Supplemental Information for:

Attention Bias in Rumination and Depression: Cognitive Mechanisms and Brain Networks

Roselinde H. Kaiser[1]*, Hannah R. Snyder[2], Franziska Goer[3], Rachel Clegg[3], Manon Ironside[3], and Diego A. Pizzagalli[3,4,5]

[1]Department of Psychology, University of California Los Angeles

[2]Department of Psychology, Brandeis University

[3]Center for Depression, Anxiety and Stress Research, McLean Hospital

[4]Mclean Imaging Center, McLean Hospital, Belmont, MA, USA

[5]Department of Psychiatry, Harvard Medical School

*Corresponding author:
Roselinde Kaiser, Ph.D.
Research on Affective Disorders and Development (RADD) Lab
Department of Psychology
University of California Los Angeles
1285 Franz Hall
502 Portola Plaza, Los Angeles, CA 90095
rhkaiser@psych.ucla.edu

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Supplemental Method

Participants

Experimental sample. The experimental sample was drawn from a larger, ongoing study with distinct, non-overlapping experimental objectives and analyses that will be reported elsewhere. One goal of that ongoing study is to investigate the effects of a low-dose dopamine agonist on reward sensitivity, therefore half of the participants in the present sample (MDD group 50%; HC group 55%) received the drug amisulpride prior to the MRI scan, while the other half received placebo. An unblinded researcher performed analyses to confirm that the pharmacological manipulation was balanced across clinical groups and unrelated to experimental variables. Therefore, only procedures that are relevant to the goals of the present study are reported here.

Replication sample. The Self-referential Information Processing (SIP) task, self-descriptiveness judgment version (SIP-SJ), was piloted in an independent community sample recruited in Boulder, Colorado. The pilot sample included 24 women ages 19-50 (mean age = 26.96, SD=9.15), four of whom met full criteria for current major depression (MDD) and twenty of whom did not report any current psychiatric illnesses (healthy control, HC). Other inclusion/exclusion criteria were the same as for the experimental sample, with the exception of criteria related to neuroimaging safety (which were not exclusionary for the pilot study). Study procedures were approved by the University of Colorado Boulder Institutional Review Board, and were conducted in accordance with the provisions of the World Medical Association Declaration of Helsinki, and participants provided informed consent. To examine whether task effects replicate across the pilot and the experimental samples, we performed analyses in the pilot sample and report results below. Of note, eight (HC) participants were unable to provide

words in each category (e.g., either reported all positive words to be self-descriptive or all negative words to be non-self-descriptive) and therefore were removed from task analyses, yielding a final pilot sample of (n=16).

Measures

Self-referential information processing.

Individualized word stimuli. As reported in the main text, experimental participants were presented serially with 320 positive and negative adjectives drawn from the Dumas word list (Dumas, Johnson, & Lynch, 2002) and rated each word on a 0 (not at all self-descriptive) to 9 (highly self-descriptive) scale. The chief goal of collecting ratings of self-descriptiveness was to support the creation of participant-specific word stimuli for use in the subsequent self-referential information processing task. The individualized word stimuli included 96 positive and negative adjectives balanced as closely as possible on self-descriptiveness, i.e., self-descriptive positive words (Self-Descriptive Positive), self-descriptive negative words (Self-Descriptive Negative), non-self-descriptive positive words (Non-Self-Descriptive Positive), and non-self-descriptive negative words (Non-Self-Descriptive Negative). In the experimental sample described in the main text, three (HC) participants were unable to provide words in each of these categories, and were removed from analyses. In the remaining (n=50) sample, words in each category were obtained for each participant (average number of words in each stimulus category, Self-Descriptive Positive = 26.26, SD = 5.60; Self-Descriptive Negative = 22.12, SD=4.22, Non-Self-Descriptive Positive = 20.79, Non-Self-Descriptive Negative = 25.09, SD=4.34). Of note, compared with healthy control (HC) participants, individuals with major depressive disorder (MDD) rated self-descriptive negative words to be somewhat more strongly self-descriptive, and rated non-self-descriptive positive words to be less self-descriptive, *p*s<0.05 (Fig S1). Therefore,

all experimental analyses were repeated controlling for dimensional ratings of self-descriptiveness; the addition of such covariates did not alter the pattern or significance of effects (all *p*s<0.05 remained <0.05). However, future studies that use a larger set of word stimuli selected along a continuum of self-descriptiveness will have better power for detecting dimensional effects of word self-descriptiveness.

Individualized image stimuli. As reported in the main text, the experiment included a comparison between two image conditions: images of the participant (Own) and images of a gender- and race-matched person (Other). Results indicated that participants were faster to judge the emotional or self-descriptive quality of words in the Own condition relative to the Other condition, and this effect was amplified for self-descriptive positive words. The effect of image type was interpreted as an orienting bias towards self-referential images. However, it could also be argued that such effects are related to orienting away from the Other condition. To explore this possibility, we piloted a third image condition consisting of Gaussian-blurred pictures of a (new) gender- and race-matched other person (Blur condition, Fig S9) and we repeated experimental analyses comparing the self-referential (Own) image condition with a Gaussian-blurred image condition (Blur).

Analyses

Three categories of supplemental analyses are reported below. First, we report on exploratory (M)ANOVA that test for task condition effects, or depression and trait brooding rumination effects, on response accuracy (proportion of words accurately judged to be self-descriptive or non-self-descriptive, or positive or negative). These analyses are preceded by a data quality summary. Second, we report on analyses designed to provide additional checks of the specificity of experimental effects. This includes (M)ANOVA examining response speed

when judging words (on emotional valence or self-descriptive content) that are accompanied by an alternative control image condition (Gaussian blurred images). This also includes (M)ANOVAs examining individual differences in reflective or depressive rumination, instead of brooding rumination. Third, we report on analyses aimed at replication. This includes a (M)ANOVA in an independent sample to replicate task effects.

Supplemental Results

Data Quality Assurance

Analyses were performed to confirm that behavioral data from the SIP task met the criteria for normal distribution of data that is necessary for group-level analysis. Specifically, we calculated skewness and kurtosis for the distributions of (log-transformed) reaction time, and (arcsine-transformed) proportion judgements (Table S2). These checks showed that the distribution of log-transformed RT data for both versions of the SIP was acceptable according to standard guidelines (Field, 2013; Judd, McClelland, & Ryan, 2009). Arcsine-transformed proportion data had elevated skew and kurtosis in a number of conditions in both the SIP-EJ and SIP-SJ, supporting our analytic focus on reaction time data.

Exploratory Analysis of Proportion Response Data (Accuracy)

Response accuracy was calculated for each task condition (positive vs. negative word, self-descriptive vs. non-self-descriptive word, own vs. other image). Accuracy for valence judgements was based on the correspondence between participant responses and *a priori* ratings of valence; accuracy for self-descriptiveness judgements was based on the correspondence between participant responses and the participant's previous ratings of self-descriptiveness. For the SIP-EJ, proportion of words reported as positive were calculated for each condition (thus, scores closer to 1 for positive word conditions, or scores closer to 0 for negative word conditions,

were most accurate). For the SIP-SJ, proportion of words reported as self-descriptive were calculated for each condition (thus, scores closer to 1 for self-descriptive conditions, or scores closer to 0 for non-self-descriptive conditions, were most accurate). Proportion estimates were arcsine transformed, to reduce the skew common to proportion estimate data; however, as noted above, distributions for several conditions remained non-normal to an extent that may violate statistical assumptions. Therefore, these analyses are considered exploratory. Separate (M)ANOVAs were performed for each task goal condition (SIP-SJ versus SIP-EJ), in consideration of differences in skew for particular categories of stimuli across conditions.

Emotion judgment task accuracy. A 2 (image type: Own, Other) x 2 (word self-descriptiveness: Self-Descriptive, Non-Self-Descriptive) x 2 (word valence: Positive, Negative) (M)ANOVA was performed on accuracy for emotional valence of words. As expected, there was a significant main effect of word valence on the proportion of words judged positive, $F(1,48)=1917.53$, $p<0.001$, $\eta^2=.98$, but there was also a main effect of word self-descriptiveness, $F(1,48)=58.28$, $p<0.001$, $\eta^2=0.55$, and an interaction between word valence and word self-descriptiveness, $F(1,48)=34.13$, $p<0.001$, $\eta^2=0.42$, in which the self-descriptiveness of words improved accuracy for positive words, and interfered with accuracy for negative words.

Self-descriptiveness task accuracy. In a 2 (image type: Own, Other) x 2 (word self-descriptiveness: Self-Descriptive, Non-Self-Descriptive) x 2 (word valence: Positive, Negative) (M)ANOVA, there was an expected main effect of word self-descriptiveness on the proportion of words judged to be self-descriptive, $F(1,49)=221.40$, $p<0.001$, $\eta^2=0.82$, but also significant main effects of word valence, $F(1,49)=47.04$, $p<0.001$, $\eta^2=.49$, and an interaction between these variables, $F(1,49)=11.54$, $p=0.001$, $\eta^2=0.19$; positive valence tended to improve accuracy for self-descriptive words, and interfere with accuracy for non-self-descriptive words, whereas

negative valence had the converse effect. In addition, there was a main effect of image type on proportion of words endorsed, $F(1,49)=5.83$, $p=0.019$, $\eta^2=0.11$, in which participants were more likely to report words as self-descriptive when their own image was displayed in the background.

Depression, trait brooding, and emotion task accuracy. The 2x2x2 (M)ANOVA investigating valence judgments on the SIP-EJ was also repeated with clinical group (MDD = +1, HC = -1) and trait brooding (z-transformed RRS-B) as between-subjects variables. This analysis revealed a moderating influence of depression on the main effect of word self-descriptiveness, $F(1,46)=9.15$, $p<0.01$, $\eta^2=0.17$, and the interaction between word self-descriptiveness and valence, $F(1,46)=7.47$, $p=0.01$, $\eta^2=0.14$, driven by lower accuracy among depressed participants in judging the valence of positive self-descriptive words, but higher accuracy in judging the valence of positive non-self-descriptive words. There were no main or moderated effects of trait brooding, or brooding by depression interactions, on accuracy when judging emotional valence of words.

Depression and self-descriptiveness task accuracy. The 2x2x2 (M)ANOVA investigating self-descriptiveness judgments on the SIP-SJ was also repeated with clinical group (MDD = +1, HC = -1) and trait brooding (z-transformed RRS-B) as between-subjects variables. As above, depression moderated the main effect of word self-descriptiveness, $F(1,47)=7.10$, $p=0.01$, $\eta^2=0.13$, and the interaction between word self-descriptiveness and valence, $F(1,47)=4.66$, $p=0.04$, $\eta^2=0.09$. Depressed participants were more accurate than healthy participants in judging negative self-descriptive words as being self-descriptive, but less accurate in judging positive self-descriptive words as self-descriptive. There were no main or moderated effects of trait brooding, or brooding by depression interactions, on accuracy when judging self-descriptiveness of words.

Experimental Check: Gaussian-blurred Image Condition

As in original analyses, a (M)ANOVA revealed that participants were faster to respond to words presented with Own compared with Blur images, although the effect was weaker, $F(1,48)=2.39$, $p=0.12$, $\eta^2=0.05$. Also as in original analyses, the facilitating effect of Own image was stronger for positive than for negative words, $F(1,48)=11.02$, $p<0.01$, $\eta^2=0.19$, and for self-descriptive than for non-self-descriptive words, $F(1,48)=19.4$, $p<0.01$, $\eta^2=0.29$.

Clinical depression (MDD = +1, HC = -1), brooding (z-transformed RRS-B), and their interaction were added to the (M)ANOVA. As in original analyses, there was a moderating influence of ruminative depression on word and image effects, $F(1,45)=6.89$, $p=0.01$, $\eta^2_p=0.13$, that was driven by an association within the depressed group between brooding and response speed to negative, self-descriptive words accompanied by the participant's own image $F(1,28)=2.71$, $p=0.10$, $\eta^2_p=0.09$. Overall, all main and interactive results comparing Own with Blur images were similar to those reported in the main text comparing Own with Other images (change in p values less than 0.05, all effects remain significant or trending). Together, these manipulation checks support the interpretation that self-referential images bias information processing, and that this effect is moderated by the ruminative phenotype of depression.

Experimental Check: Reflective Rumination or Depression Subscales of the RRS

In the present study, we used the Brooding subscale of the Ruminative Responses Scale (RRS-B) as our primary measure of ruminative depression. The decision to focus on the Brooding subscale was motivated by prior research indicating that this scale captures the tendency towards maladaptive negative, repetitive thinking that is distinct from depressive symptoms (overlapping with the Depression subscale of the RRS, RRS-D) or adaptive forms of introspection (captured in the Reflection subscale of the RRS, RRS-R) (Treynor, Gonzalez, &

Nolen-Hoeksema, 2003). However, it should be noted that in our experimental sample, all three subscales of the RRS were highly correlated with one another both across the full sample (between RRS-B and RRS-R, r(49)=0.76, p<0.01; between RRS-B and RRS-D, r(49)=0.86, p<0.01; between RRS-R and RRS-D, r(49)=0.72, p<0.01) and within the depressed group (between RRS-B and RRS-R, r(30)=0.79, p<0.01; between RRS-B and RRS-D, r(30)=0.80, p<0.01; between RRS-R and RRS-D, r(30)=0.72, p<0.01). Therefore, analyses examining specificity of task effects to trait brooding versus other forms of introspection are underpowered. Nonetheless, we performed exploratory analyses to examine whether observed effects of trait brooding on response speed would also emerge with other RRS subscales.

Results of a 2 (task condition: Emotion Judgement, Self Judgement) x 2 (image type: Own, Other) x 2 (word self-descriptiveness: Self-Descriptive, Non-Self-Descriptive) x 2 (word valence: Positive, Negative) (M)ANOVA, with clinical depression (MDD = +1, HC = -1) and trait reflection (z-transformed RRS-R) as group-level variables, showed that higher RRS-R scores were significantly related to faster response speed for self-descriptive as compared with non-self-descriptive words, F(1,46)=6.79, p=0.01, η^2_p=0.13. This pattern is similar to results reported in the main text, in analyses with RRS-B as the measure of trait introspection. However, there was no interaction between trait reflection (RRS-R) and clinical depression in predicting attention biases (ps>0.10), which is in contrast to analyses focused on brooding.

Finally, the same (M)ANOVA was performed with the depressive symptoms subscale of the RRS (z-transformed RRS-D) as a group-level variable, together with clinical depression (MDD = +1, HC = -1) and the interaction of these variables. No moderating effects of depressive symptoms, or interactions between symptoms and group status, were detected (ps>0.10);

however, it must be noted that the variables of RRS-D and group (MDD vs. HC) were highly covarying in this analysis.

Together, these exploratory findings suggest that attention biases towards self-descriptive material may be common across adaptive and maladaptive forms of introspection, but attention biases towards self-descriptive material that is negative and accompanied by self-referential images are related to maladaptive brooding but not to other forms of introspection. However, given the high covariance among RRS subscales in this sample, it will be important to explore these questions in future studies designed to disentangle various facets of trait rumination.

Replication of Experimental Findings

Replication of task effects. The Self-referential Information Processing task, self-judgement version (SIP-SJ), was administered to an independent sample with similar demographic characteristics as the experimental sample. Relevant to the present study was the question of whether attention biases observed in the experimental sample were consistent with effects observed in the replication sample. Therefore, a 2 (image type: Own, Other) x 2 (word self-descriptiveness: Self-Descriptive, Non-Self-Descriptive) x 2 (word valence: Positive, Negative) (M)ANOVA was performed on reaction time data. As in the experimental sample, in the pilot sample there was a significant main effect of image type, $F(1,15)=20.22$, $p<0.01$, $\eta^2=0.57$, in which participants were faster to respond when images of themselves were displayed in the background (Fig S10). There was no main effect of word self-descriptiveness in the pilot sample, $p>0.10$, but there was a replication of the interaction between self-descriptiveness and word valence, $F(1,15)=11.49$, $p<0.01$, $\eta^2=0.43$; once again, participants were faster to respond to positive self-descriptive words and slower to respond to negative self-descriptive words.

Supplemental Table S1. Demographics and Clinical Characteristics.

Demographics	HC (n=22)	MDD (n=31)
Age (M (SD))	26.36 (6.07)	27.68 (6.38)
Years Education (M (SD))	14.79 (4.65)	15.86 (2.32)
Race (% White)	68%	55%
Ethnicity (% Hispanic)	14%	19%
Clinical History		
Current MDD	0%	100%
Lifetime MDD	0%	100%
Current Anxiety Disorder	0%	32%
Lifetime Anxiety Disorder	0%	39%
Current Substance Use Disorder	0%	0%
Lifetime Substance Use Disorder	0%	17%
Current Eating Disorder	0%	0%
Lifetime Eating Disorder	0%	3%

Note: The full sample included n=53 participants, in either the healthy control (HC) or major depressive disorder (MDD) groups. However, (n=3) participants in the HC group were unable to provide word stimuli necessary for the self-referential information processing task, and therefore were not included in analyses. Demographic characteristics of the HC group were not significantly altered by the omission of these (n=3) participants.

Supplemental Table S2. Data Quality Assurance for Self-referential Information Processing Task

			raw mean	transformed mean	transformed SD	skew	Kurtosis
Self-Judgment Task							
Reaction Time			**(ms)**	**(ln ms)**			
Self-Desc	Other	Neg	974	6.881	0.178	-0.038	-0.283
Self-Desc	Other	Pos	939	6.845	0.185	0.100	0.772
Self-Desc	Own	Neg	954	6.861	0.167	-0.210	-0.218
Self-Desc	Own	Pos	889	6.790	0.182	0.103	1.903
Non-Self-Desc	Other	Neg	960	6.867	0.201	0.320	0.206
Non-Self-Desc	Other	Pos	980	6.888	0.182	0.210	0.765
Non-Self-Desc	Own	Neg	946	6.853	0.189	0.458	0.991
Non-Self-Desc	Own	Pos	969	6.877	0.188	-0.131	0.616
Proportion Judged Self-Descriptive			**(proportion)**	**(arcsine)**			
Self-Desc	Other	Neg	0.612	0.745	0.454	-0.060	-1.140
Self-Desc	Other	Pos	0.890	1.179	0.282	-0.544	1.070
Self-Desc	Own	Neg	0.643	0.802	0.470	0.053	-1.130
Self-Desc	Own	Pos	0.903	1.216	0.281	-0.491	0.735
Non-Self-Desc	Other	Neg	0.071	0.072	0.093	2.084	5.404
Non-Self-Desc	Other	Pos	0.304	0.324	0.267	1.167	1.295
Non-Self-Desc	Own	Neg	0.089	0.090	0.104	2.004	5.651
Non-Self-Desc	Own	Pos	0.301	0.332	0.328	1.629	3.194
Emotion-Judgment Task							
Reaction Time			**(ms)**	**(ln ms)**			
Self-Desc	Other	Neg	860	6.757	0.200	0.196	-0.486
Self-Desc	Other	Pos	821	6.710	0.183	0.175	-0.514
Self-Desc	Own	Neg	848	6.743	0.179	0.201	-0.683
Self-Desc	Own	Pos	783	6.663	0.171	0.109	-0.633
Non-Self-Desc	Other	Neg	834	6.727	0.183	0.327	-0.339
Non-Self-Desc	Other	Pos	858	6.754	0.203	0.179	-0.787
Non-Self-Desc	Own	Neg	818	6.706	0.177	0.245	-0.777
Non-Self-Desc	Own	Pos	839	6.733	0.210	0.070	-0.999
Proportion Judged Positive			**(proportion)**	**(arcsine)**			
Self-Desc	Other	Neg	0.068	0.068	0.070	0.859	-0.250
Self-Desc	Other	Pos	0.950	1.326	0.210	-0.413	-0.077
Self-Desc	Own	Neg	0.067	0.067	0.070	1.260	1.591
Self-Desc	Own	Pos	0.947	1.351	0.250	-1.161	1.746
Non-Self-Desc	Other	Neg	0.022	0.022	0.033	1.376	1.062
Non-Self-Desc	Other	Pos	0.842	1.053	0.251	0.152	0.108
Non-Self-Desc	Own	Neg	0.028	0.028	0.035	1.136	0.638
Non-Self-Desc	Own	Pos	0.832	1.041	0.274	-0.018	0.603

Note: SD= standard deviation, ms = millisecond reaction time, ln ms = natural log-transformed millisecond reaction time, proportion = proportion judged (positive, or self-descriptive), arcsine = arcsine-transformed proportion judged (positive, or self-descriptive). Analyses were performed on transformed data; skew and kurtosis were calculated, and reported here, on transformed data.

Supplemental Figures

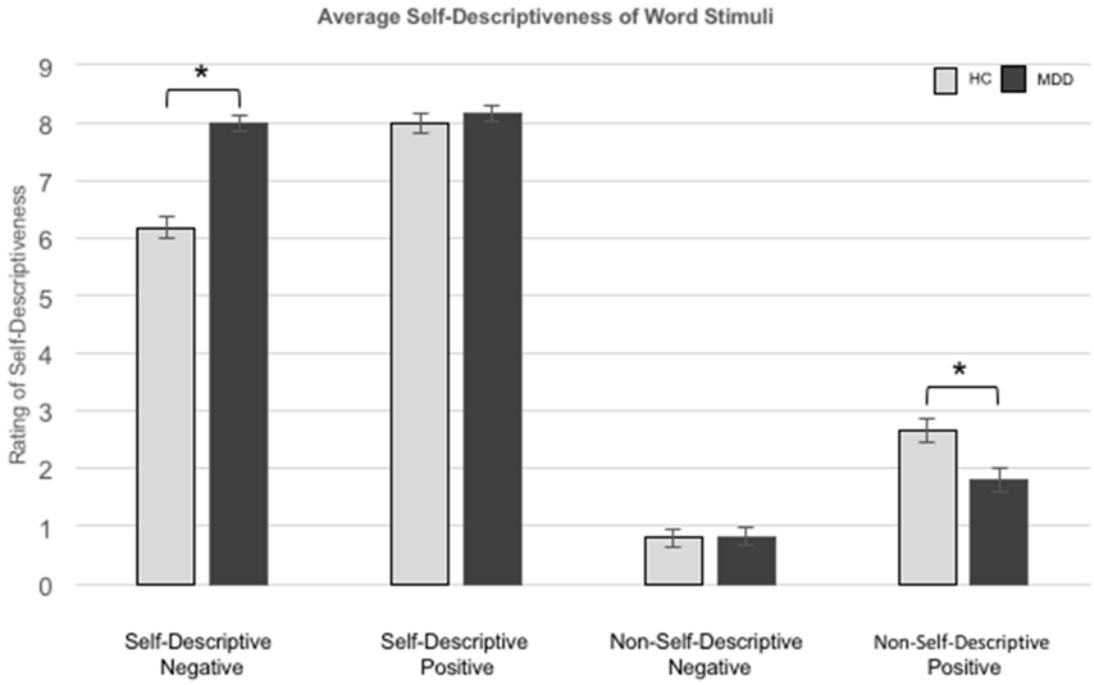

Figure S1. Average Self-descriptiveness of Word Stimuli in the Self-referential Information Processing Task. To create participant-specific word stimuli for use in the subsequent Self-referential Information Processing task, at the first research session participants were presented serially with 320 positive and negative adjectives drawn from the Dumas word list (Dumas, Johnson, & Lynch, 2002) and rated each word on a 0 (not at all self-descriptive) to 9 (highly self-descriptive) scale. Next, for each participant a subset of 96 positive and negative adjectives was extracted on the basis of their highest and lowest ratings of self-descriptiveness, balanced across emotional valence, i.e., self-descriptive positive words (Self-Descriptive Positive), self-descriptive negative words (Self-Descriptive Negative), non-self-descriptive positive words (Non-Self-Descriptive Positive), and non-self-descriptive negative words (Non-Self-Descriptive Negative). Compared with healthy control (HC) participants, individuals with major depressive disorder (MDD) rated self-descriptive negative words to be somewhat more strongly self-

descriptive, and rated non-self-descriptive positive words to be less self-descriptive, *p*s<0.05. Therefore, all experimental analyses were repeated controlling for dimensional ratings of self-descriptiveness; the addition of such covariates did not alter the pattern or significance of effects (all *p*s<0.05 remained <0.05), but future studies that examine dimensional effects of self-descriptiveness may provide additional insight. *Note:* Significant group differences, **p*<0.05, $^{(*)}p$<0.10.

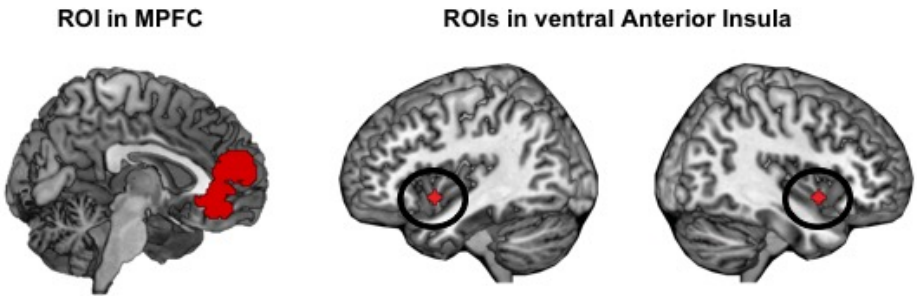

Figure S2. Regions of Interest (ROIs) for Static and Dynamic Resting-State Functional Connectivity Analysis (RSFC). Frontoinsular ROIs included medial prefrontal cortex (MPFC, cluster defined by meta-analysis of default network RSFC abnormalities in depression, (Kaiser, Andrews-Hanna, Wager, & Pizzagalli, 2015)), and left and right anterior insula (AI, 4mm-radius spherical ROIs at +/- 34, 8, -8, defined by meta-analysis of insular RSFC and implicated in emotion processing and psychopathology (Chang, Yarkoni, Khaw, & Sanfey, 2013)).

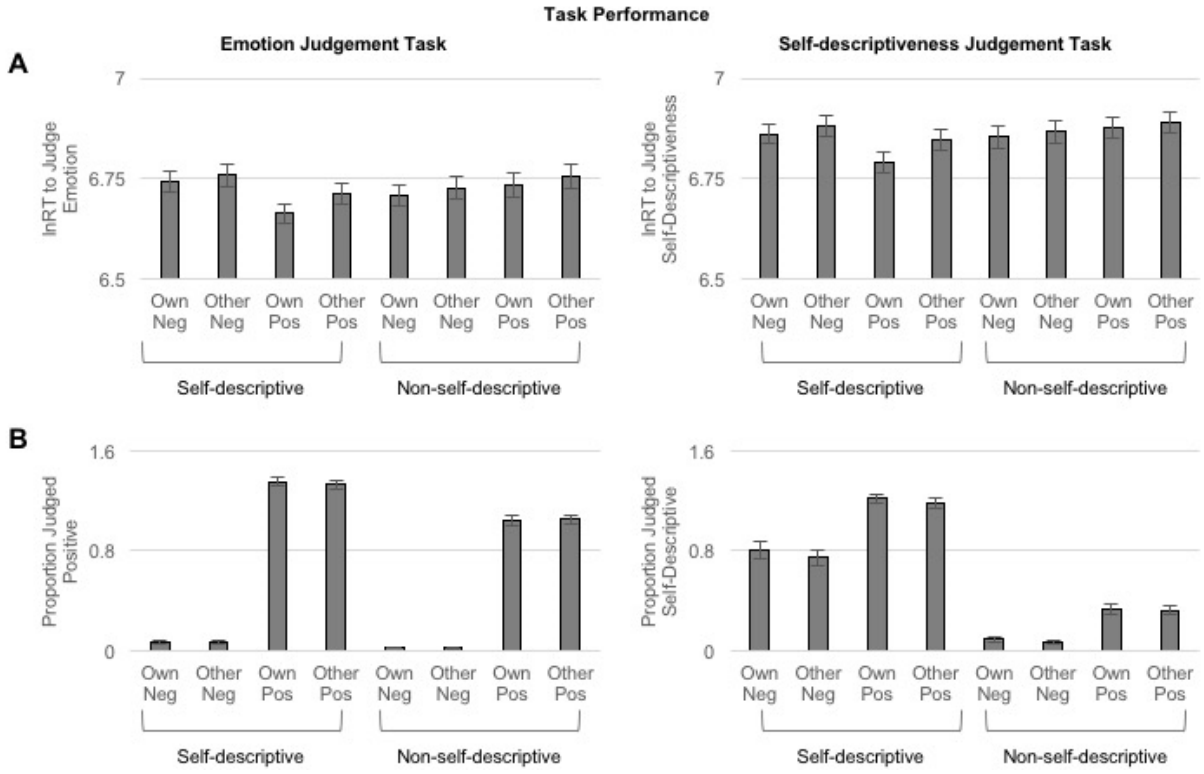

Figure S3. Reaction Time (RT) and Responses on the Self-referential Information Processing Task. Displayed are **(A)** average natural-log transformed RTs for each trial type, and **(B)** average arcsine-transformed proportion of words judged to be positive (in the Emotion Judgement condition) or judged to be self-descriptive (in the Self-descriptiveness Judgement Condition).

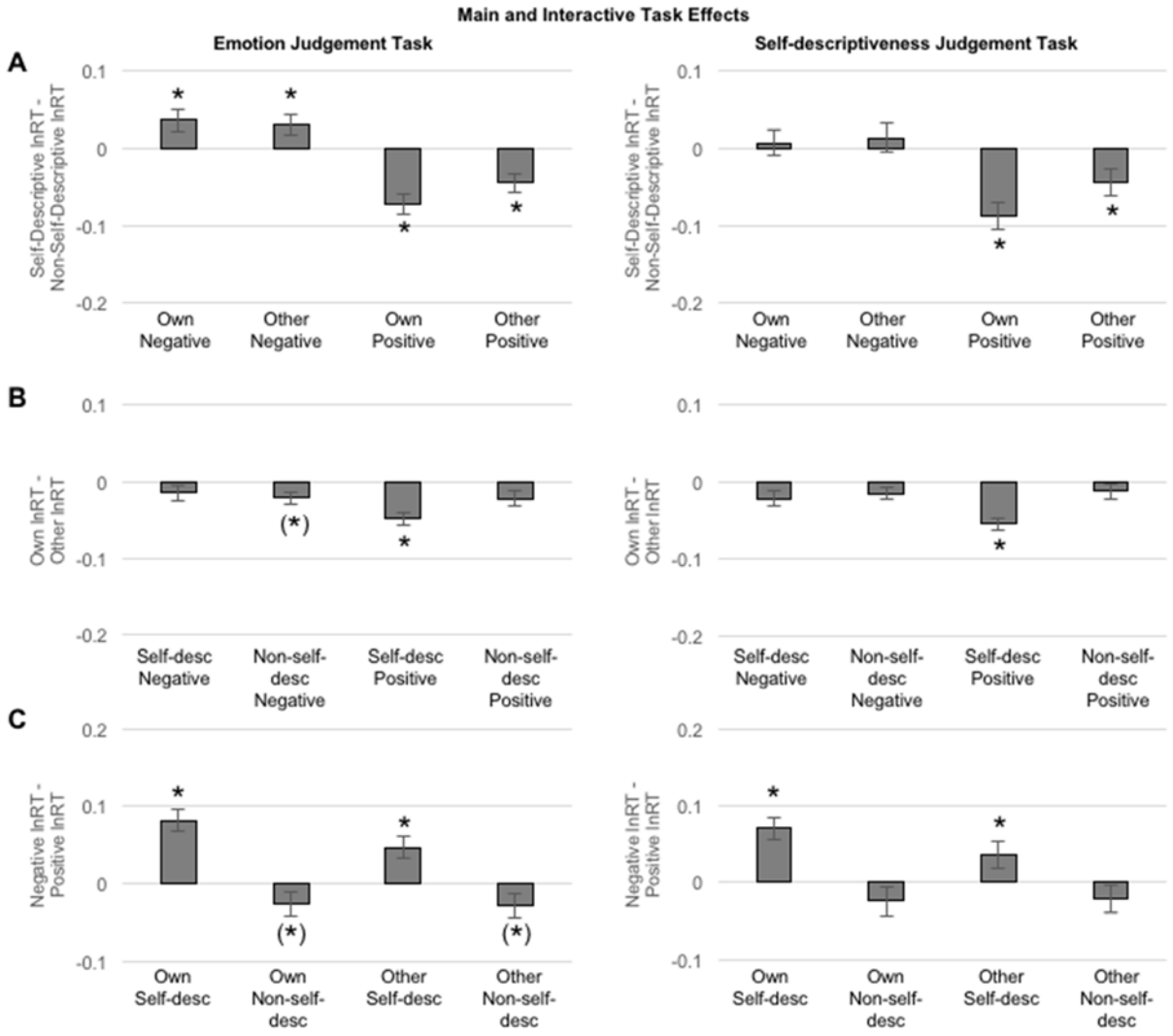

Figure S4. Main and Interactive Effects of the Self-referential Information Processing Task on Reaction Time (RT). Both when judging the emotional valence of words, and when judging the self-descriptiveness of words, participants were significantly faster to judge self-descriptive (compared with non-self-descriptive) positive (compared with negative) words paired with their own (compared with someone else's; "other") image. **(A)** Main and interaction effects of *word self-descriptiveness* for each judgement condition: displayed are natural-log transformed RTs for Self-Descriptive – Non-Self-Descriptive word trials. **(B)** Main and interaction effects of *image type* for each judgement condition: displayed are natural-log transformed RTs for Own – Other

image trials. **(C)** Main and interaction effects of *word valence* for each judgement condition: displayed are natural-log transformed RTs for Negative – Positive word trials. *Note:* Significant task effects, $*p<0.05$, $^{(*)}p<0.10$.

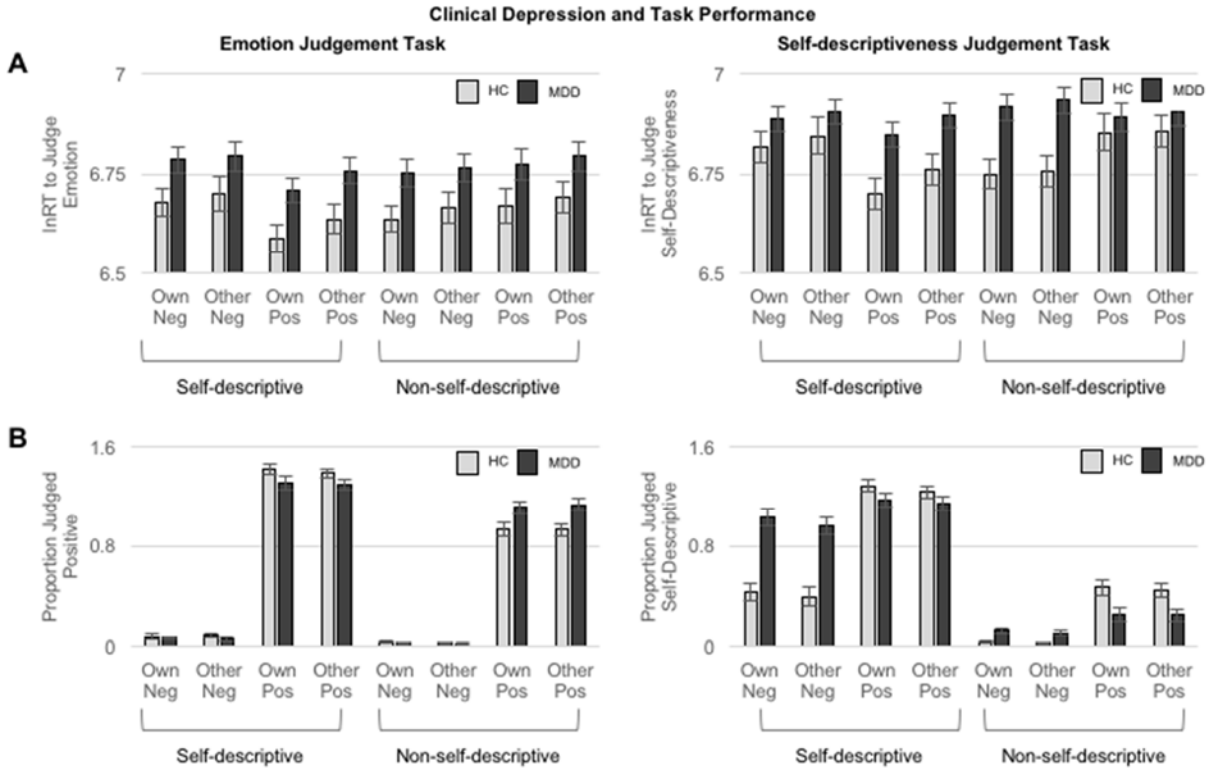

Figure S5. Reaction Time (RT) and Responses on the Self-referential Information Processing Task by Clinical Group. Displayed are **(A)** average natural-log transformed RTs for each trial type, for individuals in the healthy control (HC) or major depressive disorder (MDD) groups; and **(B)** average arcsine-transformed proportion of words judged to be positive (in the Emotion Judgement condition) or judged to be self-descriptive (in the Self-descriptiveness Judgement Condition) for individuals in the HC or MDD groups.

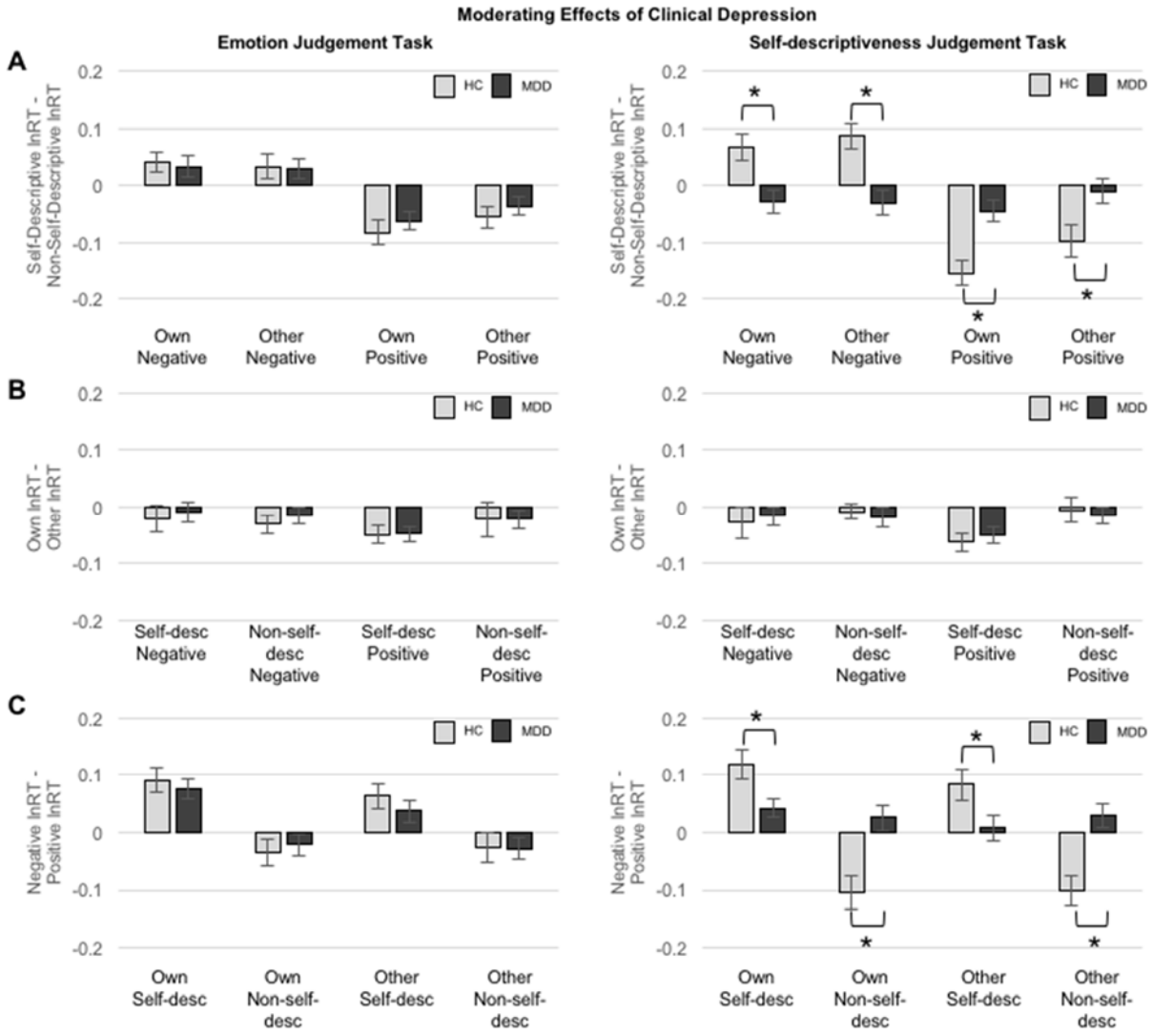

Figure S6. Moderating Effects of Depression on Reaction Time (RT) for the Self-referential Information Processing Task. Displayed for health controls (HC) and individuals with major depressive disorder (MDD) are: **(A)** Main and interaction effects of *word self-descriptiveness* for each judgement condition on response speed (shown are natural-log transformed RTs for Self-Descriptive – Non-Self-Descriptive word trials). **(B)** Main and interaction effects of *image type* for each judgement condition on response speed (shown are natural-log transformed RTs for Own – Other image trials). **(C)** Main and interaction effects of *word valence* for each judgement condition on response speed (shown are natural-log transformed RTs for Negative – Positive

word trials. There were no moderating effects of depression on response speed when judging the emotional valence of words, but when judging self-descriptiveness of words, individuals with MDD were faster to respond to self-descriptive (relative to non-self-descriptive) negative words than HC individuals; but HC individuals were faster to respond to self-descriptive (relative to non-self-descriptive) positive words. *Note:* Significant group differences in task effects, $*p<0.05$, $^{(*)}p<0.10$.

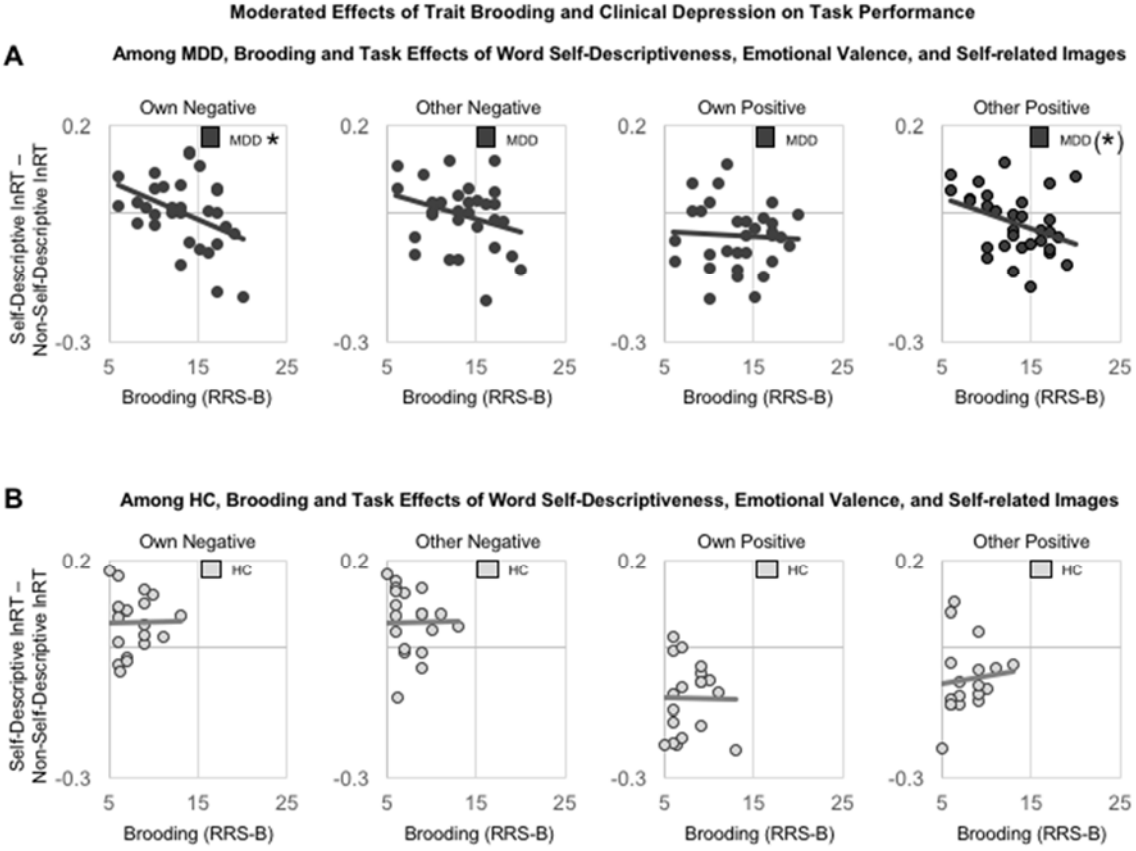

Figure S7. Moderating Effects of Trait Brooding Rumination on Reaction Time (RT) for the Self-referential Information Processing Task. (A) Among individuals with major depressive disorder (MDD), higher levels of trait brooding rumination (measured with the Ruminative Responses Scale, Brooding Subscale; RRS-B) were associated with significantly faster RTs to self-descriptive (compared with non-self-descriptive) negative words accompanied by their own image, and a trend for higher RRS-B to be associated with faster RTs to self-descriptive (compared with non-self-descriptive) positive words accompanied by someone else's ("other") image. **(B)** Among healthy control (HC) individuals, there were no significant associations between RRS-B and response speed. *Note:* Significant correlations, *p<0.05, $^{(*)}p$<0.10.

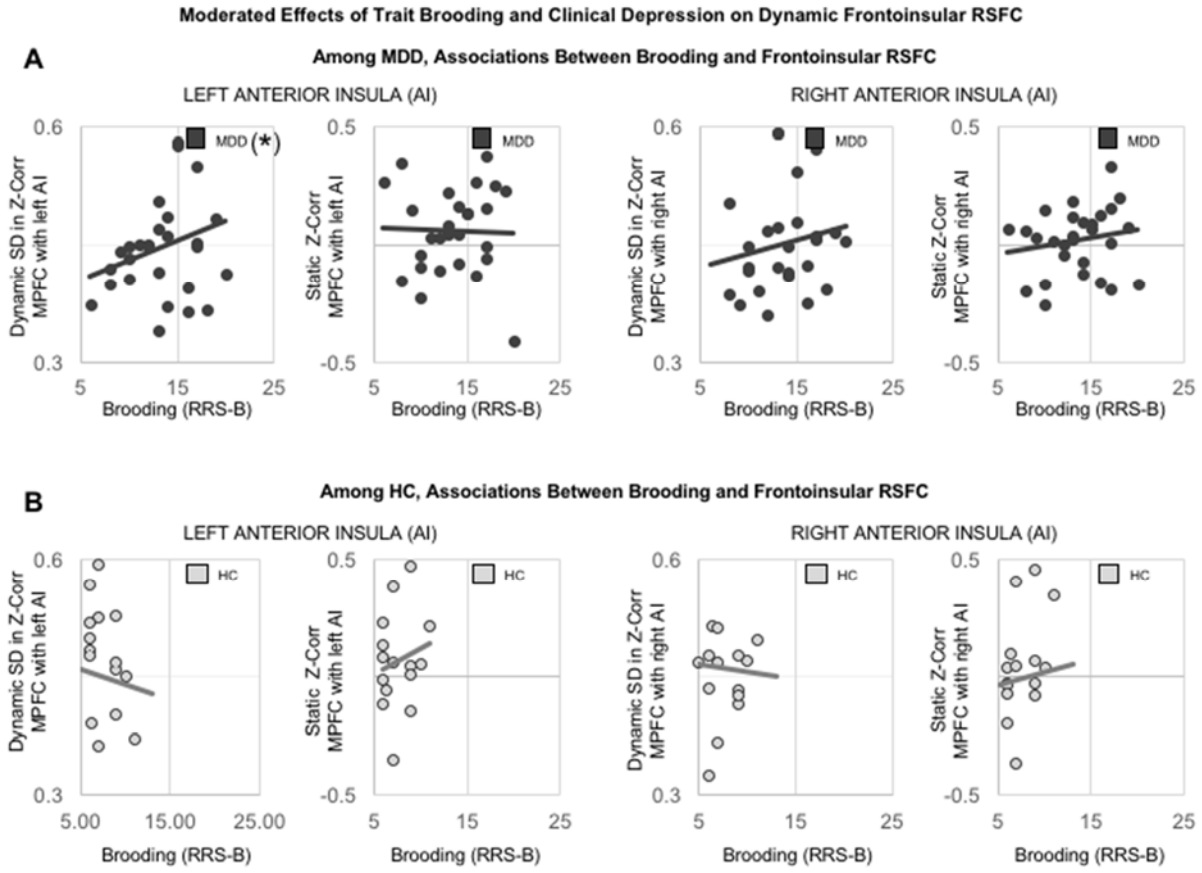

Figure S8. Moderating Effects of Trait Brooding Rumination on Resting-State Functional Connectivity (RSFC) Between Medial Prefrontal Cortex (MPFC) and Anterior Insula (AI). Higher levels of trait brooding rumination (measured with the Ruminative Responses Scale, Brooding Subscale; RRS-B) were associated with significantly higher dynamic variability in RSFC (standard deviation in Fisher's Z-transformed correlations in activity across sliding windows, SD in Z-Corr) between MPFC and AI, and this association was stronger for **(A)** individuals with major depressive disorder (MDD) compared with **(B)** healthy control individuals (HC). There were no significant differences in static RSFC (overall Fisher's Z-transformed correlations in activity across the full duration of the scan, Z-Corr) between clinical

groups, and no interactions between RRS-B and group in predicting static RSFC. *Note:* Significant correlations, $*p<0.05$, $^{(*)}p<0.10$.

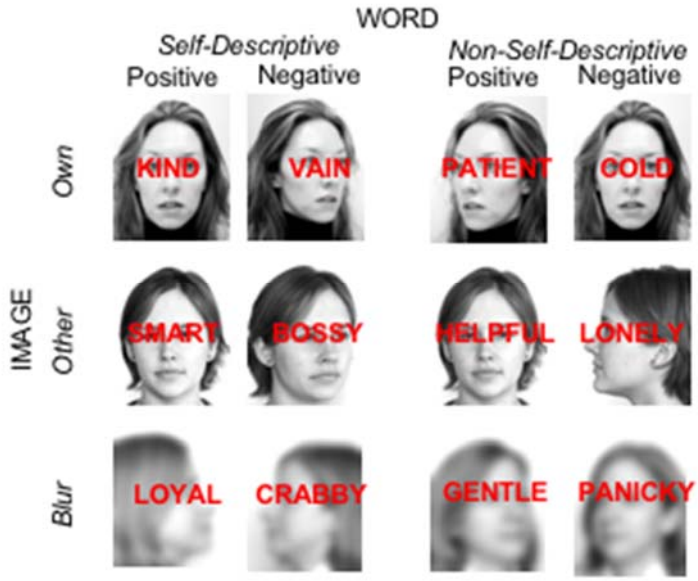

Figure S9. Manipulation Check: Gaussian Blurred Image Condition in the Self-referential Information Processing Task. The image manipulation in the Self-referential Information Processing (SIP) task was designed to test the effects of task-irrelevant, self-referential images on performance. In experimental analyses comparing responses to trials featuring the participant's own image (Own) to trials displaying a gender- and race-matched other person's image (Other), the effect of image type was interpreted as an orienting bias towards self-referential images. However, it could also be argued that such effects are related to orienting away from the Other condition. To explore this possibility, we piloted a third image condition consisting of Gaussian-blurred pictures of a (new) gender- and race-matched other person (Blur) and we repeated experimental analyses comparing the self-referential (Own) image condition with a Gaussian-blurred image condition (Blur). The same individualized word stimuli were used, consisting of emotionally valenced self-descriptive ("Self-Descriptive Positive" or "Self-Descriptive Negative"), or non-self-descriptive ("Non-Self-Descriptive Positive" or "Non-Self-Descriptive Negative"), adjectives superimposed onto images. Of note, results of these

manipulation checks showed similar patterns of biased attention towards Own compared with Blur images, supporting the interpretation that self-referential images bias information processing.

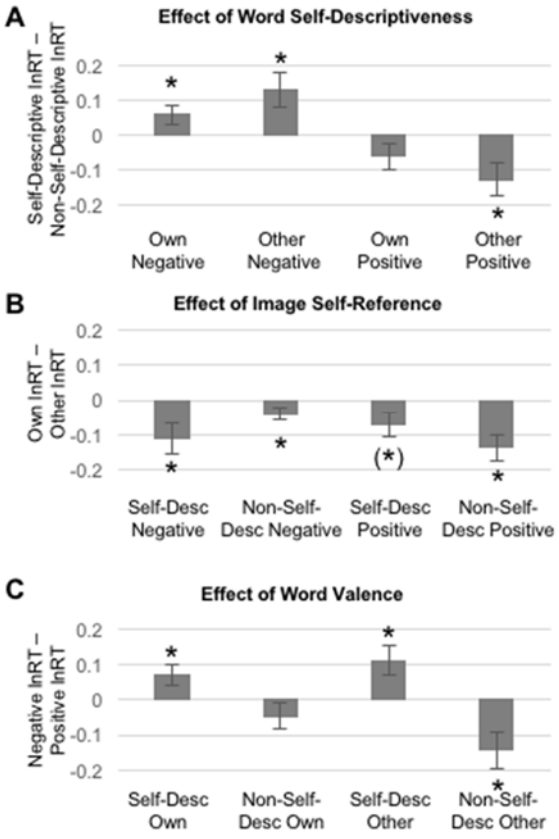

Figure S10. Replication of Main and Interactive Self-referential Information Processing Effects on Reaction Time (RT) in an Independent Sample. The Self-referential Information Processing Task, Self-Judgement condition, was administered to an independent sample (n=16 eligible for analysis, based on reporting words of each condition type). Analyses were performed to examine replication of task effects. **(A)** Main and moderated effects of word self-descriptiveness: displayed are natural-log transformed RTs for Self-Descriptive – Non-Self-Descriptive word trials. **(B)** Main and moderated effects of image type: displayed are natural-log transformed RTs for Own – Other image trials. **(C)** Main and moderated effects of word valence: displayed are natural-log transformed RTs for Negative – Positive word trials. *Note:* Significant task effects, $^{*}p<0.05$, $^{(*)}p<0.10$.

Supplemental References

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