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Processing of emotional information in seasonal depression across different cognitive measures

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Abstract

This study examined memory for emotional material, rate of endorsement of emotional adjectives, and degree of negative attributional style (NAS) in individuals diagnosed with Seasonal Affective Disorder (SAD) and never-depressed controls, when the SAD group were depressed (Time 1). The SAD patients were also followed up into the remission period (Time 2). At Time 1 the SAD group displayed a relatively elevated NAS and increased relative endorsement of negative self-referent information, but evidenced no mood-congruent memory bias for negative material, when compared to controls. None of these cognitive measures significantly predicted symptom outcome at Time 2, independent of Time 1 symptom levels. The cross-sectional findings for adjective endorsement and recall were replicated in a second experiment. These data provide further evidence that depression-related memory effects in SAD are different to these found in non-seasonal depression. Various accounts of these differences involving putative mood repair processes and/or an absence of dysfunctional negative schemas in SAD are discussed.

Cognitive theories of unipolar depression (e.g. (Beck, Rush, Shaw, & Emery, 1979; Teasdale & Barnard, 1993) propose that depressed states are maintained by systematic biases in cognitive processing in favor of depressogenic information that have a deleterious effect on mood, thus maintaining the disorder. There are considerable research data consistent with this cognitive model (see Williams, Watts, MacLeod & Mathews, 1997, for a review).

For some depressed individuals the onset and abatement of depressive episodes is closely associated with seasonal changes in the weather and the light-dark cycle. The DSM-IV (APA, 1994) classifies this subtype of depression as Recurrent Mood Disorder with Seasonal Pattern, though it is also referred to as Seasonal Affective Disorder (SAD) or seasonal depression. There are a number of differences between SAD and non-seasonal unipolar depression. First, SAD is more likely to be characterized by reversed neuro-vegetative symptoms, relative to non-seasonal depression (Dalgleish, Rosen & Marks, 1996). For example, increased appetite, and hypersomnia, as opposed to loss of appetite and early morning waking. Secondly, SAD is normatively treated with photo-therapy (e.g. Rosenthal & Wehr, 1992). In contrast, the preferred treatments for non-seasonal depression are anti-depressant medication and psychological therapies such as cognitive-behavior therapy.

These differences in symptom presentation and treatment profiles between SAD and non-seasonal depression are reflected in the theoretical accounts of the etiology of SAD episodes. Most conceptualizations of SAD view the disorder as a direct function of reduced light levels in the winter, focusing on variations in melatonin secretion, shifted circadian rhythms, individual differences in retinal photo-chemistry, and/or problems with various neurotransmitter systems (Dalgleish et al., 1996). Importantly, in terms of the present study, there has traditionally been little suggestion that the

proposed cognitive factors involved in the etiology and maintenance of non-seasonal depression have a role in the course of SAD. The one exception is Young's (1999) dual vulnerability model of SAD that proposes that sufferers are susceptible both to the onset of vegetative symptoms as a function of seasonal changes in light levels as well as to the onset of cognitive and affective symptoms in response to this vegetative symptomatology (see Lam et al., 2001, for a test of this model).

Results for the handful of existing studies of cognitive processing in SAD provide some support for Young's ideas (1999), however, and suggest that cognitive factors may be a more prominent feature of the disorder than traditionally thought. For example, Levitan, Rector and Bagby (1998) and Hodges and Marks (1998) found that SAD patients presented with depressotypic attributions on the Attributional Style Questionnaire (ASQ; Peterson et al., 1982) in the same way as non-seasonally depressed individuals. Similarly, reported levels of negative thinking, dysfunctional attitudes and rumination in SAD samples (Hodges & Marks, 1998; Rohan, Sigmon & Dorhofer, 2003) are similar to those from studies of non-seasonally depressed patients (e.g. Hollon & Kendall, 1980).

In another study, Spinks and Dalgleish (2001) found that SAD participants were significantly slower to color-name both negative emotional and season-related words (versus neutral words), compared to controls, on an emotional Stroop task. This indicates that cognitive processing of the semantic content of those particular word categories was selectively interfering with color-naming in a similar way to that found in non-seasonally depressed samples (Williams, Mathews & MacLeod, 1996). Interestingly, this difference in color-naming latencies across word types in the Spinks and Dalgleish data was present both in the winter, when the SAD group were in episode, and in the summer when they were in remission.

The findings from these studies suggest that cognitive processes may play an important role in the psychopathology of SAD in ways that mirror those proposed for non-seasonal depression. However, there are other data that indicate some caution in promoting this hypothesis. Dalgleish, Spinks, Yiend and Kuyken (2001) asked SAD participants and controls to generate specific autobiographical memories as quickly as possible to a set of emotional cue words. The typical, and very reliable, finding in non-seasonally depressed participants is that they find it relatively difficult to generate specific personal memories, located in time and place, and instead come up with categorical descriptions of their autobiography that conflate across a number of past events in their lives (Williams, 1996; Williams & Broadbent, 1986). Dalgleish et al. (2001) found that this was not the case with SAD participants who tended to be more specific in their autobiographical recall than controls. The dominant theoretical account of this 'overgeneral memory' effect in non-seasonal depression rests on a disruption to the memory system as a function of the adverse childhood experiences that are common in the disorder (e.g. Williams et al., 1997). However, Dalgleish et al. (2001) reasoned that, as SAD is driven predominantly by biological factors associated with the light-dark cycle and there is no evidence to support the idea of a vulnerability associated with unusually high levels of childhood adversity, it is unlikely that there would have been any such developmental disruption to the autobiographical memory system. Hence, one would not necessarily expect an overgeneral memory effect on the cue word task in SAD sufferers. In this analysis, cognitive biases that are a function of being in a depressed mood state *per se* would be evident in SAD (e.g. negative attributional style, selective Stroop interference), but those biases that are purported to be driven by processes that have a developmental genesis (such as overgenerality of autobiographical memories; Dalgleish et al., 2001) would be absent.

An alternative account of the extant data was also proposed by Dalgleish et al. (2001). They suggested that there might be a more widespread absence of depressotypic memory biases in SAD that extends beyond the realm of autobiographical recall. They speculated that perhaps there is some form of automatic mood-repair process that operates specifically on memory in SAD and counteracts the usual memory bias effects associated with depression. The rationale would be that, because SAD involves regular mood changes linked to natural variations in environmental variables, cognitive processes that counteract the effects of such shifts in mood (for instance by activating mood incongruent information) could have developed. Indeed, there is some evidence for the existence of such processes operating in memory in healthy individuals subjected to negative mood inductions (see Erber & Erber, 1994; Parrott & Sabini, 1990; Rinck, Glowalla, & Schneider, 1992; Rusting & DeHart, 2000). For instance, Parrot and Sabini (1990) showed that following a mood induction, the initial material recalled by healthy participants tended to be mood incongruent.

The present study therefore sought to examine the degree of mood-congruency in memory for positive and negative word lists in SAD to see if this could shed some light on the validity of the two explanations presented above. One of the more robust findings in the non-seasonal depression literature is that depressed persons selectively remember emotional word lists and stories congruent with their mood state, relative to controls, and that this effect is stronger and more consistent when the to-be-remembered material has been processed in a self-referent manner (See Matt, Vacquez & Campbell, 1992, for a meta-analytic review of many of these studies, and see Blaney, 1986, and Williams et al., 1997, for literature reviews). These effects are present in clinically depressed patients, analogue depressed samples, and in individuals who have experienced a negative-mood induction. Consequently, in contrast to the autobiographical memory cue word task (Dalgleish et al., 2001), one might expect to

find mood-congruent memory effects in word list recall in SAD sufferers, even if the genesis of their psychopathology was not a function of developmental adversity. However, if there was something unusual about memory effects relating to emotional information associated with SAD that did not impact on other aspects of cognitive processing, possibly as a function of mood repair, one might expect an absence or even a reversal of the usual mood-congruent memory bias associated with depression on standard word recall tasks.

The memory task that was selected for the present study was that used by Bradley and Mathews (1983, 1988; for a detailed description see the Method section of Experiment 1). The advantages of this task for the present study are two-fold. Firstly, the task has reliably revealed a mood-congruent memory bias for negative material in non-seasonal depression across more than one study. Secondly, the task comprises a self-description component (an initial adjective endorsement phase) and a recall component. Consequently, within the same paradigm it is possible to examine an individual's tendency to endorse negative words as self-descriptive along with any bias for selectively recalling those same words. This means that any absence of a mood-congruent recall bias for the words in the task, in the context of mood-congruent endorsement of those same words, is unlikely to be because the stimulus material is not resonating with the emotional concerns of the participants.

In addition to the memory task, we also wanted to include a paradigm for which there would be a strong hypothesis that the SAD participants would exhibit depressotypic biases, on the basis of prior data. Performance on this task should therefore provide a marker that cognitive processing is biased in our particular SAD sample and this would then provide a further context in which to interpret performance on the memory recall task. We therefore selected the ASQ as this had been shown in

two previous studies (Levitan et al., 1998; Hodges & Marks, 1998) to reveal a negative attributional style in SAD sufferers relative to controls.

Therefore, the first aim of Experiment 1 was to examine the hypothesis that on the encoding stage of the memory task, relative to never-depressed controls, SAD participants would have a higher endorsement rate for self-referent negative adjectives, a lower endorsement rate for self-referent positive adjectives, and a comparable endorsement rate for other-referent adjectives. In addition, it was hypothesized that the magnitude of this selective endorsement effect in SAD should correlate with higher scores on continuous measures of depressive symptomatology.

The second aim of Experiment 1, and the key aspect of the study, was to examine whether the pattern of recall for adjectives on the memory task would mirror the endorsement data. Related to this, a further aim was to statistically compare the endorsement and recall data to see whether or not any apparent differences in the two sets of data considered separately were statistically reliable.

The third aim of Experiment 1 was to examine the hypotheses that the SAD participants would evidence a greater negative attributional style (NAS) than the healthy controls (as measured by scores on the ASQ) and that this would correlate positively with higher scores on the continuous symptom measures in the SAD participants.

The present study also provided the opportunity to examine whether performance on the endorsement, memory and attribution measures predicted future levels of symptom remission in SAD. To our knowledge this is the first study to examine the extent to which performance on an emotional word recall task can predict the course of disorder in any kind of depressed sample. On this basis, and in the light of the existing theoretical literature, it is not clear what results one might expect to find for the recall measure. In contrast, there have been previous studies on the longitudinal predictive power of scores on the ASQ. For example, Levitan et al. (1998) found that

degree of NAS predicted clinical recovery (with lower NAS being associated with greater likelihood of recovery) in non-seasonally depressed patients but not in patients with SAD. One might therefore expect to find no relationship between NAS and future symptom course for the SAD participants in the present study. In terms of negative adjective endorsement, Dent and Teasdale (1988) showed that the number of global negative adjectives that non-seasonally depressed patients used to describe themselves independently predicted future symptom levels. Specifically, for a given level of depression, greater degree of adjective endorsement was associated with poorer long-term outcome. However, given the discrepant findings across seasonal and non-seasonal depression regarding NAS, it is unclear what one would predict for the present study regarding the endorsement measure.

The fourth aim of Experiment 1, therefore, was to examine the ability the cognitive variables to predict future summer symptom levels in SAD participants, independent of initial winter symptom levels.

Experiment one

Method

Participants

Twenty-one (17 women, 4 men; mean age = 42.14 years; SD = 12.23) members of the U.K. Seasonal Affective Disorder (SAD) Association, a self-help organization, were recruited via oral advertisement for the research at their annual meeting. The inclusion criteria were: 1) meeting DSM-IV criteria for Recurrent Mood Disorder with Seasonal Pattern (APA, 1994) and presenting with a current Major Depressive Episode, as assessed by clinical interview at Time 1 (winter testing); 2) being available for re-testing at Time 2 (summer testing); 3) presenting with no evidence of psychosis or organic brain damage; and 4) being between the ages of 16 and 60. The diagnostic interview utilized the questions from the Structured Clinical Interview for DSM (SCID;

First, Spitzer, Gibbon & Williams, 1997) to assess the presence of a Major Depressive Episode, along with additional questions on seasonality derived from the DSM-IV (APA, 1994).

Control participants were group-matched for age and sex with the clinical participants. There were 20 controls, 16 women and 4 men (mean age = 40.11 years; SD = 12.07), all of whom were recruited from the participant panel at the Cognition and Brain Sciences Unit, U.K. None of the controls met criteria for a current or past Major Depressive Episode (APA, 1994), according to the SCID, and none reported a history of depression[1].

Materials

Measures of symptom severity

The SAD participants were administered the Hamilton Rating Scale for Depression – SAD version (HRSD-SAD; Williams, Link, Rosenthal, Amira, & Terman, 1988) . The HRSD-SAD is a structured interview modified from the HRSD (Hamilton, 1960) that measures levels of SAD symptomatology. There are 21 depression questions reflecting the original scale (which has well established reliability coefficients of .84 to .90), and 8 SAD questions that can be added in to give a total score (HRSD-SAD). Participants also completed the state scale of the Spielberger State Trait Anxiety Inventory (STAI-State; Spielberger, Gorsuch & Lushene, 1970) and the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock & Erbaugh, 1961) .

The Attributional Style Questionnaire (ASQ; Peterson et al., 1982).

The ASQ is a self-report measure that assesses whether an individual has a tendency to attribute ostensibly uncontrollable good and bad events in particular ways. The attribution patterns vary along 3 dimensions. The internality–externality dimension reflects the extent to which the individual self-attributes the cause for a given outcome. The dimension of stability-instability refers to the extent to which the outcome is

attributed to transient factors. Finally, global-specific refers to whether the individual perceives the causes of the given event to be specific to that event or to be pervasive across a number of events. The ASQ consists of 12 events (e.g. “you have been looking for a job unsuccessfully for some time”) about which three ratings along the dimensions outlined above are made. The sub-scales for good and bad events across the 3 dimensions have Cronbach’s alphas ranging from .44 to .69 (Peterson et al., 1982). A composite rating of negative attributional style (NAS) can be computed by summing across the three dimensions for both positive and negative events and subtracting the sum for negative events from the sum for positive events. A lower score on this composite is therefore indicative of greater NAS (Hollon, Evans, & DeRubeis, 1990).

Adjective endorsement and recall task (Bradley & Mathews, 1988)

In this task participants were told that that the experimenter was interested in how they think about and what they can remember about people. They were first asked to think of someone they knew but whom they did not know very well (for example, the mail delivery person). This was the "unfamiliar person" in the context of the task. Participants then listened to 3 tape-recorded lists, each of 8 positive and 8 negative trait adjectives, with 10 second intervals between words. Half of the positive words and half of the negative words in each list were preceded by the instruction "self" and half by the instruction "unfamiliar". For half of the words, participants were therefore required to decide whether the word described themselves ("self" condition). For the other half of the words, they had to decide whether the word described the unfamiliar person that they had identified previously ("unfamiliar" condition). They were also told that they would be asked to recall the words later. After each list there was a 20 second interference task (counting backwards in threes) to minimize recency effects, followed by a two minute free recall period. Alternate forms of each word list allowed each word to be presented in both reference conditions by counterbalancing across participants.

The adjectives in the recall task were the same as those used by Bradley and Mathews (1988).

Procedure

Participants took part in a clinical interview before completing the ASQ and the memory task in a counterbalanced order. They were next assessed (by Helen Spinks) using the HRSD-SAD (SAD group only), before completing the BDI and STAI-State. The SAD participants were assessed at two time points. Time 1 was in November/December (winter) and Time 2 was in June/July (summer) of the following year. The inter-test interval ranged from 6-8 months. The same procedure and measures were used at the two time points; however, Time 2 memory and ASQ data are not reported here.

Results

Age and mood variables

As expected, the two groups of participants did not differ on age, $t < 1$. The scores on the symptom measures are presented in Table 1. As expected, at Time 1 the SAD group scored significantly higher than the controls on STAI-State, $t\ (39) = 5.60$, $p < .001$, and BDI, $t\ (38) = 6.10$, $p < .001$. None of the depressed participants met criteria for a Major Depressive Episode (APA, 1994) at Time 2. According to the Frank et al. (1991) criteria for interpreting scores on the HRSD (in this case the HRSD-SAD scores with the scores for the 8 SAD items removed), 18 of the participants were fully remitted in the summer and 3 were partially symptomatic. Comparison of winter mood scores with those in the summer revealed highly significant improvements in mood, lowest $t = 3.8$, all $ps < .001$.

INSERT TABLE ONE ABOUT HERE

Memory performance

Endorsement data

Table 2 presents the numbers of "yes" ratings (endorsements) generated by participants in the study phase of the memory task for both the positive and negative words, and for both words that referred to the self and words that referred to the unfamiliar other.

INSERT TABLE 2 ABOUT HERE

A Group (2) by Valence (2) by Reference (2) ANOVA with repeated measures on the last two factors was conducted on the endorsement data to test the hypothesis that the SAD participants would endorse relatively more negative than positive words as self-referent compared to the controls, but would be comparable with controls in their endorsement profile with respect to the unfamiliar other person. There was a main effect of Valence, F (1,39) = 218.68, $p < .001$, with participants overall endorsing more positive than negative words, a main effect of Reference, F (1,39) = 32.91, $p < .001$, with participants overall endorsing more self-referent words, though no main effect of Group, F (1,39) = 1.73, ns. There was a significant interaction of Valence by Group, F (1,39) = 17.34, $p < .001$, that was qualified by the a significant three-way interaction of Valence by Reference by Group, F (1,39) = 23.70, $p < .001$. None of the other interactions was significant.

The three-way interaction of Valence by Reference by Group was deconstructed by examining each reference category separately in two Valence (2) by Group (2) ANOVAs. For the self-referent words, there was the expected main effect of Valence, F (1,39) = 99.48, $p < .001$, no main effect of Group, F (1,39) = 1.37, ns, but a significant Group by Valence interaction, F (1,39) = 43.11, $p < .001$. Follow-up independent sample t-tests revealed that the depressed group endorsed more negative words, t (39) = 5.62, $p < .001$, Cohen's d = 1.80, and fewer positive words, t (39) = 5.17, $p < .001$, Cohen's d = 1.66, as self-referent compared to controls. For the unfamiliar-referent

words, there was the expected main effect of Valence, F (1,39) = 138.25, p < .001, no effect of Group, F < 1, and no interaction of Group by Valence, F < 1.

These analyses therefore support the hypothesis that the depressed participants would endorse significantly more negative words and significantly fewer positive words as self-referent compared to the controls, but would be comparable to controls in their profile of endorsement with respect to an unfamiliar other.

Recall data

The absolute numbers of words that were later recalled were transformed into proportions of the numbers that were originally rated for each condition (e.g. self-negative word- rated "yes", unfamiliar-positive word-rated "no"). Proportions were computed in order that the differential endorsement rates across groups (see above) did not distort the recall analyses. The absolute numbers and proportions of words recalled are presented in Table 3.

INSERT TABLE THREE ABOUT HERE

In order to examine whether the pattern of recall mirrored the pattern of adjective endorsement reported above, a Reference (2) by Valence (2) by Group (2) ANOVA, with repeated measures on the first two factors, was carried out on the proportion data for just the endorsed words to examine whether there was a recall bias in favor of negative (versus positive), endorsed self-referent material in the depressed group, compared to controls, with no difference across groups for the unfamiliar-referent material. The results revealed a main effect of Valence, F (1,39) = 17.17, p < .01, with trends towards an effect of Reference, F (1,39) = 3.74, p = .06, and of Group, F (1,39) = 3.17, p = .08, and towards a Reference by Group interaction, F (1,39) = 3.73, p = .07. However, the other interactions, including the critical Group by Reference by Valence interaction, were not significant, Fs < 1. It is also important to note that the

SAD group's recall was in a mood-incongruent direction in that they recalled more positive self-referent words than negative (see Table 3)(Matt et al., 1992).

In the original Bradley and Mathews (1988) study that reported a mood-congruent recall bias for negative self-referent material in non-seasonal depressed patients, the critical effect involved absolute numbers of words recalled, regardless of whether or not they had been endorsed in the study phase of the task. The reason for concentrating on absolute numbers was because Bradley and Mathews found that the proportions of "yes" and "no" rated words recalled for a given reference-valence pairing (e.g. self-negative) did not differ significantly for their participants.

As the proportions of "yes" and "no" rated words also did not differ in the present data (all Ps > .1), the specific finding of Bradley and Mathews (1988) of a recall bias for negative self-related material relative to positive self-related material was examined in a planned Group (2) by Valence (2) ANOVA, with repeated measures on the last factor, of the absolute numbers of recalled self-related words, regardless of whether or not they were originally endorsed (SAD group: self-positive – M = 5.76, SD = 2.02, self-negative – M = 4.76, SD = 1.18; Control group: self-positive – M = 6.50, SD = 1.91, self-negative – M = 4.95, SD = 1.76). There was a main effect of Valence, F (1,39) = 14.68, p < .001, with more positive than negative words being recalled overall. However, the critical Valence by Group interaction was not significant, F < 1. Indeed, the effect size for the difference across groups for the relative proportions of negative versus positive words recalled was "small", Cohen's d = 0.27 (Cohen, 1988).

Overall, then, these findings do not provide support for the existence of a relative recall bias for negative (versus positive) self-referent material in SAD participants, compared to controls.

A comparison of rating and recall data

In order to examine whether the groups differed significantly in their profiles of endorsement data and recall data, a Group (2) by Reference (2) by Valence (2) by Measure (2; endorsement proportion, recall proportion), with repeated measures on the last three factors, was carried out. The dependent variables were the proportions of words endorsed (the mean numbers of words endorsed [see Table 2] divided by 12) and the proportions of endorsed words recalled (see Table 3). This ANOVA essentially combines the two full factorial ANOVAs on, firstly, the endorsement data and, secondly, the proportions of endorsed words recalled, reported above. The critical term of interest was therefore whether there was a four-way interaction of Group by Reference by Valence by Measure. This was indeed the case, $\underline{F}$ (1,39) = 5.03, $\underline{p} < .05$, indicating that the negative endorsement bias for self-referent material in the SAD group, relative to controls, is a significantly greater effect than the absence of a statistically significant recall bias for endorsed negative self-referent words across the two groups.

This issue was again also examined in terms of the specific negative recall bias effect reported by Bradley and Mathews (1988). An index of the overall numbers of negative relative to positive self-referent words recalled (irrespective of whether or nor they had originally been endorsed) was computed by subtracting the latter from the former for each participant. This represents the critical variable that was different across non-seasonally depressed and control groups in the original study (see Bradley & Mathews, 1988). This variable - the Recall Index- was compared to a similar index of the numbers of negative self-referent words endorsed minus the respective number of positive words - the Endorsement Index - for each participant, using a Group (2) by Index (2) ANOVA with repeated measures on the last factor (see Figure 1). There was a main effect of Group, $\underline{F}$ (1,39) = 49.71, $\underline{p} < .001$, that was qualified by a significant Group by Index interaction, $\underline{F}$ (1,39) = 22.56, $\underline{p} < .001$. Follow-up independent sample

t-tests revealed that the Groups differed on the Endorsement Index, t (39) = 6.57, p < .001, Cohen's d = 2.10, with the depressed group showing greater relative endorsement of negative words versus positive words compared to the controls, but not on the Recall Index, t < 1, Cohen's d = 0.27.

INSERT FIGURE 1 ABOUT HERE

Negative attributional style (NAS)

Five SAD participants and 1 control participant did not complete the ASQ. Composite NAS scores were computed for the remaining participants with more negative scores on this composite measure reflecting greater NAS. A t-test comparing the two groups on the NAS scores (SAD: M = -.88, SD = 24.83; Controls: M = 13.21, SD = 15.06) was significant, t (33) = 2.07, p < .05, Cohen's d = 0.72, thereby supporting the hypothesis of a stronger NAS in the SAD group relative to the controls.

Correlational analyses

Zero-order correlations were performed between the three symptom measures (HRSD-SAD, BDI, and STAI-State) and the Endorsement Index, Recall Index and NAS score (see Table 4) for the SAD group only.

INSERT TABLE 4 ABOUT HERE

As can be seen, both the Endorsement Index and the NAS composite score correlated significantly with the two self-report questionnaire measures of mood (BDI, STAI-State), such that greater cognitive negativity was associated with more negative mood. However, the cognitive measures did not correlate with the clinician-rated measure (HRSD-SAD), though the relationships were in the expected direction. The Recall Index did not correlate significantly with any of the mood measures.

Longitudinal analyses

Two stepwise linear regression analyses were performed for the SAD sample data to examine the relationship between the two measures of depressive symptoms

(BDI and HRSD-SAD) at Time 2, when the depression was in full or partial remission, and the indices of cognitive performance at Time 1 (entered on the second step), with Time 1 symptom measure scores as an additional predictor variable (entered on the first step). Although positively skewed, the summer mood data did not violate assumptions for linear regression.

For BDI, there was no significant change in R^2 due to the inclusion of the cognitive variables, $F < 1$, and the overall model was not significant, F (4, 11) = 1.34, ns, R^2 = .33. Furthermore, none of the cognitive measures, nor Time 1 BDI, was an independent predictor of Time 2 BDI, Ps > .05. For HRSD-SAD, there was no significant change in R^2 due to the inclusion of the cognitive variables, F (3,11) = 1.16, ns, and the overall model was not significant, F (4, 11) = 1.25, ns, R^2 = .31. Furthermore, none of the cognitive measures, nor Time 1 HRSD-SAD, was an independent predictor of Time 2 HRSD-SAD, Ps > $.20^2$.

Discussion

Experiment 1 had 4 aims and each of these will be considered in turn in the light of the results. The first aim was to test the hypothesis that participants with SAD would endorse more negative and fewer positive self-referent adjectives than controls, but would be comparable to controls in their profile of endorsement for adjectives describing an unfamiliar other person. The data supported this hypothesis. Furthermore, the degree of relative negative self-referent endorsement (Endorsement Index) was positively correlated with questionnaire (BDI, STAI-State) measures of negative symptoms but was not significantly associated with the scores on the interview measure (HRSD-SAD), though the relationship was in the expected direction.

The second aim of Experiment 1 was to examine whether this pattern of data for endorsement rates was mirrored in the subsequent recall performance. There was no

evidence to support this hypothesis, and the effect size for the relative recall of negative (versus positive) self-referent adjectives in the SAD group, as compared to the controls, was small. Also, the degree of relative recall of negative self-referent adjectives in the SAD sample was not significantly correlated with the symptom measures. Furthermore, in absolute terms, recall performance was mood incongruent in the SAD sample. This contrasts with the predominant pattern of mood-congruent memory in non-seasonal clinical depression (Matt et al., 1992). An additional related aim was to statistically compare the endorsement and recall data. This analysis revealed that the different patterns of performance across groups for endorsement rates was a statistically larger effect than the non-statistically different group comparison on the recall data.

The third aim of Experiment 1 was to test the hypothesis that the SAD group would exhibit a greater degree of negative attributional style (NAS), relative to the controls. The data supported this hypothesis. Furthermore, the degree of NAS in the SAD group positively correlated with the self-report questionnaire measures of mood but was not significantly associated with the clinician-completed measure (HRSD-SAD), in the same way as the endorsement data.

The final aim of Experiment 1 was to examine the ability of the performance on the three cognitive measures to predict levels of symptom remission the following summer, independently of Time 1 (winter) mood, in the SAD group. The data offered no support for any of the measures being a significant independent predictor of later symptom remission.

This pattern of findings from Experiment 1 echoes the previous findings using cognitive measures in the literature on SAD (discussed in the Introduction) in that the SAD patients performed as one would expect a depressed sample to perform on the measure of attributional style and on the endorsement of emotional trait adjectives, but did not show any evidence in support of the usual depression-related memory effects; in

this case, mood-congruent recall. Before embarking on a discussion of the possible reasons for the apparent lack of a mood-congruent recall effect in SAD, it seemed important to examine the replicability of the recall data as they go against the grain of the extant literature on memory and mood effects in depression. The same adjective endorsement and recall task was therefore administered to a new group of SAD participants, recruited from a hospital source rather than from a self-help organization, to examine the replicability of the results of Experiment 1.

Experiment two

Method

Participants

There were 14 participants in the SAD group (10 women, 4 men; mean age = 42.64 years, SD = 12.31), all of whom were either adult out-patients (N=4) or in-patients at the Bethlem and Maudsley Joint Hospital, London. Participants were recruited through clinicians working on the Affective Disorders Unit at the hospital. Of the people approached to take part, none refused. All of the depressed participants met DSM-IV criteria for Recurrent Mood Disorder with Seasonal Pattern and presented with a Major Depressive Episode (APA, 1994) at the time of testing, as assessed by the SCID (First et al., 1997). The exclusion criteria were: a) any evidence of history of psychosis or organic brain damage; b) being aged under 16 or over 65. All of the SAD participants were currently using photo-therapy and were under the clinical care of a consultant psychiatrist and either a psychologist or nurse therapist.

The control participants were group-matched for age and sex with the clinical participants. There were 14 controls, 10 women and 4 men (mean age = 40.35 years, SD = 11.56), all of whom were recruited from the participant panel at the Cognition and Brain Sciences Unit, U.K. None of the controls met criteria for a current or past Major

Depressive Episode (APA, 1994) according to the SCID and none reported a history of depression[1].

Procedure

The procedure was almost the same as for the participants in Experiment 1 and used the same version of the memory recall task (Bradley & Mathews, 1988). The only differences this time were that: 1) participants were not administered the HRSD-SAD; 2) participants did not complete the ASQ; and, 3) SAD participants were not followed up to a Time 2. Participants were all tested in the winter months in the U.K. (November – February).

Results

Demographic and mood measures

As expected, the SAD and control groups did not differ on age, $t < 1$. Also, the SAD participants scored higher on STAI-State (SAD: $M = 44.14$, $SD = 11.85$; control: $M = 27.57$, $SD = 6.20$), $t\ (26) = 4.64$, $p < .001$, and BDI (SAD: $M = 16.86$, $SD = 9.37$; control: $M = 1.93$, $SD = 3.15$), $t\ (26) = 5.65$, $p < .001$[3].

Memory performance

The endorsement data and the proportions of endorsed words recalled are presented in Table 5.

INSERT TABLE 5 ABOUT HERE

Endorsement rates

A Group (2) by Valence (2) by Reference (2) ANOVA with repeated measures on the last two factors was conducted on the endorsement data. There was a main effect of Valence, $F\ (1,26) = 140.92$, $p < .001$, with participants overall endorsing more positive than negative words, a main effect of Reference, $F\ (1,26) = 17.11$, $p < .001$, with participants overall endorsing more self-referent words, though no main effect of

Group, F (1,26) = 3.16, p = .09. There was a significant interaction of Valence by Group, F (1,26) = 8.93, p < .001, that was qualified by a significant three-way interaction of Valence by Reference by Group, F (1,39) = 7.53, p < .02. None of the other interactions was significant.

The three-way interaction of Valence by Reference by Group was deconstructed by examining each reference category separately in two Valence (2) by Group (2) ANOVAs. For the self-referent words, there was the expected main effect of Valence, F (1,26) = 53.27, p < .001, no main effect of Group, F < 1, but a significant Group by Valence interaction, F (1,26) = 15.09, p < .01. Follow-up independent sample t-tests revealed that the depressed group endorsed more negative words, t (26) = 3.51, p < .01, Cohen's d = 1.38, and fewer positive words, t (26) = 3.56, p < .01, Cohen's d = 1.40, as self-referent compared to controls. For the unfamiliar-referent words, there was the expected main effect of Valence, F (1,26) = 74.60, p < .001, no main effect of Group, F (1,26) = 2.46, p = .13, and no interaction of Group by Valence, F < 1.

These analyses therefore mirror the findings from Experiment 1and support the hypothesis that the seasonally depressed participants would endorse significantly more negative words and significantly fewer positive words as self-referent compared to the controls, but would be comparable to controls in their profile of endorsement with respect to an unfamiliar other.

Recall rates

A Reference (2) by Valence (2) by Group (2) ANOVA, with repeated measures on the first two factors, was carried out on the proportions of endorsed words recalled in the different conditions to examine whether there was a relative recall bias in favor of negative, endorsed self-referent material in the depressed group. The results revealed a trend towards a main effect of Valence, F (1,26) = 3.98, p < .06, an effect of Reference, F (1,26) = 5.44, p < .05, and of Group, F (1,26) = 5.13, p < .05, and a weak trend

towards a Valence by Group interaction, F (1,26) = 3.73, p = .07. However, the other interactions, including the critical Group by Reference by Valence interaction, were not significant, Fs < 1[4]. Again, in absolute terms, recall of self-referent material in the SAD group was in a mood-incongruent direction (Matt et al., 1992). These findings therefore mirror those of Experiment 1 and provide no support for a relative recall bias in favor of negative (versus positive) material in SAD patients, as compared to controls.

Comparison of endorsement rates and recall rates

An Endorsement Index and a Recall Index were computed from the memory data in the same way as for Experiment 1 (SAD group: Endorsement Index – M = -2.93, SD = 6.03, Recall Index – M = -0.50, SD = 2.56; Control group - Endorsement Index – M = -9.58, SD = 2.18, Recall Index – M = -1.64, SD = 2.34). A Group (2) by Index (2) ANOVA, with repeated measures on the last factor, revealed a main effect of Group, F (1,26) = 14.62, p < .01, that was qualified by a significant Group by Index interaction, F (1,26) = 8.85, p < .01. Follow-up t-tests revealed that the groups did not differ on the Recall Index, t (26) = 1.23, p > .2, Cohen's d = .48, but did differ on the Endorsement Index, t (26) = 3.88, p < .01, Cohen's d = 1.62, with the SAD group evidencing greater relative endorsement of negative versus positive words, compared to the controls.

This analysis indicates that, as in Experiment 1, the magnitude of the difference in Endorsement rates for negative versus positive self-referent words between the seasonally depressed and control groups is a significantly greater effect than the statistically non-significant difference in the relative recall of negative versus positive self-referent words.

Correlational analyses

As in the first experiment, there were significant correlations between the Endorsement Index and both STAI-State, r (12) = .54, p < .05, and BDI, r (12) = .73, p

< .01, with non-significant correlations between the Recall Index and the two symptom measures: STAI-State, r (12) = .24, p > .4; BDI, r (12) = .22, p > .4.

General Discussion

The two experiments reported here are the first to our knowledge to examine the existence of mood-congruent memory biases for negative self-referent material in individuals with a diagnosis of seasonal affective disorder (SAD), in the context of performance on two other cognitive measures: the Attributional Style Questionnaire (ASQ), and endorsement of negative adjectives in the encoding stage of the memory task. The data provided no support for the existence of mood-congruent memory effects in SAD relative to controls, despite the existence of a relative endorsement bias in favor of negative information and relatively elevated negative attributional style (NAS) in the same SAD participants. Indeed, in absolute terms, self-referent recall was in a mood-incongruent direction in the SAD participants in both experiments (Matt et al., 1992). The pattern of results on the endorsement and recall measures was replicated in a second experiment. In addition, the magnitude of the attributional and endorsement rate depressotypic biases correlated positively with two self-report questionnaire measures of symptoms (the BDI and the STAI-State) but not significantly (though nevertheless in the expected direction) with a clinician-rated measure (the HRSD-SAD). However, correlations between the symptom measures and the index of recall bias did not approach statistical significance. Finally, longitudinal analyses revealed no support for any of the cognitive measures being an independent predictor of depression symptom levels in the following summer.

In this general discussion section three putative accounts of these data, and the other data on cognitive measures in participants with SAD, will be considered. The first potential account of the data rests on the inherent difficulties in interpreting null results

on a given task - in this case, the recall measure (see Vasey, Dalgleish, & Silverman, 2003, for a discussion). It is possible, for example, that the present experiments are under-powered or that the recall task is not sensitive to the effects that it has been designed to test, and that the same is true for the earlier work on autobiographical memory. However, in our view there are at least four reasons why this explanation is unlikely and why the present data merit serious consideration. The first reason is that the SAD groups, across the 2 experiments, exhibited a relative mood-congruent endorsement bias for the words in the memory task, while showing no subsequent mood-congruent recall bias for the same material (indeed, as noted, the pattern of recall bias was mood-incongruent in the SAD groups). In previous administrations of this type of endorsement-recall paradigm, the profiles of endorsement and later recall have mirrored each other (e.g. Bradley & Mathews, 1988). Indeed, using such an endorsement-recall methodology, Dent and Teasdale (1988) reported that “these two measures shared so much reliable variance….accordingly, we treated them as measures of the same underlying construct” (p. 32). The fact that these measures seem to be discrepant in the present data therefore suggests that there is something meaningful about the recall data that needs to be addressed.

The second reason to take the present data seriously concerns the size of the reported effects. The mean effect size (including analyses involving both proportions and absolute numbers of words recalled) for the relative recall bias for negative versus positive material across groups in the present experiments was a Cohen's d of 0.36. In the most comparable study on non-seasonal depression (Bradley & Mathews, 1988), the effect size was a Cohen's d of 0.97. This indicates that, independent of sample size, the memory bias effect in SAD on this particular paradigm is markedly smaller than in the comparable study on non-seasonal depression.

Another way to examine this issue is to consider the effect size reported in the Matt et al. (1992) meta-analysis of studies on mood-congruent recall in non-seasonal depression, across various different paradigms (this includes the Bradley & Mathews, 1988 study). Matt et al. (1992) did not present group comparisons in their paper. Instead, the effect sizes that they reported represented the difference between recall of negative and positive material, with zero representing no difference, negative values a bias in favor of negative material (mood-congruent recall), and positive values a bias in favor of positive material (mood-incongruent recall). The rationale for this approach was that these effect sizes present an indication of whether recall is mood congruent (or incongruent) in absolute terms for a given index population, rather than relative to the performance of controls. Using this approach, for clinically depressed participants Matt et al. (1992) reported an effect size of $h_s' = -.19$, with a 90% confidence interval of -.06 to -.33; in other words, a clear mood-congruent recall effect. Using their method of calculation for the present data[5], the effect sizes are $h_s' = .26$ for the memory bias effect in Experiment 1 and $h_s' = .18$ for Experiment 2. These values both fall outside of the Matt et al. 90% confidence limits and, as already noted, are indicative of mood-incongruent recall in the terms of the Matt et al. guidelines.

The third reason that the present data merit serious consideration is the pattern of correlations. Performance on both adjective endorsement and on the ASQ was significantly correlated with self-reported anxiety and depression in the direction that one would expect based on the extant literature in non-seasonal depression. However, there was no support for a significant association between mood-congruent recall and self-reported mood in the correlational data, again suggesting that for the SAD participants, mood and emotional adjective recall are not clearly related.

The final reason to think that the present data merit serious consideration is the fact that the endorsement and recall findings were replicated across two experiments

using different SAD samples. Furthermore, power analysis based on these Bradley & Mathews (1998) data indicated that the sample sizes in the present studies were acceptable (see Footnote 1). These facts reduce the possibility that the findings of either experiment are chance effects.

Considering these four reasons together, there is a strong case for arguing that it is appropriate to use the present data to interpret the nature of cognitive processing in SAD at a theoretical level (Vasey et al., 2003). To this end the second potential account of the cognitive processing data in SAD, as discussed in the Introduction, is that some form of process of mood repair is operating in SAD that affects performance on mood and memory tasks, but not on other measures (see Parrott and Sabini, 1993; Rusting and DeHart, 2000). However, if this was the case one would have to propose that such mood repair processes acted so as to make memory both more specific, to account for the data on the autobiographical memory test (Dalgleish et al., 2001), and non-mood-congruent, to account for the present data on word list recall. This implies that more than one process of mood repair is operating in SAD. If such mood repair processes are in operation in SAD, it is important to consider why they would not also affect performance on other cognition-emotion measures such as endorsement of negative adjectives, self-report mood questionnaires, the modified Stroop task, and the ASQ. One possibility is that the mood repair processes are somewhat automatic and are only evident on tasks that are relatively immune to depressogenic response biases.

In this analysis, individuals with SAD both have an experience of depression, and also have explicitly held negative views of the self and world, in ways that are similar to those found in non-seasonal depression. Consequently, on tasks where such explicit beliefs and experiences will be influential, such as self-report questionnaires, endorsement of negative adjectives and the ASQ, SAD participants will present with a response profile similar to that in non-seasonal depression. However, the effects of any

automatic processes of mood repair that operate in SAD will be apparent on tasks such as the present memory recall measure that are relatively immune to depression-related response biases. One could of course argue that the selective interference for negative and season-related words on the modified Stroop paradigm (Spinks & Dalgleish, 2001) should have also been eliminated by any putative mood repair processes. However, it is possible that any mood repair effects operate on the way that material in memory is encoded and retrieved rather than affect whether particular material recruits attentional resources at an earlier stage in cognitive processing (Williams, Mathews, & MacLeod, 1996).

The final putative account of the data concerning cognitive processing in SAD is that individuals with the disorder, unlike those with non-seasonal depression, are not characterized by underlying dysfunctional and negative schemas about themselves and the world (Beck et al., 1979). As a consequence, although SAD individuals resemble non-seasonally depressed participants on tasks susceptible to response bias effects, as discussed in terms of the second account above, they differ from the non-seasonal depressed participants on tasks that tap this underlying schema structure. In this vein, one could argue that performance on the memory tasks that reveal no evidence of depressotypic processing biases in SAD is predominantly influenced by the existence of dysfunctional negative schemas, hence the lack of any clear effects in the SAD samples. Again, the modified Stroop data (Spinks & Dalgleish, 2001) would not necessarily be a problem for this type of account because selective Stroop interference effects can arise as a function of familiarity with material, rather than because of any relationship between that material and underlying emotion-related schemas (e.g. Dalgleish, 1995). Indeed, both the fact that the biased Stroop interference effect was present for season-related words as well as depression-related words, and the fact that the effect remained

when the SAD group were in remission/recovery, are in line with such a familiarity-based interpretation.

The advantage of a schema-based account of this type is that it does not rely on speculations concerning the existence of multiple, automatic, memory-specific mood repair processes. However, the main difficulty with a straightforward schema-based account is that, without advocating any process of mood repair, it is necessary to explain why mood congruent recall effects did not emerge in the present data as a function of depressed mood per se (irrespective of the nature of underlying schemas). Similar tasks to the present one have revealed mood-congruent memory effects associated with induced negative mood in healthy participants (e.g. Rusting, 1999) and so one might expect the level of negative mood in the SAD participants in the present study to have generated comparable findings. However, it is important to note that there are also examples of mood-induction studies that have not revealed mood-congruent recall effects (e.g. Gotlib & McCann, 1984), though these results may of course themselves be a function of some form of mood-repair process.

Finally, it is useful to note that a schema-based account is not necessarily mutually exclusive to the mood-repair hypothesis outlined earlier. It is possible that SAD is characterized by an absence of dysfunctional negative schemas as well as by automatic mood repair processes. After all, this combination would presumably be proposed for healthy, never-depressed individuals (e.g. Parrott & Sabini, 1993).

Irrespective of whether one favors a schema-based account, a mood-repair account, or a combination of both of these, as an explanation of the cognitive data in seasonal depression, the profile of cognitive processing in the disorder seems different to that in non-seasonal depression. This in turn would seem to suggest that the maintenance of psychopathology in seasonal depression has a different cognitive substrate to that in non-seasonal depression. This provides further support for the

conceptualization of SAD as a distinct depression subtype. However, care must be taken with respect to such relative statements as the present study did not include a non-seasonally depressed comparison group. Consequently, although there are strong arguments, grounded in the present data, for taking seriously the apparent lack of a mood-congruent memory effect in SAD (as outlined above), any comments regarding the relative performance of SAD and non-seasonal depressed samples must rest on comparisons across different studies.

Further research in this area is clearly warranted. One useful direction would be to examine mood and memory effects following a negative mood induction in SAD patients in remission. We know that such mood induction in remitted/recovered non-seasonal depression patients leads to an induced mood-congruent recall bias effect, over and above any effects of the mood induction on never-depressed controls, and that this induced memory bias has been interpreted as evidence of latent negative schemas (e.g. Teasdale & Dent, 1987). However, if mood-repair processes were predominant in SAD one might expect a negative mood induction to give rise to enhanced mood-incongruent recall, relative to a pre-induction baseline (cf. Parrott & Sabini, 1993; Rusting & DeHart, 2000). Such a study might therefore provide a direct test of the mood repair hypothesis. It would be important for any such future research to include both SAD and non-seasonal depression groups to overcome any problems that can arise from comparisons across different studies.

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Footnotes

1 – A power analysis was carried out for the recall task based on the Bradley & Mathews (1988) data. In that study the difference between clinically depressed and control participants on the relative number of negative versus positive self-referent adjectives recalled generated an effect size of 0.97. Using a directional alpha of .05 with 80% power, a sample size of 13 participants for each group was therefore indicated (Cohen, 1988).

2 - In the previous study examining adjective endorsement and course of depression in a non-seasonal sample (Dent & Teasdale, 1988), it was the absolute number of negative adjectives endorsed that was the significant independent predictor of outcome. Consequently, the regressions were repeated using this variable. However, the pattern of results was unaltered.

3 - The mean BDI scores for SAD participants in Study 2 are slightly lower than those in Study 1, despite the Study 2 sample consisting of in-patients and out-patients who one might expect to be more severely depressed. However, this difference was not statistically significant ($\underline{P} > .2$). Possible reasons why the Study 2 sample did not have significantly higher BDI scores than the Study 1 sample are, firstly, that the BDI is predominantly a measure of the cognitive symptoms of depression. It may therefore be that the Study 2 sample would be more severe on non-cognitive symptoms. Secondly, the Study 2 sample may have been receiving more appropriate treatment and this may have reduced their self-reported depression levels.

4 - A similar analysis with absolute numbers of words recalled across conditions (Bradley & Mathews, 1988) also revealed no significant Group by Valence interaction, $\underline{F}\ (1,26) = 1.52$, $\underline{p} > .2$.

5 - Matt et al. (1992) used an effect size known as h_s' (2 x arcsine $\sqrt{}$ proportion of positive responses) - (2 x arcsine $\sqrt{}$ proportion of negative responses; Cohen, 1998, p.

212) which gets around problems that arise through the pooling of standard deviations in studies with differential retrieval rates.

Table 1

Scores for the mood variables across groups in Experiment one.

	SAD (N=21)		Controls (N=20)	
	M	SD	M	SD
BDI - winter***[a]	21.50	13.84	2.20	2.93
BDI - summer	7.24	7.56	-	-
STAI-State - winter***	42.33	11.06	26.90	5.59
STAI-State- summer	30.67	9.67	-	-
HRSD-SAD - winter	32.00	11.01	-	-
HRSD-SAD - summer	6.86	6.53	-	-

Note

BDI = Beck Depression Inventory.

STAI-State = Spielberger State Trait Anxiety Inventory–State scale.

a = one of the SAD group did not complete this measure.

*** = groups significantly different at $p < .01$.

Table 2

Numbers of "yes" rated (endorsed) positive and negative words with reference to the self or the unfamiliar other, for the SAD and control groups, in Experiment one.

	SAD (N=21)		Controls (N=20)	
	M	SD	M	SD
SELF-NEGATIVE	5.43	3.09	1.10	1.55
SELF-POSITIVE	7.43	2.64	10.81	1.28
UNFAMILIAR-NEGATIVE	0.95	2.04	0.75	1.29
UNFAMILIAR-POSITIVE	8.43	2.66	7.95	3.35

Table 3

Absolute numbers and proportions (in parentheses) of words remembered across different conditions for the memory variables across groups, in Experiment one.

	SAD (N=21)		Controls (N=20)	
	M	SD	M	SD
UN-YES	0.38 (0.16)	0.97 (0.32)	0.45 (0.33)	0.60 (0.46)
UN-NO	1.57 (0.15)	1.08 (0.11)	3.05 (0.27)	1.85 (0.17)
UP-YES	2.19 (0.30)	1.12 (0.21)	3.60 (0.49)	1.76 (0.31)
UP-NO	1.19 (0.48)	0.93 (0.37)	1.30 (0.32)	1.30 (0.31)
SN-YES	2.05 (0.36)	1.20 (0.23)	0.65 (0.29)	0.93 (0.39)
SN-NO	2.71 (0.44)	1.45 (0.21)	4.30 (0.40)	1.66 (0.17)
SP-YES	3.48 (0.49)	1.69 (0.21)	5.80 (0.54)	1.99 (0.18)
SP-NO	2.29 (0.46)	1.49 (0.29)	0.70 (0.47)	0.66 (0.45)

Note

S = self

U = unfamiliar

P = positive

N = negative

YES = rated "yes"

NO = rated "no"

Table 4

Correlations between the indices of cognitive task performance and the continuous mood measures for the SAD participants in Experiment one. Sample sizes in parentheses.

	RECALL INDEX	ENDORSEMENT INDEX	NEGATIVE ATTRIBUTIONAL STYLE (NAS)
BDI	.07 (20)	.59** (20)	-.52* (16)
HRSD-SAD	.08 (21)	.25 (21)	-.34 (16)
STAI-State	.06 (21)	.49* (21)	-.53* (16)

Note

BDI = Beck Depression Inventory.

HRSD-SAD = Hamilton Rating Scale for Depression- SAD version

STAI-State = Spielberger State Trait Anxiety Inventory–State scale.

* significant at $p < .05$.

Table 5

Numbers of "yes" rated (endorsed) positive and negative words with reference to the self or the unfamiliar other, for the SAD and control groups, and the proportions of those words subsequently recalled (in parentheses), in Experiment two.

	Depressed (N=14)		Controls (N=14)	
	M	SD	M	SD
SELF-NEGATIVE	5.01 (.40)	3.48 (.31)	1.36 (.35)	1.73 (.39)
SELF-POSITIVE	7.93 (.49)	2.81 (.18)	10.93 (.57)	1.44 (.19)
UNFAMILIAR-NEGATIVE	1.86 (.18)	1.75 (.22)	1.00 (.40)	1.47 (.48)
UNFAMILIAR-POSITIVE	8.71 (.25)	2.67 (.20)	7.79 (.51)	3.77 (.34)

Figure 1

A comparison of an index of the relative number of self-referent negative versus positive words recalled (Recall Index) with an index of the relative number of such words endorsed in the study phase (Endorsement Index) of the memory task in Experiment one, for the depressed and control groups (negative scores indicate a bias in favor of positive words relative to negative words)