Supplementary Materials

Methods

To examine the specificity of the present results at the brain level, we tested the proposed model with comparison brain regions. A test with nearby regions was conducted to assess whether adjacent brain areas show the same patterns of prediction (i.e., right frontal pole, left pars triangularis, left medial orbital frontal cortex [OFC]). A test with regions that perform similar roles in the context of the targeted processes (e.g., maintaining goal-relevant information, monitoring and assessing outcomes, reward and pleasure processing; right superior parietal cortex, left rostral anterior cingulate, left accumbens area) was conducted to assess whether the lateral prefrontal cortex (PFC) is of particular importance for the current findings. A test with bilateral middle frontal cortex (MFC), inferior frontal cortex (IFC), and OFC regions was conducted to see whether considering the regions bilaterally is more appropriate than the hypothesized lateralized regions of interest (ROIs). For the purpose of comparison at the personality level, we also tested the proposed model with neuroticism included as an additional personality trait in the *Resilience* factor. For comparison at the symptom level, we tested the proposed model with state anxiety. Finally, to confirm that our primary results were not influenced by our data screening procedure, we re-tested our primary path model with univariate statistical outliers included.

Structural MRI Data Acquisition and Preprocessing

Volume measures from additional ROIs were extracted using the parcellation from Desikan et al. (2006). Specifically, the right frontal pole, left pars triangularis, left medial OFC, right superior parietal cortex, left rostral anterior cingulate, and left accumbens area were

examined. Consistent with the primary analyses, brain region volumes were scaled to account for overall brain size differences.

Individual Differences Measures

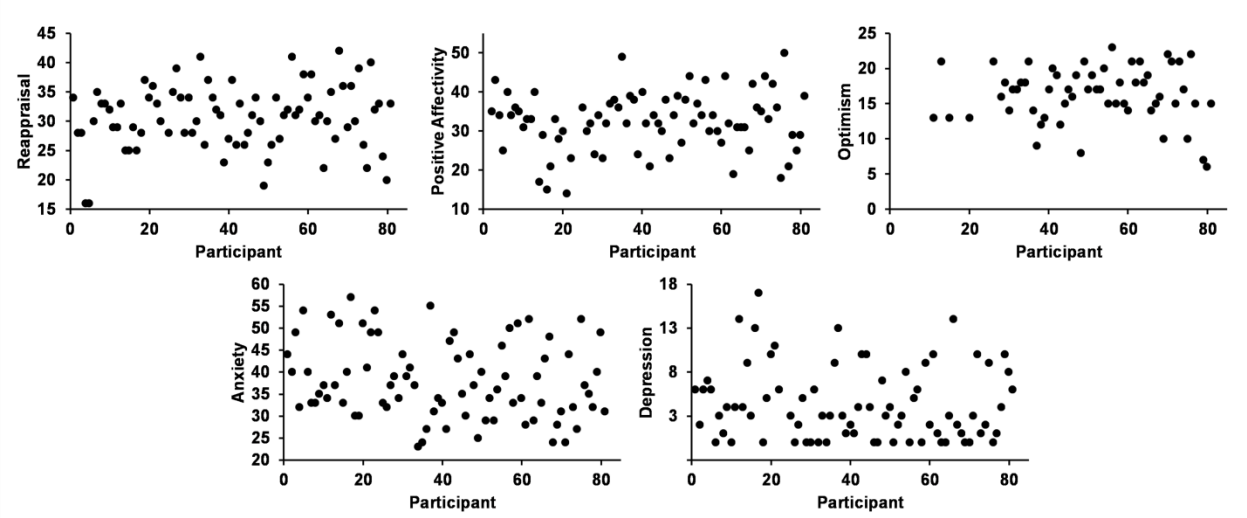
Neuroticism was measured with the Neuroticism-Extraversion-Openness Five-Factor Inventory neuroticism subscale (Costa & McCrae, 1992). The subscale consists of 12 statements, such as "I often feel tense and jittery". Participants rated how much they agreed with each statement, using a 1-5 Likert scale (1 = "strongly disagree or the statement is definitely false," 3 = "neutral or undecided or the statement is about equally true and false," 5 = "strongly agree or the statement is definitely true"). The ratings were summed to obtain a score for each participant. Higher scores were taken to indicate higher level of neuroticism. Cronbach's alpha for neuroticism was .82 in this sample (extraversion Cronbach's alpha = .84; openness Cronbach's alpha = .71; agreeableness Cronbach's alpha = .77; conscientiousness Cronbach's alpha = .86; n = 81).

The State-Trait Anxiety Inventory (STAI) provides measures of the temporary condition of "state anxiety" and the more general and long-standing quality of "trait anxiety" (Spielberger, Gorsuch, & Lushene, 1970). The total state anxiety measure was used for additional comparison with the analyses targeting trait anxiety. Cronbach's alpha was .89 in this sample (n = 81).

Analytic Overview

Data for the targeted brain regions, traits, and symptoms, as well as comparison brain regions, neuroticism, and state anxiety were assessed for potential outlier cases at a univariate level using a criterion of 3 *SD*s (Osborne & Overbay, 2004). Besides the cases identified in the primary analyses, one participant was identified because of an outlier scaled ROI volume (left pars triangularis). Hence, analyses relating to the targeted variables excluded the identified

outliers for the targeted brain regions, traits, and symptoms, while comparison analyses excluded the outlier cases for the relevant brain regions, traits, and symptoms. Supplementary Materials Figure 1 displays the questionnaire data targeted for primary analyses after outlier removal.



Supplementary Materials Figure 1. Scatterplots of the variables included for the latent construct of *Resilience*, and the symptoms of *Anxiety* and *Depression*. Scatterplots depict the distributions after outlier removal.

Correlation analyses were carried out to examine bivariate associations among the variables of interest and with the control variable of age. Since some variables had fewer observations than others, correlations were assessed using pairwise deletion for missing observations. Correlation results are described using two-sided significance tests unless otherwise specified. Path analyses were conducted consistent with procedures described for the primary analyses.

Results

Analyses were conducted on brain, personality, and symptom measures first using bivariate correlations and then using the hypothetical structural equation model. The structural equation model included confirmatory factor analysis of the manifest brain and personality variables into latent variable constructs, which then were tested for predicted associations among

each other and anxiety and depression measures using regression and mediation analyses. As expected, the intercorrelations of the variables of interest showed that the scaled PFC volume measures were positively associated with each other, the *Resilience* personality traits were positively associated with each other, and the *Distress* symptoms were also positively associated with each other. Supplementary Materials Table 1 shows the intercorrelations between the variables considered in the primary analyses. At a bivariate level, right MFC volume was positively associated with optimism, marginally positively associated with reappraisal (p = .032 one-tailed), and marginally negatively associated with *Anxiety* (p = .026 one-tailed). Left IFC volume was negatively associated with *Anxiety*. Left OFC volume was positively associated with optimism, and negatively associated with *Anxiety*. *Anxiety* was negatively associated with positive affectivity and optimism, and marginally negatively associated with reappraisal (p = .031 one-tailed). *Depression* was negatively associated with positive affectivity and optimism. Age was not significantly associated with any of the variables of interest (ps > .13).

Supplementary Materials Table 1. *Means, standard deviations, and correlations.*

Variable	*n*	*M*	*SD*	1	2	3	4	5	6	7	8
1. Age		23.40	3.98								
n	81										
2. Right MFC		181.36	27.62	-.00							
n	81			81							
3. Left IFC		41.59	8.73	.10	.53**						
n	81			81	81						
4. Left OFC		59.04	8.27	-.04	.75**	.60**					
n	81			81	81	81					
5. Reappraisal		30.66	5.48	-.17	.21	.12	.14				
n	80			80	80	80	80				
6. Positive Affectivity		32.36	7.52	.09	.11	.15	.15	.33**			
n	78			78	78	78	78	78			
7. Optimism		16.29	3.92	.06	.27*	.13	.26*	.31*	.37**		
n	58			58	58	58	58	58	58		
8. Anxiety		38.09	8.72	-.05	-.22	-.23*	-.26*	-.21	-.42**	-.42**	
n	81			81	81	81	81	80	78	58	
9. Depression		4.35	4.17	.03	-.08	-.12	-.13	-.11	-.28*	-.46**	.53**
n	79			79	79	79	79	79	78	58	79

Notes: * indicates $p < .05$; ** indicates $p < .01$. *N*, *M*, and *SD* are used to represent sub-sample size, mean, and standard deviation, respectively.

To check for sex differences in the variables of interest, independent sample *t* tests were performed. There were no significant differences between females and males for age, scaled PFC volumes, reappraisal, positive affectivity, or *Anxiety* (*p*s > .406). Results showed that females had greater trait optimism (M = 17.14, SD = 3.39, n = 36) compared to males (M = 14.91, SD = 4.39, n = 22; t[36.24] = 2.04, p = .049), and lower *Depression* (M = 3.38, SD = 3.48, n = 45) compared to males (M = 5.65, SD = 4.68, n = 34; t[58.62] = -2.37, p = .021). To control for the possible influences of sex and age on the variables of interest, these variables were included within the following path model analyses as variables of no interest.

Within the overall model, the comparison regions fit into common latent variables, but they did not appear to predict *Resilience* or indirectly predict *Anxiety* symptoms as well as the featured model. Specifically, when testing the regions selected based on nearby proximity, the overall model had reasonable fit, $\chi^2(22) = 30.04$, *ns*, $\chi^2/df = 1.37$, CFI = .94, RMSEA = .07, but the mediation did not show a significant indirect association between *Control* and *Anxiety* (a = .33, p = .062; b = -.66, p = .005; c = -.32, p = .008; c' = -.10, p = .411; ab = -.22, p = .060). Similarly, when testing the regions selected based on similar roles, the overall model had good fit, $\chi^2(22) = 18.66$, *ns*, $\chi^2/df = .85$, CFI = 1.00, RMSEA = .00, but the latent variable of scaled brain volumes did not significantly predict *Resilience* or indirectly predict *Anxiety* (a = .36, p = .057; b = -.71, p = .004; c = -.21, p = .101; c' = .05, p = .721; ab = -.26, p = .063). Testing the model with both left and right hemispheres of the MFC, IFC, and OFC showed similar but not increased significance of results. The overall model showed good fit, $\chi^2(46) = 36.43$, *ns*, χ^2/df = .79, CFI = 1.00, RMSEA = .00, but the mediation did not improve in terms of predicting *Anxiety* (a = .35, p = .050; b = -.66, p = .010; c = -.29, p = .011; c' = -.06, p = .649; ab = -.23, p = .047). Together, these results are consistent with the idea that the right MFC, left IFC, and left OFC are

particularly important in predicting *Resilience* and indirectly predicting *Anxiety* through *Resilience*, but also suggest that the homologous regions and regions that play similar roles may help in similar ways that are not captured in the present model.

Similarly, we tested our model with the addition of neuroticism in the manifest variables associated with *Resilience*. This model showed fit indices similar to our featured model, $\chi^2(30) = 35.90$, *ns*, $\chi^2/df = 1.20$, CFI = .97, RMSEA = .05, however the path from *Control* to *Resilience* became marginal (a = .40, $p = .073$; b = -.94, $p = .031$; c = -.29, $p = .012$; c' = .09, $p = .440$; ab = -.38, $p = .011$), suggesting that neuroticism did not improve this leg of the path model. The test of the primary model with STAI-state as the symptom measure showed that the mediation did not significantly predict this measure, ($\chi^2[22] = 24.17$, *ns*, $\chi^2/df = 1.10$, CFI = .98, RMSEA = .04; a = .33, $p = .061$; b = -.66, $p = .006$; c = -.10, $p = .370$; c' = .11, $p = .377$; ab = -.22, $p = .060$). Together, these results support the idea that the right MFC, left IFC, and left OFC are particularly relevant brain regions for *Control* of emotion, and that reappraisal, positive affectivity, and optimism are particularly relevant for *Resilience*. These results are also consistent with the idea that the current model captures more enduring aspects of symptom expression than state-like measures.

Consistent with the primary analyses, the results of the featured model when tested with univariate statistical outliers included showed the same pattern of associations for *Anxiety*. Specifically, the overall model had good fit, $\chi^2(22) = 24.83$, *ns*, $\chi^2/df = 1.13$, CFI = .98, RMSEA = .04, and the mediation significantly predicted *Anxiety* (a = .42, $p = .011$; b = -.75, $p = .001$; c = -.35, $p = .002$; c' = -.03, $p = .803$; ab = -.31, $p = .012$). Interestingly, when tested for *Depression* with outliers included, the mediation for *Depression* appeared to go from marginal to significant ($\chi^2[22] = 24.39$, *ns*, $\chi^2/df = 1.11$, CFI = .99, RMSEA = .04; a = .37, $p = .018$; b = -.65, $p = .002$; c

= -.13, p = .228; c' = .11, p = .360; ab = -.24, p = .017). We are cautious in interpreting this result as it appears to possibly be driven by particular outlier cases such as one participant that was a statistical outlier on multiple questionnaire measures, including *Depression*. This might indicate that this person did not complete the measures accurately, or is potentially outside the spectrum of "typical" healthy individual differences. With this in mind, we focus on the more conservative set of results without these cases.

References

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