anxiety and stress.

TAS-20 The Toronto Alexithymia Scale (Bagby *et al.*, 1994) was used to measure participants' levels of alexithymia. The scale is made of 20 items that map onto three subscales: difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and externally oriented thinking (EOT).

AQ-10 The 10 items Autism Spectrum Quotient (Allison, Auyeung and Baron-Cohen, 2012) was used to measure participants levels of autistic traits.

AMES The Adolescent Measure of Empathy and Sympathy (Vossen, Piotrowski and Valkenburg, 2015) was used to measure levels of cognitive and affective empathy and sympathy.

Face Rating Questionnaire

Following the completion of all VRT blocks participants were shown the image of the other face they had seen in the VRT task, this time without the hands present. They were asked to

rate the face for the properties of attractiveness, likeability and trustworthiness using a nine-point scale. The order of questions was randomised across participants.

Procedure

VRT Calibration Task

Tactile detection thresholds for each cheek were established (see Fig. 1B) using a psychophysics staircase procedure. A stimulation intensity was delivered to either cheek increasing in steps of 1 mA until the participant perceived the stimulus. In the first block initial stimulation intensity was set at 0 mA and in subsequent blocks it was set at the threshold found in the previous block. Participants sat upright in front of a computer and were asked to fixate a white cross on the screen. On the delivery of tactile stimuli, the cross turned green and participants indicated by key press if they had felt a touch on either cheek. After the first detection, the current was reduced in steps of 0.5 mA until the stimulus was no longer perceived. After the fourth reversal, the step size of the staircase was further decreased to 0.25 mA. Stimuli from the staircase for each cheek were interleaved. Each staircase ended once eight reversals had occurred. The mean current intensity at the last four reversals was taken as an estimate of participants' detection threshold for that cheek. The same staircase procedure was repeated before the beginning of each block, to minimise habituation and/or sensitisation effects. In this case, the starting stimulation intensity of the staircase was set to the threshold level established in the previous block.

Supplementary Results

Individual Variance in Amount of Anomalous Subjective Recall Predicts Overall VRT Strength

The full results of our regression analysis examining the extent to which individual variance in depersonalisation symptoms predicts VRT averaged across the three image conditions are shown in Table S1.

Table S1. Summary of hierarchical regression analysis for CDS-29 subscales predicting mean VRT across all images

Variable	*B*	*P*	R^2	ΔR^2	ΔF	Δp
Step 1			0.140	0.140	60.21	0.017
Anomalous body experience	0.375	0.017				
Step 2			0.180	0.040	10.80	0.188
Anomalous body experience	0.046	0.873				
Anomalous subjective recall	0.385	0.188				
Step 3			0.129	0.016	00.70	0.407
Anomalous body experience	−0.095	0.777				
Anomalous subjective recall	0.347	0.242				
Emotional numbing	0.215	0.407				
Step 4			0.106	0.001	00.06	0.808
Anomalous body experience	−0.059	0.874				
Anomalous subjective recall	0.365	0.238				
Emotional numbing	0.253	0.408				
Alienation from surroundings	−0.094	0.808				

No Significant Effect of Depersonalisation Experience on Threshold Levels

To further investigate the difference between our two groups in terms of their accuracy and criterion level for detecting bilateral touch we examined the data from the staircase by carrying out a three-factor mixed ANOVA with block (1–6) and cheek stimulation level (threshold vs. supra-threshold) as within-subject factors and amount of DP experiences as a between-subjects factor. The ANOVA revealed a main effect of block ($F_{5,190} = 2.85$, $p = 0.017$, $\eta^2_p = 0.07$), which was due to threshold intensity increasing in later blocks as participants adapted to the level of stimulation (Block 1: EMM = 2.87, SE = 0.15; Block 6: EMM = 3.17, SE = 0.19). However, no main effect was found for either cheek stimulation level ($F_{1,38} = 0.39$, $p = 0.537$, $\eta^2_p = 0.01$), or amount of DP experiences ($F_{1,38} = 2.55$, $p = 0.118$, $\eta^2_p = 0.063$) and there were no significant interactions.

Anxiety and Generalised Alexithymia Predict Severity of Depersonalised Experiences

To investigate how far individual differences in the questionnaires administered in the pre-experiment sessions (DASS-21, TAS-20, AMES and AQ-10) affected DP, the four questionnaires were entered as predictors into a hierarchical regression with participants' experimental CDS-29 score as the dependent variable. For the DASS-21, TAS-20 and AMES we entered each subscale as independent predictor. The subscales were entered in an order that seemed plausible given previous evidence regarding their relationship to depersonalisation. Previous research has found links between depersonalisation and anxiety (Hunter *et al.*, depression (Sierra, 2009) and alexithymia (Lemche *et al.*, 2013a; Majohr *et al.*, 2011) so we entered the three DAS-21 subscales (depression, anxiety and stress) at the first level, the three TAS-20 subscales ('Difficulty identifying feelings', 'Difficulty describing feelings' and 'Externally orientated thinking') at the second level, the AMES scores at the third level and the AQ-10 at the fourth scale.

Full results of the hierarchical regression are given in Table S2. The regression revealed that including the DASS-21 subscales led to a model that significantly predicted CDS-29 scores, $R^2 = 0.518$, $F_{3,36} = 12.89$, $p < 0.001$. Examination of the coefficients showed that this effect was largely explained by the anxiety subscale which was the only significant predictor. The addition of the three TAS subscales significantly increased the predictive power of the

model, R^2 =.633, $F_{6,33}$ = 9.49, p < 0.001. However, none of the three additional predictors were significant on their own. The addition of the AMES subscales and AQ-10 measure did not significantly improve model fit further.

We also conducted a hierarchical regression analysis using the same predictors to examine whether individual differences in these measures predicted VRT self-bias, however this model was not significant at the first stage R^2 = 0.114, $F_{3,36}$ = 1.55, p = 0.219, and the addition of further methods did not significantly improve model fit.

Table S2. Summary of hierarchical regression analysis for DASS, TAS and AMES subscales and AQ predicting CDS-29 scores.

Variable	*β*	*p*	R^2	ΔR^2	ΔF	Δp
Step 1			0.518	0.518	120.99	<0.001
DASS_depression	−0.045	0.788				
DASS_anxiety	0.510	0.005				
DASS_stress	0.308	0.073				
Step 2			0.633	0.115	30.45	0.027
DASS_depression	−0.141	0.437				
DASS_anxiety	0.495	0.004				
DASS_stress	0.135	0.451				
TAS_DIF	0.207	0.222				
TAS_DDF	0.237	0.18				
TAS_EOT	0.055	0.648				
Step 3			0.644	0.11	0.3	0.822
DASS_depression	−0.137	0.476				
DASS_anxiety	0.515	0.005				
DASS_stress	0.157	0.402				
TAS_DIF	0.236	0.238				
TAS_DDF	0.207	0.272				
TAS_EOT	0.051	0.713				
AMES_cognitive empathy	−0.008	0.957				

AMES_affective empathy	−0.093	0.495				
AMES_sympathy	−0.05	0.740				
Step 4			0.662	0.18	10.56	0.222
DASS_depression	−0.049	0.808				
DASS_anxiety	0.453	0.015				
DASS_stress	0.141	0.450				
TAS_DIF	0.259	0.194				
TAS_DDF	0.106	0.599				
TAS_EOT	0.086	0.544				
AMES_cognitive empathy	0.066	0.684				
AMES_affective empathy	−0.129	0.35				
AMES_sympathy	−0.032	0.831				
AQ-10	0.184	0.222				

Attractiveness and Likability Ratings Predict VRT Effect for Other

To investigate the relationship between DPD scores and ratings of the other face's attractiveness, likability and trustworthiness we carried out three independent-sample *t*-tests with DP group as the independent variable and each rating as the dependent variable. We found no difference in ratings between the high (attractiveness: $M = 4.83$, SD = 1.79; likeability: $M = 6.06$, SD = 1.77; trustworthiness: $M = 6.11$, SD = 1.61) and low (attractiveness: $M = 5.23$, SD = 1.74; likeability: $M = 5.55$, SD = 1.77; trustworthiness: $M = 6.14$, SD = 1.52) groups for any of the three attributes [attractiveness: $t_{38} = -0.7$, $p = 0.487$; likeability: $t_{38} = 0.91$, $p = 0.369$; ball: $t_{38} = -0.05$, $p = 0.96$).

Finally, we examined how participant's ratings of the attractiveness, likeability and trustworthiness of the other's face affected VRT by conducting two regressions both with the three ratings as predictors. One regression used the VRT self-bias index as the dependent variable and the other used the Other VRT index. The self-bias VRT regression produced a non-significant model, $R^2 = 0.155$, $F_{3,36} = 2.2$, $p = 0.105$. However, the ratings did significantly predict the other face VRT index, $R^2 = 0.507$, $F_{3,36} = 4.14$, $p = 0.013$. Examination of

coefficients showed that this was driven by attractiveness significantly negatively predicting other VRT, $\beta = -0.606$, $t_{36} = -3.13$, $p = 0.003$ and likeability significantly positively predicting other VRT, $\beta = 0.557$, $t_{36} = 2.94$, $p = 0.006$.

Discussion

Relationship between DP, VRT and Other Individual Differences

In addition to investigating the relationship between DP and VRT self-bias we also investigated how much our other measures of individual difference, occurrence of depression, anxiety and stress, alexithymia, empathy and autistic traits modulated both the occurrence of depersonalisation and self-bias in VRT. The results of this regression confirmed previous findings by indicating a link between overall scores on the CDS-29 and both anxiety (Hunter *et al.*, 2003; Lemche *et al.*, 2013b) and alexithymia (Lemche *et al.*, 2013a; Majohr *et al.*, 2011). However, a subsequent analysis that examined the effect of those individual differences on VRT self-bias showed that none of them significantly predicted self-bias in the VRT task suggesting that the effects of ABE on VRT are due to specific disruptions related to bodily experiences rather than being a side effect of DPs relationship with other individual differences.

Relationship between VRT and Ratings of the Other Person

Our final analysis consisted of two regressions which investigated the relationship between participants' ratings of the other person's likeability, attractiveness and trustworthiness and their tendency to remap tactile sensations seen on the other's face. Note that these ratings did not differ between DP groups. The first regression examined the relationship between ratings and self-bias and failed to find any association, suggesting that opinions about the other did not play an important role in the tendency to remap tactile stimuli more to the self-face than the other-face. The second regression looked only at remapping towards the other and found

that VRT for the other was positively correlated with ratings of likeability but negatively correlated with ratings of attractiveness.

This finding may at first appear contradictory given the well-established relationship between attractiveness and likeability (Dion *et al.* 1972; Little *et al.*, 2011; Paunonen, 2006) and previous evidence for greater VRT effects for attractive faces (Noel *et al.*, 2014). Indeed, we found a strong correlation between ratings of liking and attractiveness in the current study. However, it is worth noting that Noel *et al.*'s study did not examine the relationship between participants' individual ratings of attractiveness and VRT but instead showed a difference between faces that had been manipulated to appear more or less attractive. It is possible that their results were driven largely by feelings of greater likability for the attractive faces rather than by attractiveness per se. It may be also that the negative relationship between VRT and attractiveness seen in the current is related to the fact that, in our study, the other-face was always the same gender as the participant while the faces in Noel's study were a mix of both same and other sex. Finally, the fact that the two attributes give significant results in opposite directions may simply be due to the strong correlation between them, although VIF factors for all three predictors were below 10. Further research is needed to determine the exact relationship between affiliation, attractiveness and mirroring phenomena such as the VRT.

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