The accuracy of self-monitoring and its relationship to self-focused attention in dysphoria and clinical depression

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Date

June 2006

Running Head

Accuracy of self-monitoring in depression

Abstract

The accuracy with which dysphoric (Study One) and clinically depressed (Study Two) individuals make self-regulatory judgments about their own performance in the absence of external feedback and the extent to which this relates to trait self-focused attention (SFA) were examined. Relative to objective criteria, both dysphoric and depressed participants showed a positive judgment bias, overestimating the number of trials they had performed correctly. Relative to control participants, the dysphoric and depressed groups showed a reduction in the extent of this positive bias in that they judged error trials more accurately and correctly-performed trials less accurately. While the dysphoric and depressed groups both reported elevated trait SFA, this did not correlate significantly with accuracy of self-judgment on the performance-monitoring task. Implications for self-regulation models of depression are discussed.

(127 words)

Key words

Self-focused attention

Self-regulation

Depressive realism

Cognitive bias

Depression

Introduction

A key aspect in maintaining adaptive, goal directed behavior is successfully judging the extent to which current responses are fully meeting their objectives. Often there is not clear feedback available from the environment, and such judgments have to be based on some kind of internal comparison between the current status achieved and the ideal status imagined. This process has been described as 'self-regulation' (Carver & Scheier, 1981).

Normative models of self-regulation (e.g. Duval & Wicklund, 1972; Carver & Scheier, 1981, 1998) typically posit two stages in the maintenance of goal directed behavior. First, individuals engage in self-focused attention (SFA), where awareness is directed to self-referent, internally generated information as opposed to non self-referent, externally generated information. Second, individuals then proceed with self-monitoring, where actual status is compared to ideal status on one or more self-relevant dimensions using an iterative 'test-operate-test-exit' (TOTE) function (Miller, Galanter & Pribram, 1960). If the current status falls short of the ideal status in this comparison, individuals experience negative affect. This motivates them to change their behavior and then to re-examine whether there is a better fit between current and ideal status. This feedback cycle is typically exited when a sufficiently small discrepancy is found, therefore alleviating negative affect and allowing attention to be deployed elsewhere (Duval & Wicklund, 1972; Carver & Scheier, 1990; Silvia & Duval, 2001). There is a general assumption in these models that increasing the level of SFA raises the accuracy with which the output from the TOTE mechanism can be read, referred to as the 'perceptual accuracy hypothesis' (Silvia & Gendolla, 2001).

Self-regulation and judgment accuracy in depression

For individuals suffering from depression, such self-regulation seems to be particularly difficult. Depressed patients typically describe experiencing elevated negative affect, finding it hard to make decisions, struggling to carry through a plan of action, being self-focused, and tending to ruminate about the causes and consequences of their depression. All of these symptoms could potentially relate to self-regulation disturbances (Gotlib & Hammen, 1992). A challenge for clinical research is to elucidate how self-regulation may be going wrong in depressed states, both to aid theoretical understanding and to increase the efficacy of existing therapeutic interventions that target self-regulation disturbances.

A number of theorists have applied aspects of Carver and Scheier's control theory (1981) to model self-regulation difficulties in depression. Most notably, Pyszczynski and Greenberg (1985, 1986, 1987) proposed that depressed individuals are characterized by a chronic form of SFA that initially develops following the irretrievable loss of an important source of self-esteem (e.g. a relationship or a job) and then generalizes into an excessive self-focusing style in response to all negative outcomes. Such chronic SFA is believed to intensify negative affect, exacerbate internal attributions and self-criticism, lower self-esteem, impair behavioral performance, and build a negative self-image, therefore maintaining the depressed state. Similarly, Ingram (1990) has suggested that many forms of psychopathology (including depression) are related to "self-absorption", a rigid, excessive, sustained type of self-focus that the individual cannot shift out of in response to situational demands. Finally, Higgins (e.g. Higgins, 1987) has proposed that depression is characterized by elevated, chronic accessibility of negative actual-ideal comparisons[1].

Empirical studies have provided strong support for the notion that both sub-clinically and clinically depressed individuals do indeed show increased SFA at both a trait and state level (e.g. Ingram, Lumry, Cruet & Sieber, 1987; Smith & Greenberg, 1981; Ingram & Smith, 1984). Moreover, experimental elevation of state SFA in depressed individuals promotes negative affect, exaggerates negative attributions, and impairs problem solving (e.g. Gibbons et al., 1985; see Mor & Winquist, 2002, for a meta-analytic review). Conversely, focusing on positive or negative mood-eliciting events has been found to elevate levels of state SFA in dysphoria, suggesting a reciprocal relationship (Ingram & Wisnicki, 1999; Sloan, 2005).

As previously discussed, however, SFA is only one part of the core mechanism in self-regulation theory (Carver & Scheier, 1981, 1998). Once attention is internally engaged, the proposal is that individuals then make a comparison between actual state and ideal state to decide if behavior needs to be modified. For this comparison process to be adaptive, it is clearly necessary to be able to appraise accurately current status and how much this deviates from ideal status, when no source of external feedback is available (we shall henceforth refer to this process as *judgment accuracy*). Interestingly, theoretical approaches to depression (e.g. Pyszczynski & Greenberg, 1985, 1986, 1987) that have borrowed extensively from self-regulation models in the normative literature, despite placing considerable emphasis on the nature of SFA in depression, have tended to neglect questions regarding

judgment accuracy in the condition. Indeed, as far as we are aware, there have been no studies to date examining judgment accuracy in the context of self-regulation in depression.

It is possible that despite showing an elevated tendency to engage in SFA, depressed individuals may nevertheless show systematic biases in judgment accuracy similar to those that they exhibit in other cognitive domains (see Mineka, Rafaeli & Yovel, 2003, for a review of information processing biases in depression). Any such biases could potentially play an important role in maintaining depression, with consequent implications for treatment. For example, if depressed individuals show a negative bias (appraising current status as falling further short of ideal status than it really does) this could stop a TOTE mechanism being exited, therefore sustaining ongoing self-focus and maintaining negative affect. Further, a negative bias in judgment accuracy could encourage the premature termination of potentially effective behavioral attempts to resolve the discrepancy. The principal aim of the current study therefore was to extend existing research (and potentially theory) on self-regulation in depression by examining the accuracy of self-regulatory judgments in the disorder.

Predictions about judgment accuracy from depression theory

Different theoretical models make competing predictions about judgment accuracy in depression. Beck's cognitive theory (e.g. Beck, 1967, 2005; Beck, Rush, Shaw & Emery 1979) argues that symptoms of depression result in part from a systematic tendency to distort environmental information in a negative direction. These biases lead to a focus on information that confirms a negative view of the self, world, and future, and dismissal of data that would suggest a more positive view (see Mineka & Sutton, 1992; Mineka, Rafaeli & Yovel, 2003, for reviews). Beck's model would predict that depressed individuals should exhibit inaccurate, negatively biased, judgment accuracy. In contrast, the depressive realism framework (Alloy & Abramson, 1979; for reviews see Alloy & Abramson, 1988; Haaga & Beck, 1995) would hypothesize that people with depression are *more* rather than less accurate in their judgments.

One way to illustrate these alternate predictions from depression theory is to draw a distinction between different ways of conceptualizing judgment accuracy. Dobson and Franche (1989) differentiated between 'discrepancy' and 'distortion' analyses of cognitive tasks. Discrepancy analyses look at whether there is a significant difference between the judgment accuracy of depressed and non-depressed groups on a paradigm, therefore making it possible to infer if depression leads to a judgment

bias *relative to control participants*. Both depressive realism and cognitive theory would predict that depressed individuals should be negatively biased on discrepancy analyses.

Distortion analyses look at whether there is a significant difference between the judgment accuracy of depressed or non-depressed groups, relative to some *objective assessment* of task performance or to the predictions of probability theory. This distinction is necessary because it is increasingly apparent that healthy participants may actually be 'positively biased' rather than 'realistic' in their judgments, for example over-estimating their degree of control or success on an experimental task (e.g. Taylor & Brown, 1998; Baumeister, 1989; Mezulis, Abramson, Hyde & Hankin, 2004). While both models predict that healthy volunteers would be positively biased on distortion analyses (judging their performance as better than it actually was, therefore leading to an over-estimation of successes and an under-estimation of errors), they differ in their hypotheses relating to depression. A strict depressive realism position suggests that depressed individuals would be realistic (judging their own performance more or less in line with how well they were actually doing, therefore leading to accurate, even-handed estimation of both successes and failures). In contrast, classic Beckian cognitive theory predicts that depressed participants would exhibit a negative distortion (judging that they performed worse than they actually did, therefore over-estimating errors and under-estimating successes).

There have been some previous attempts to examine the contrasting predictions of cognitive theory and depressive realism, although these have not looked at judgment accuracy in the context of self-regulation and so cannot speak directly to control theory models of depression (e.g. Ingram, 1990). Moreover, the results of these studies to date have been mixed and inconclusive and it therefore remains an open question as to which model best characterizes depression. Dunning and Story (1991) asked student participants to predict their future behaviors and, at follow up, examined the accuracy of those predictions. Inconsistent with both theories, dysphoric students and control participants did not differ in the accuracy of their predictions regarding the occurrence of negative events in discrepancy analyses. Further, although in discrepancy terms the depressed group were indeed less accurate than the control group as regards positive events (as predicted by both theories), this was because, on a distortion analysis, dysphoric individuals surprisingly *overestimated* the likelihood of positive events occurring to a greater degree than did control participants, rather than because the dysphoric group

were negatively biased. In a very similar student study, Kapci and Cramer (1998) found that, in discrepancy terms, dysphoric participants were more accurate in their judgments about the experience of negative events than control participants (in line with both theories). However, this time there was no discrepancy between groups in accuracy concerning the experience of positive events.

Given the equivocal nature of this existing literature, it is both theoretically and clinically important to test the differential predictions of depressive realism and the Beckian cognitive model of depression more systematically. An advantage of the present study is that it allowed us to use distortion analyses of judgment accuracy in depression as a vehicle to contrast further the hypotheses generated from depressive realism (i.e. realistic accuracy judgments) and Beckian cognitive theory (i.e. negatively distorted judgments).

The relationship between judgment accuracy and self-focused attention

Another important and largely unexplored question with regards to self-regulation models of depression concerns the nature of the *relationship* between degree of SFA and judgment accuracy in the disorder. The 'perceptual accuracy hypothesis' in the normative literature (e.g. Silvia & Gendolla, 2001) would predict that elevated trait SFA should be *positively* associated with increased judgment accuracy. Further, this should lead to a consequent improvement in overall performance on a given task, since a central feature of self-regulation models is that ongoing behavior is calibrated on the basis of recent judgments. The logic behind this argument is presumably that people who habitually self-focus will be more practiced at reading the output of the TOTE mechanism than low trait SFA individuals who self-focus relatively less frequently.

However, it is debatable whether the perceptual accuracy hypothesis would apply to SFA in depression. It is increasingly realized that individuals may differ in their style of SFA and that some styles of SFA may be beneficial whereas others may be counter-productive. For example, an experiential mode of SFA has been shown to promote recovery from upsetting events, relative to a conceptual-evaluative mode of SFA (Watkins, 2004). As discussed earlier, depression appears to be particularly associated with a negative self-focusing style (e.g. Pyszczynski & Greenberg, 1987), characterized by conceptual-evaluative rather than experiential processing (Teasdale, 1999). This self-focusing style is believed to exacerbate negative affect and negative information-processing biases and impair decision-making. Therefore, in contrast to predictions derived from the perceptual accuracy

hypothesis, elevated SFA in depression may be *negatively* rather than positively related to judgment accuracy and subsequent performance improvement. This might arise because negative cognitive biases in depression lead to selective misreading of the output of any TOTE mechanism. Alternatively, SFA in depression may habitually be oriented more towards other aspects of internal state (including affect, ruminations, task-irrelevant thoughts and so on), thus deflecting attentional resources away from the output of any TOTE mechanism (Carver & Scheier, 1998).

In light of these different conceptualizations from the perceptual accuracy hypothesis and from the depression literature, the second aim of the current study was to explore the nature of any relationship between SFA and judgment accuracy in depressed individuals and control participants. In this initial study in this domain, we restricted our investigation to the role of trait SFA, measured using the Private factor of the Self Consciousness Scale (Fenigstein, Scheier & Buss, 1975)[2].

Operationalization of judgment accuracy in the context of self-regulation

Having mapped out the principal aims of the research and derived clear theoretical predictions about judgment accuracy and its relationship to SFA in depression, the next steps were to operationalize judgment accuracy in terms of a particular experimental paradigm and to articulate specific hypotheses.

There are clearly a number of aspects of self-regulation about which judgments can be made. Due to the well-documented sensitivity to failure information in depression (e.g. Beck, 1967; Pyszczynski & Greenberg, 1987) a fertile approach for revealing any biases or otherwise in judgment accuracy in the disorder is to examine whether depressed individuals can monitor their performance accurately on experimental tasks in the absence of external feedback (so called 'performance-monitoring' paradigms)[3]. Cybernetic models, analogous to those believed to underlie self-regulation, have been put forward to account for such performance monitoring (e.g. Scheffers & Coles, 2000; Smith, Shields & Washburn, 2003; although see Holyroyd, Yeung, Coles & Cohen, 2005, for an alternative account), suggesting they may rely on a common mechanism. Moreover, Silvia and Gendolla (2001), in their review of self-regulation research, recommended that judgment accuracy is best measured using tasks that can be categorically classified on the basis of both performance (completed correctly, completed wrongly) and judgment (judged accurately, judged inaccurately) (cf. Hastie & Rasinski, 1988). Performance monitoring paradigms match these guidelines. For these

reasons, we decided to index judgment accuracy in the present study using a performance-monitoring paradigm.

Although, to our knowledge, no studies have looked at judgment accuracy in this way in depression, there has been some investigation of *confidence ratings* regarding performance, using general knowledge and facial recognition tasks (e.g. Hancock, Moffoot & O'Carroll, 1996; Wood, Moffoot & O'Carroll, 1998; see also Stone, Dodrill & Johnson, 2001). Of course, confidence estimates concerning performance are different to judgment accuracy. Indeed, it would be possible to be very accurate in one's judgments yet have little confidence in them, and vice versa. Nevertheless, the finding of systematic differences in confidence estimates about performance between depressed individuals and control participants in these studies encourages the view that other forms of appraisal about performance (such as judgment accuracy) may reveal similar differences.

In terms of finalizing the choice of performance-monitoring paradigm for the present study, various methodological aspects of these confidence rating studies (e.g. Hancock et al., 1996) were also informative. For instance, the use of general knowledge and facial recognition tasks arguably made self-evaluation of task performance relatively easy in those studies, since people are likely to posses more comprehensive meta-cognitive knowledge about whether or not they know the answer to each item. One way around this problem is to use a more novel performance measure. Furthermore, it seems likely that confidence estimates (and potentially therefore other forms of judgment) may be influenced by task difficulty. One way to mitigate against this potential confound is to titrate task difficulty, so that all participants are kept close to their performance ceiling. Such titration can then also be used to ensure that participants complete around half of the trials correctly and half incorrectly, thus preventing any imbalance between success and failure rates from influencing judgments.

The present studies

In the present studies, therefore, we asked participants to carry out a novel task about which they should have little a priori meta-cognitive knowledge - a spatial span working memory task. They were asked to judge after each trial on this task whether they had performed correctly or incorrectly, in the absence of any external feedback. Furthermore, to ensure that the performance judgment was equally difficult for all participants, the span length of each trial was kept close to each participant's maximum capacity using a titration approach (see Method section of Study One). Moreover, titration

was calibrated to provide around 50% success across all trials for each participant. We then analyzed the data in terms of both distortion and discrepancy and related the findings to the Private factor of the SCS (Fenigstein et al., 1975).

The first study investigated these issues in dysphoric participants and control volunteers. We had six hypotheses. Our first hypothesis was that dysphoric participants would show a negative bias in judgment accuracy on the memory span task in *discrepancy* analyses; specifically, that they would judge they had performed more trials incorrectly than did control participants (as predicted by both depressive realism and Beck's cognitive model). The second hypothesis, again in line with both theories, was that the control group would be positively biased in within-subjects *distortion* analyses (overestimating the number of trials they had performed correctly compared to the number they had actually performed correctly). The third hypothesis, as predicted by Beckian cognitive theory but not depressive realism, was that the dysphoric group would show inaccurate judgment in within-group *distortion* analyses, under-estimating the number of trials they had performed correctly relative to the number they had actually performed correctly. We further predicted that this negative bias on both distortion and discrepancy analyses would lead the dysphoric group to detect more accurately when they had made a mistake and detect less accurately when they had been successful, relative to control participants (Hypothesis 4). The fifth hypothesis was that dysphoric participants would report elevated levels of chronic SFA compared to control participants - the standard finding in the literature (cf. Smith & Greenberg, 1981; Ingram & Smith, 1984). Finally, we predicted that the relationship of SFA with both judgment accuracy and overall task performance would be significant and positive in control participants, as well as being stronger than in dysphoric participants, in line with the respective normative (i.e. the perceptual accuracy hypothesis) and depression literatures (Hypothesis 6).

Study One

Method

Participants

Twenty people with a Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock & Erbaugh, 1961) score greater than 15 (“moderately to severely depressed”; Shaw, Vallis & McCabe, 1985) comprised the dysphoric group. Twenty people with a BDI score less than 10 (“non-depressed”;

Shaw et al., 1985) comprised the control group[4]. All participants were between 18 and 65 years of age. Participants were excluded if they had a history of brain injury, psychosis, learning disability, or substance abuse problems. Groups were group-matched for age, gender and estimated IQ according to the National Adult Reading Test (NART; Nelson, 1982) (see Table 1). The dysphoric group was recruited by advertisement in a local newspaper and participants were screened for presence of low mood symptoms and exclusion criteria over the telephone using a brief semi-structured interview prior to inclusion in the study. Seven participants in the dysphoric group had been diagnosed with clinical depression by their general practitioners and were taking Selective Serotonin Reuptake Inhibitors (SSRIs). One participant was taking St John's Wort.

The control participants were recruited from the MRC CBU panel of community volunteers. They were screened for exclusion criteria over the telephone prior to inclusion in the study. The interviewer also asked control participants if they had sought or received assessment or treatment for mental health problems from a health care professional in the past year and whether they thought they were currently suffering from any mental health problems. If they answered yes to either of these items, additional questions were asked to clarify whether this was a clinically significant problem. In practice, no participants with a BDI score less than ten reported a current clinically significant problem so no further exclusions were necessary. All participants were tested on the same day that the BDI was administered. All participants provided written informed consent prior to the experimental session, and were reimbursed £5 (around US $8) per hour for their time. The study was approved by the University of Cambridge Psychology Research Ethics Committee.

Performance-monitoring task

To assess judgment accuracy, participants were asked to evaluate their performance on a variant of the Corsi block tapping spatial span paradigm (Milner, 1971). On each trial eight boxes were shown in fixed random positions on the screen and a variable number of these boxes changed color one by one in a randomized order. Participants were asked to remember the order in which the boxes changed color and to repeat this sequence by clicking each box in turn with the mouse when prompted at the end of the trial. To assess how well participants could monitor their performance, they were then asked to judge whether they had repeated each span correctly or incorrectly. No feedback on the accuracy of either performance or judgments was provided, to ensure that judgment accuracy was

based on internal monitoring processes and not biased by exogenous sources of information. Participants were not informed that the primary purpose of the task was to explore judgment accuracy, and at face value the goal of the task was to measure memory span. Therefore, it is unlikely that the task served as a state self-focus induction.

Task difficulty was titrated so that underlying span performance did not confound judgment accuracy. Following success on a trial the span increased by one and following failure on a trial the span decreased by one, in order to keep participants at the upper limits of their performance capability. This contingency was not explained to participants and none reported observing that span length related to the accuracy of performance when questioned about it after the experiment. The minimum span on each trial was one and the maximum span was eight, although in practice very few participants reached these limits. Each participant completed two practice trials and 20 experimental trials. The span for the first experimental trial was always five.

Each trial on the performance-monitoring task was classified as a function of participants' performance and judgment accuracy. Trials performed correctly and judged as correct were called 'correct – correct' (CC). Trials where a mistake was made and that were judged as wrong were called 'wrong – wrong' (WW). Trials where no mistakes were made but the trial was judged as incorrect were labeled 'correct-wrong' (CW). Trials performed wrongly and judged as correct were designated 'wrong-correct' (WC). Analysis explored how well the spans were reproduced (performance accuracy) and how well participants could evaluate their own performance on each trial (judgment accuracy).

Self-report of self-focused attention

The Private factor of the Self-Consciousness Scale (SCS; Fenigstein et al., 1975; Carver & Glass, 1976; see Gohm & Clore, 2000, for a review) was used to assess trait levels of self-focus. Private self-consciousness is the extent to which individuals focus on psychological aspects of themselves and closely resembles how SFA is conceptualized in cybernetic models of self-regulation (Duval & Wicklund, 1972; Carver & Scheier, 1981, 1998). It is measured by asking participants to evaluate to what degree a series of ten statements about self-attention (e.g. "I'm always trying to figure myself out") are true of them on a scale ranging from 0 (extremely uncharacteristic) to 4 (extremely characteristic).

Procedure

Participants were screened, the NART was administered, and they were then given the BDI and the SCS. They also completed the Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983), a 14 item brief self-report questionnaire that measures the presence and severity of anxiety (seven items) and depression (seven items) symptoms over the past week. Further, participants filled in the Spielberger State Trait Anxiety Inventory (STAI; Spielberger, 1983), which consists of two 20 item scales measuring state (current experience) and trait (stable predisposition) anxiety. Measures of anxiety as well as depression were included since these conditions are often comorbid with one another and we wished to investigate the relative contributions of anxiety and depression symptoms to judgment accuracy. After completing a series of other questionnaire measures and experimental tasks not reported here, volunteers were then given the performance-monitoring task. Testing took place in a quiet, softly lit room, with participants seated in a comfortable chair facing the computer monitor. The performance monitoring task was programmed in Microsoft Visual Basic 6.0 (Microsoft, 2000) and presented on a Pentium 300 computer with a 15” monitor.

Results

All analyses reported are two-tailed with alpha set at 0.05, unless otherwise stated.

Group comparison

Dysphoric participants had significantly greater scores on the BDI, HADS Anxiety factor, HADS Depression factor, and Spielberger State and Trait Anxiety scales, compared to the control group (see Table 1). As intended, the groups were comparable in terms of age and NART estimated intelligence and had identical gender ratios (57% female in both groups).

Judgment accuracy

Figure 1 presents the proportion of CC, WW, CW and WC trials produced by each group and the left hand side of Table 2 summarizes other performance and judgment accuracy measures on the task. Exploratory analysis revealed that NART estimated intelligence was significantly correlated with a number of these measures of judgment accuracy. To reduce the likelihood that this correlation was reducing the sensitivity of our depression comparisons, NART estimated intelligence was therefore entered as a covariate in all subsequent between-group and correlational analyses of judgment

accuracy data. Analysis of covariance (ANCOVA) found that the performance levels of the dysphoric and control groups was comparable, with no significant differences emerging for mean memory span, $F(1, 37) = 1.48$, $p = .23$, or proportion of spans performed correctly, $F(1, 37) < 1$. Further, both groups performed around half of the trials correctly, suggesting that the task titration was successful. There was no difference in how long dysphoric and control participants took to judge whether they had performed a trial correctly, $F(1, 37) < 1$.

Judgment *discrepancy* was indexed by computing the proportion of trials judged as correct, regardless of actual performance ([CC trials + WC trials]/total trials). There was clear support for our first hypothesis that dysphoric participants would show a negative judgment bias on this index relative to control participants, $F(1, 37) = 6.97$, $p = .01$, Cohen's f (Cohen, 1988) = .44, in line with predictions from both Beck's cognitive model (Beck, 1967) and depressive realism (Alloy & Abramson, 1979).

Judgment *distortion* was indexed by contrasting the proportion of spans *actually* performed correctly with the proportion of spans *judged* by participants to have been performed correctly, using a paired sample t-test for each group separately. There was a significant difference between estimated and actual performance in the control group, $t(19) = 7.35$, $p < .01$, Cohen's d (Cohen, 1988) = .77. Control participants over-estimated the number of trials they performed correctly (a positive distortion), in line with the predictions of depressive realism and Beckian cognitive theory and therefore supporting our second hypothesis. Contrary to Hypothesis 3, however, the dysphoric group also *overestimated* the number of trials they had performed correctly, $t(19) = 3.60$, $p < .01$, $d = .50$, indicating that dysphoric individuals were also exhibiting a positive distortion bias. To measure if the magnitude of this positive distortion varied across the groups, the proportion of spans performed correctly was subtracted from the proportion of spans judged as correct and this difference variable was analyzed in a between groups ANCOVA. This revealed that the control group had a significantly greater positive bias on distortion analyses than the dysphoric group, $F(1, 37) = 6.01$, $p = .02$, $f = .40$.

To examine Hypothesis 4, the proportion of correctly performed trials accurately judged (CC/[CC + CW] trials) and the proportion of incorrectly performed trials accurately judged (WW/[WW + WC] trials) were computed. ANCOVA then compared the two groups on each of these variables separately. Supporting Hypothesis 4, the dysphoric group judged a *greater* proportion of

wrongly performed trials accurately as predicted, $F(1, 37) = 6.02$, $p = .02$, $f = .40$, and tended to judge a *smaller* proportion of correctly performed trials accurately, $F(1, 37) = 4.32$, $p = .05$, $f = .35$, relative to the control group[5].

To examine whether the performance-monitoring task findings were an artifact of medication status, the analyses were repeated using only the subgroup of dysphoric participants who were not taking anti-depressant medication ($n = 13$). A broadly similar pattern of findings emerged with comparable effect sizes. The dysphoric group showed a negative judgment bias on discrepancy analyses, $F(1, 29) = 5.45$, $p = .03$, $f = .44$. On distortion analyses, dysphoric individuals overestimated how many trials they had performed correctly, $t(12) = 2.40$, $p = .03$, $d = .48$, but to a lesser extent than control participants, $F(1, 29) = 4.57$, $p = .04$, $f = .04$. Moreover, they judged a smaller proportion of correctly performed trials accurately, $F(1, 29) = 5.00$, $p = .03$, $f = .42$, and tended to judge a greater proportion of wrongly performed trials accurately, $F(1, 29) = 3.80$, $p = .06$, $f = .36$. This suggests that the findings are not due solely to the effects of anti-depressant medication.

SFA and its relationship to judgment accuracy

The mean scores for the control and dysphoric groups on the Private factor of the SCS are reported in the bottom half of Table 1. Supporting Hypothesis 5, the dysphoric group scored higher on Private SFA, relative to the control group. To test the final hypothesis that there would be an association between self-report measures of SFA and judgment accuracy, partial correlations (partialling out NART estimated intelligence) looked at the relationships between the key monitoring task variables and the Private factor of the SCS (see left hand side of Table 3). The significance criterion was set at .01 to partially control for multiple comparisons. Given our prediction that the patterns of correlations could be different across the dysphoric and control groups, these analyses were conducted for each group separately. None of the partial correlations was significantly different from zero, therefore not supporting Hypothesis 6[6].

Discussion

Study One investigated judgment accuracy associated with the TOTE self-regulation mechanism (Duval & Wicklund, 1972; Carver & Scheier, 1981, 1998) in dysphoria by asking participants to evaluate their performance on a memory span task in the absence of any external feedback. Further, to ensure that the judgment of performance was not trivial, the memory span for

each participant was titrated to remain close to his or her maximum capacity. The fact that the mean number of spans performed correctly in each group was around fifty percent indicates that this titration was successful.

The first hypothesis that judgment accuracy in dysphoria would be associated with a negative processing bias in discrepancy analyses was supported, consistent with both the classic cognitive model of depression (Beck, 1967, 2005; Beck et al., 1979) and depressive realism (Alloy & Abramson, 1979). The dysphoric group judged they had made more mistakes and completed fewer trials correctly overall, relative to the judgment of the control group, despite the fact that both groups performed equivalently on the memory task. Within-subjects distortion analyses found that the control group showed positively distorted judgment accuracy in objective terms (over-estimating how many trials they had performed correctly relative to objective criteria), therefore supporting Hypothesis 2. Unexpectedly, the dysphoric group also showed a positive distortion bias, inconsistent with Hypothesis 3. This finding is inconsistent with the predictions from both Beckian cognitive theory (which predicts a negative distortion bias in objective terms) and strict depressive realism (which predicts accurate judgment in objective terms) in dysphoria. The fourth hypothesis that the dysphoric group would show more accurate judgment on error trials and less accurate judgment on success trials, relative to control participants, was supported (in line with the predictions of cognitive theory; Beck, 1967, 2005). These overall patterns of data do not appear to be an artifact of anti-depressant medication status, since identical findings emerged when looking at the sub-group of dysphoric participants who were medication free.

The fifth hypothesis that dysphoria would be characterized by elevated trait SFA on a self-report measure (Private SCS) was supported, replicating earlier findings of elevated SFA in dysphoria and depression (Smith & Greenberg, 1981; Ingram & Smith, 1984; Ingram et al., 1987). Contrary to Hypothesis 6, no significant associations were found between Private SCS and judgment or performance accuracy on the performance-monitoring task.

This overall pattern of findings suggests that self-regulation in dysphoria is characterized by elevated chronic levels of SFA and altered accuracy of the TOTE mechanism, at least when considering performance monitoring on cognitive tasks. Accuracy of self-regulation judgments in dysphoria can be characterized as negatively biased in a discrepancy sense, where dysphoric

individuals estimate they have performed fewer trials correctly overall, relative to control participants. However, in a distortion sense, dysphoria was surprisingly associated with a positive judgment distortion in objective terms (albeit reduced relative to control participants). This overall pattern means that dysphoric individuals judge mistakes more accurately and successes less accurately, compared to control participants.

Before generalizing these conclusions to depression more globally and to clinical presentations of depression in particular, however, some caution is warranted. It has been argued that findings that emerge in dysphoric samples are not always replicated when studying clinically depressed populations (Haaga & Beck, 1995). It may therefore be the case that the finding of a positive judgment distortion in dysphoria would not be replicated in clinical depression. Indeed, we know of no studies that have shown a positive bias in the domain of self-evaluation in clinically depressed individuals. Clinically depressed participants may therefore show the negative judgment distortion that classic cognitive theory (Beck, 1967, 2005) would predict. To examine this important question, it was decided to repeat Study One with groups of clinically depressed individuals and never-depressed control participants. The hypotheses in Study Two were broadly the same as for Study One. However, Hypothesis three was appropriately refined on the basis of the Study One data to predict a positive judgment distortion in the depressed sample on the within-subject distortion analysis.

Study Two

Method

The task, procedure and analysis were as described in Study One.

Participants

25 people diagnosed with a current Major Depressive Disorder (MDD) according to the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV; American Psychiatric Association [APA], 1994) were compared to 25 never-depressed control participants. MDD diagnosis was ascertained using the Structured Clinical Interview for DSM-IV (SCID; First, Spitzer, Gibbon & Williams, 1994). Twenty-four individuals were outpatients and one was an inpatient, all recruited from a hospital psychiatric clinic (the Fermoy Unit, Kings Lynn, UK) by a consultant psychiatrist. Nine had

a pure diagnosis of MDD (all female), 10 had marked anxiety symptoms but did not meet diagnostic criteria for any anxiety disorders (5 females; 5 males), and 6 had comorbid Panic Disorder (3 females; 3 males). All of the depressed patients were using anti-depressant medication: SSRIs (n = 16); SSRIs and anxiolytics (n = 4); SSRIs and tri-cyclics (n = 2); tri-cyclics and anxiolytics (n = 3). The depressed sample was moderately to severely depressed, according to the 21 item Hamilton Depression Rating Scale (HDRS, Hamilton, 1960), Mean = 21.40; SD = 5.45. All depressed participants were tested within two weeks of diagnostic assessment.

The never-depressed control participants were recruited from the MRC CBU participant panel. Those with a BDI score greater than 10 or with past or current MDD or dysthymia based on SCID assessment were excluded. The same exclusion criteria were used as in Study One and all participants were screened over the telephone with a brief semi-structured interview prior to participation. All participants provided written informed consent prior to the experimental session. Control participants were given £5 (around US $8) per hour for their participation in the study and the depressed participants had their travel expenses reimbursed. The study was approved by the Cambridge and Kings Lynn NHS research ethics committees.

Results and discussion

Group comparison

The depressed group had significantly greater scores on the BDI, HADS Depression and Anxiety factors, and the Spielberger State and Trait scales, compared to control participants (see Table 4). As intended, the two groups did not significantly differ on age and had identical gender ratios (68% female for both samples). There was a non-significant trend for the depressed group to demonstrate a lower NART estimated verbal IQ than the control group (at $p = .08$). To control for the possibility that this IQ difference was driving any group differences in SFA and judgment accuracy and to replicate the analyses from Study One, NART estimated intelligence was therefore covaried out of all subsequent analyses.

Performance-monitoring task

The data on the spatial span task were analyzed exactly as in Study One. The right-hand side of Table 2 summarizes performance on the task and Figure 2 shows the mean proportion of CC, CW, WW, and WC trials generated by participants in each group. One participant's data from the depressed

group were set aside as s/he had performed at floor on the task (a mean span of two), meaning that the judgment data were compromised.

In terms of performance accuracy, there were no group differences in mean memory span, $F(1, 46) < 1$, mean judgment latency, $F(1, 46) = 1.39$, $p = .24$, or mean number of trials performed correctly, $F(1, 46) < 1$. Further, both groups performed around half of the trials correctly (control: mean = .52, SD= .04; depressed: mean = .51, SD = .02), indicating that the task titration had been successful.

Replicating Study One, *discrepancy* analysis found that the depressed group estimated that they had performed a smaller proportion of trials correctly overall, relative to the judgment of the control group, $F(1, 46) = 9.57$, $p < .01$, $f = .46$. This suggests that depression is associated with a negative judgment discrepancy bias, relative to the judgment of control participants.

Also replicating Study One, *distortion* analyses found that both the control, $t(24) = 12.32$, $p < .01$, $d = .84$, and depressed, $t(23) = 3.43$, $p < .01$, $d = .46$, groups overestimated how many trials they performed correctly. Again, this positive bias distortion was more marked in the control group, $F(1, 46) = 8.11$, $p < .01$, $f = .42$. The depressed group judged a smaller proportion of correctly performed trials accurately, $F(1, 46) = 5.12$, $p = .03$, $f = .33$, and judged a greater proportion of wrongly performed trials accurately, $F(1, 46) = 7.99$, $p < .01$, $f = .40$, relative to control participants.

Self-focused attention and its relationship to judgment accuracy

As in Study One, the depressed group had significantly greater scores on the Private factor of the SCS (see bottom half of Table 4). Replicating Study One, no individual partial correlations were significantly different from zero, therefore not supporting Hypothesis 6[7].

In summary, Study Two produced a strikingly similar pattern of findings to that demonstrated in Study One, suggesting that clinical depression is also evidenced by a negative judgment bias in discrepancy terms, yet a reduced positive judgment bias in distortion terms, relative to the performance of control participants.

General Discussion

The primary aim of the current research was to investigate, for the first time, the accuracy of self-regulatory judgments in depressed states, using a novel performance-monitoring task. As predicted, both dysphoric (Study One) and clinically depressed (Study Two) participants showed negatively biased judgment accuracy concerning their task performance according to discrepancy analyses (where performance was contrasted with that of control groups, without consideration of objective performance measures). This supports the claims of both Beckian cognitive theory (Beck 1967, 2005; Beck et al., 1979) and depressive realism (Alloy & Abramson, 1979, 1988). However, contrary to the strict predictions of either model, both dysphoric and depressed participants actually displayed a *positive* bias according to within-subjects distortion analyses (where judgment accuracy was contrasted with objective measures of task performance), overestimating the number of trials that they had performed correctly.

To the best of our knowledge, this is the first evidence that clinically depressed participants can be positively biased on self-related judgments in objective distortion terms. This positive distortion bias was nevertheless less marked than that found in control participants. Effect sizes for these key findings were medium to large (Cohen, 1988). Importantly, an identical pattern of results emerged in both Studies 1 and 2, suggesting that the findings are robust and replicable[8].

This finding of a marked positive distortion bias in both dysphoria and depression poses a challenge to the classic cognitive model of depression (Beck, 1967, 2005; Beck et al., 1979), which would predict that depressed states are characterized by a global negative distortion bias. This result is also problematic for a 'strict' depressive realism account (Alloy & Abramson, 1979, 1988), which would argue that depressed states are associated with accurate, non-biased self judgments. The data arguably would fit with a 'weak' or 'relative' depressive realism position, since the positive distortion bias in dysphoria and depression is smaller, albeit still positive, than that shown by control participants.

One possible way to explain an attenuated positive judgment bias in depression is to speculate that healthy individuals exhibit variable distortion biases (ranging from positive to realistic to negative) across different information processing domains and that, although the *profile* of biases may be largely preserved in depression, a general negativity is super-imposed on top of them (Stone et al.,

2001). By this analysis, depressed individuals will demonstrate (attenuated) positive biases, negative biases, or 'realism' depending on the task or situation at hand. This suggests that apparently realistic self-judgments in depressed states (e.g. Alloy & Abramson, 1979) may not reflect increased *insight* into the self (Coyne & Gotlib, 1983; Stone et al., 2001) but may instead be the net result of two opposing biases with no true gains in judgmental ability (see Keren, 1990, for a discussion of this issue).

There are a number of other clinical and theoretical implications of the finding of a positive distortion bias associated with depressed states. Should the positive distortion bias demonstrated in the present study be shown to extend to the kind of problems that depressed clients bring into therapy, a clinical ramification would be that in some instances it may actually be counter-productive to use the 'reality-testing' techniques of classic cognitive therapy for depression (e.g. see J.S. Beck, 1995). In instances where depressed individuals evidence positive distortions, encouraging them to systematically evaluate how much their model of the world corresponds to 'reality' could potentially further exacerbate rather than alleviate depressed mood. This would suggest that clinicians may need to be selective in their use of these techniques, rather than applying them globally[9].

The present findings are also potentially significant for theoretical models of self-regulation in at least two ways. First, they suggest that healthy individuals are poor at reporting ideal-actual discrepancies on the type of performance monitoring task used here, routinely over-estimating how well they are doing. This presents something of a challenge to cybernetic models of self-regulation (Duval & Wicklund, 1972; Carver & Scheier, 1981, 1998), since it is uncertain how such an inaccurate mechanism could *adaptively* maintain goal directed behavior. Systematically regulating behavior on the basis of inaccurate, positively biased ideal-actual discrepancies could potentially lead to the protracted maintenance of unhelpful responses that do not allow the individual to appropriately respond to the demands of the environment. For example, depressed individuals could continue to ruminate because they inaccurately judge that this is an effective way to improve their mood.

Second, the current data suggest that biases in judgment accuracy are unlikely to be a sufficient explanation as to why dysphoric and depressed individuals become locked in dysfunctional self-regulatory cycles (Ingram, 1990; Pyszczynski & Greenberg, 1987). The sort of positive bias revealed here would at face value suggest that depressed individuals should prematurely exit TOTE

cycles, rather than become enmeshed in them. The challenge therefore is perhaps to search for other causes that could maintain protracted self-focus in depression. One possible explanation is that depressed individuals may hold rigidly perfectionist or unachievable desired goal states (cf. Enns & Cox, 1999), for example expecting themselves to perform all tasks perfectly. Therefore, even if depressed individuals perceive their performance as better than it really is, they may still judge this to be inadequate compared to their ideal state and thus enter ruminative self-regulatory cycles. Additionally, recent revisions of cybernetic models describe how self-regulation involves monitoring the rate of progress towards the desired goal state in addition to the degree of the discrepancy between desired and current state (e.g. Carver & Scheier, 1998). Therefore, depressed individuals may still become locked in self-regulatory cycles even when over-estimating their performance if they perceive the rate of progress towards the desired state as too slow. Another possibility is that depressed individuals may differ in the inferences they make when they detect a discrepancy in the TOTE cycle. For example, a stable, global attribution style in response to negative events might lead to the conclusion that the discrepancy is highly unlikely to be resolved and will impact on broad aspects of life, therefore further exacerbating ruminative self-focus (Abramson et al., 2002).

Finally, it is of some clinical and theoretical interest that an identical pattern of results emerged in the present data in both dysphoric and clinically depressed individuals. This does not support assertions that dysphoria is invariably characterized by a different, less negative pattern of information processing (for this domain of cognition at least) and is therefore not a valid model for investigating clinical depression (e.g. Haaga & Beck, 1995). Instead, it offers some support for dimensional rather than categorical classifications of depression (e.g. Watson, 2005) and suggests that studying sub-clinical presentations of depression such as dysphoria may, in some circumstances, be a valuable aid to enhancing understanding of clinical depression.

Across both studies the reduction in the magnitude of the positive distortion bias in depressed states was a function of the dysphoric and depressed groups making more accurate judgments following mistakes but less accurate judgments following successful performance, relative to control participants. Consistent with these results, signal detection analyses found that the depressed and dysphoric participants displayed a more conservative response bias but did not differ in the accuracy (d-prime) of their self regulatory judgments, compared to control participants.

This finding of less accurate judgment following success in dysphoric and depressed groups compared to control participants partly replicates results from earlier studies looking at feedback perception (Hancock et al., 1996; Wood et al., 1998). Slightly at odds with the present results, however, these earlier studies found no difference between depressed groups and control participants in confidence ratings following mistakes on general knowledge tasks. As discussed in the Introduction, two methodological aspects of study design may explain this discrepancy in findings. First, the earlier studies used confidence ratings, which may index generic self-esteem rather than any kind of judgment accuracy. Second, on the general knowledge and facial recognition tasks that participants completed in these earlier studies, errors were perhaps more transparent to judge than they were on the spatial span task used in the current studies. This may have meant that all participants were performing closer to ceiling in error judgments in the earlier studies, potentially masking group differences. Adopting a titration approach in the present studies meant that all participants remained close to their spatial span capacity, therefore making judgments about task performance more ambiguous. In addition, the earlier studies used small sample sizes (largest n = 14), giving a higher chance of a Type II error. Group differences in error monitoring may have emerged if greater statistical power were available.

The demonstration of superior accuracy regarding errors in dysphoric and depressed individuals compared to control participants, while at face value offering some support for the depressive realism perspective (Alloy & Abramson, 1979, 1988), seems unlikely to reflect genuine elevations in judgment accuracy. While the dysphoric and depressed participants were more accurate at detecting mistakes relative to control volunteers, in objective terms their error detection rate was actually still close to chance (57 percent accuracy in the dysphoric group; 50 percent accuracy in the depressed group).

The second aim of the current research was to examine, for the first time to our knowledge, the relationship between trait self-focused attention (SFA) and judgment accuracy in a self-regulation context in dysphoria and depression. As expected, both dysphoria (Study One) and depression (Study Two) were found to be characterized by elevated reports of trait SFA on the Private subscale of the SCS (Fenigstein et al., 1975), replicating earlier findings of elevated trait and state SFA in these conditions (e.g. Smith & Greenberg, 1981; Ingram & Smith, 1984; Ingram et al., 1987). Contrary to

the perceptual accuracy hypothesis (Silvia & Gendolla, 2001), however, there was no support for the idea that degree of SFA and accuracy of TOTE judgments would be positively correlated, even in the healthy participants. Indeed, there was no significant relationship between SFA and any measures of judgment accuracy on the performance-monitoring task in either study[10].

It is important to outline some limitations of the current studies. First, asking participants to evaluate how well they had done on an experimental task in the absence of external feedback indexes only one aspect of judgment accuracy. A challenge for future research is to identify other ways in which the accuracy associated with different forms of self-regulatory judgments can be externally verified to see if these results generalize to other domains of self-evaluation.

Second, the lack of any significant association found between SFA and judgment accuracy may be due to the selection of the Self Consciousness Scale (Fenigstein et al., 1975) to measure SFA. The psychometric properties and factor structure of the SCS have been criticized (see Mor & Winquist, 2002) and its items may not fully capture the quality of SFA as conceptualized in depression. Depression appears to be particularly associated with a ruminative, negative self-focusing style following failure (e.g. Nolen-Hoeksema, 1991), which may not be reliably indexed by the SCS. The failure to find significant correlations may also relate to the small sample sizes available (ns <= 25 in each group), meaning that the analyses had relatively low statistical power. Therefore, it is premature to abandon the hypothesis that elevations in levels of SFA are associated with greater judgment accuracy solely from the current data. To explore the validity of the perceptual accuracy hypothesis more conclusively, additional studies are required that relate judgment accuracy to other measures of SFA and that use larger sample sizes. These studies should particularly include state measures of SFA (e.g. the Situational Self Awareness Scale; Govern & Marsch, 1991) and perhaps also scales more explicitly examining style of SFA (e.g. the Ruminative Responses scale of the Response Styles Questionnaire; Nolen-Hoeksema & Morrow, 1991).

Third, around one third of the dysphoric and all of the depressed participants were on anti-depressant medication and the effect that this had on the data is not clear. However, analysis of the subgroup of dysphoric participants not taking anti-depressant medication produced an identical pattern of results to those for the whole sample, with comparable effect size estimates. Fourth, the samples in

the two studies were of mixed gender and the sample sizes were not such that the effect of gender could be examined reliably.

Fifth, it remains an open question as to whether the present results are primarily driven by depressive symptoms, anxious symptoms, or some combination of the two. Both the dysphoric and depressed groups reported high levels of anxious symptoms and there was substantial anxiety disorder co-morbidity in the clinical sample. This reflects the overlap often found clinically and postulated theoretically between anxiety and depression (e.g. Clark & Watson, 1991; Mineka, Watson & Clark, 1998). Further studies looking at the relative contributions of depression and anxiety symptoms to the judgment accuracy profile found in depressed states are clearly needed. One approach would be to use mood measures that distinguish between anxiety specific symptoms, depression specific symptoms and symptoms common to both anxiety and depression (e.g. the Mood and Anxiety Symptoms Questionnaire; Watson & Clark, 1991, Watson et al., 1995).

In conclusion, it was shown across two studies that depressed states are characterized by an altered self-regulatory style on measures of both judgment accuracy and SFA. Dysphoric (Study One) and depressed (Study Two) individuals surprisingly showed a clear *positive* distortion bias when making self-regulatory judgments. This bias was attenuated in the dysphoric and depressed samples, relative to the judgment of control participants, as a function of more accurate assessment of when a mistake had been made alongside less accurate appraisal of when a correct response had been given. Depressed and dysphoric individuals also reported elevated trait levels of SFA but this was not clearly related to judgment accuracy, contrary to the perceptual accuracy hypothesis. This hints at the possibility that SFA and judgment accuracy may be dissociable aspects of the self-regulation mechanism, though more research is clearly needed. The finding of a positive bias in judgment accuracy in depressed states poses a challenge to the classic negative bias characterization of depression in Beckian cognitive theory.

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Tables

Table 1

Demographic and clinical characteristics of participants in Study One (Control and Dysphoric Groups).

Variable	Control (n = 20)	Dysphoric (n = 20)	Comparison	Effect Size (d)
Age (in years)	46.9 (12.4)	40.2 (14.8)	t (38) = 1.55, p = 0.13	0.49
NART Verbal IQ	118.0 (4.2)	115.7 (6.4)	t (38) = 1.38, p = 0.18	0.42
% Female	70	70	-	-
BDI	5.0 (2.6)	21.7 (7.9)	t (38) = 9.06, p < 0.01	2.84
STAI – State	30.5 (6.2)	48.6 (12.1)	t (38) = 5.96, p < 0.01	1.89
STAI – Trait	37.1 (6.9)	59.5 (9.0)	t (38) = 8.83, p < 0.01	2.79
HADS – Depression	2.1 (1.5)	9.2 (3.8)	t (38) = 7.75, p < 0.01	2.46
HADS – Anxiety	5.1 (2.1)	12.5 (4.4)	t (38) = 6.73, p < 0.01	2.15
SCS – Private	21.2 (5.3)	25.8 (6.3)	t (38) = 2.53, p < 0.01	0.79

Note -

Data are mean (standard deviation) values unless specified. NART = National Adult Reading Test; BDI = Beck Depression Inventory; STAI = Spielberger State Trait Anxiety Inventory; HADS = Hospital Anxiety and Depression Scale; SCS = Fenigstein Self-Consciousness Scale.

Groups compared using independent sample t-tests. Effect size calculated using Cohen's d (Cohen, 1988).

Table 2

Performance-monitoring task data in Study One (Control and Dysphoric Groups) and Study Two (Control and Depressed Groups).

	Study One		Study Two	
	Control (n = 20)	Dysphoric (n = 20)	Control (n = 25)	Depressed (n = 24)
Mean span	5.03 (0.85)	5.30 (0.64)	5.24 (0.75)	4.97 (0.65)
Judgment latency (seconds)	2.04 (0.52)	2.08 (0.71)	1.83 (0.60)	2.10 (0.61)
Proportion of trials performed correctly	0.50 (0.05)	0.50 (0.04)	0.52 (0.04)	0.51 (0.02)
Discrepancy: Proportion of trials judged as correct	0.77(0.15)	0.65 (0.18)*	0.80 (0.12)	0.68 (0.23)*
Distortion: Proportion of trials judged as correct minus proportion of trials performed correctly	0.27 (0.16)	0.16 (0.19)*	0.28 (0.11)	0.17 (0.25)*
Proportion correct trials judged accurately	0.95 (0.07)	0.87 (0.16)*	0.95 (0.07)	0.85 (0.25)*
Proportion wrong trials judged accurately	0.42 (0.26)	0.57 (0.23)*	0.36 (0.21)	0.50 (0.28)*

Note -

Data are mean (standard deviation) values.

* = Groups significantly differed at $p < .05$.

Table 3

Within group partial correlations between the Private factor of the Self-Consciousness Scale and the performance-monitoring task indices in Study One (Control and Dysphoric groups) and Study Two (Control and Depressed groups).

	Study One		Study Two	
	Control (n = 20) df = 17	Dysphoric (n = 20) df = 17	Control (n = 25) df = 22	Depressed (n = 24) df = 21
Proportion trials performed correctly	.52	-.41	.38	-.28
Discrepancy: Proportion trials judged as correct	.31	-.03	.19	-.10
Distortion: Proportion trials judged as correct minus proportion of trials performed correctly	.11	.08	.08	-.07
Proportion correct trials judged accurately	-.08	-.06	.12	-.19
Proportion wrong trials judged accurately	-.27	-.05	-.14	-.03

Note –

NART estimated intelligence was partialled out of all correlations.

* = correlation significant at $p < .01$

Table 4

Demographic and clinical characteristics of participants in Study Two (Control and Depressed Groups).

Variable	Control (n = 25)	Depressed (n = 25)	Comparison	Effect Size (d)
Age (in years)	47.5 (12.9)	46.0 (10.0)	t (48) < 1	0.13
NART Verbal IQ	113.6 (4.4)	109.6 (10.3)	t (48) = 1.79, p = 0.08	0.51
% Female	68	68	-	-
HDRS	-	21.4 (5.5)	-	-
BDI	2.4 (2.3)	27.6 (8.7)	t (48) = 14.05, p < 0.01	3.96
STAI – State	26.0 (5.1)	57.2 (12.0)	t (48) = 12.00, p < 0.01	3.38
STAI – Trait	29.6 (7.6)	64.5 (8.0)	t (48) = 15.84, p < 0.01	4.47
HADS – Depression	1.3 (1.4)	11.7 (3.6)	t (48) = 13.61, p < 0.01	3.81
HADS – Anxiety	3.6 (1.8)	14.6 (3.4)	t (48) = 14.50, p < 0.01	4.04
SCS – Private	16.0 (5.9)	24.2 (5.9)	t (48) = 4.93, p < 0.01	1.39

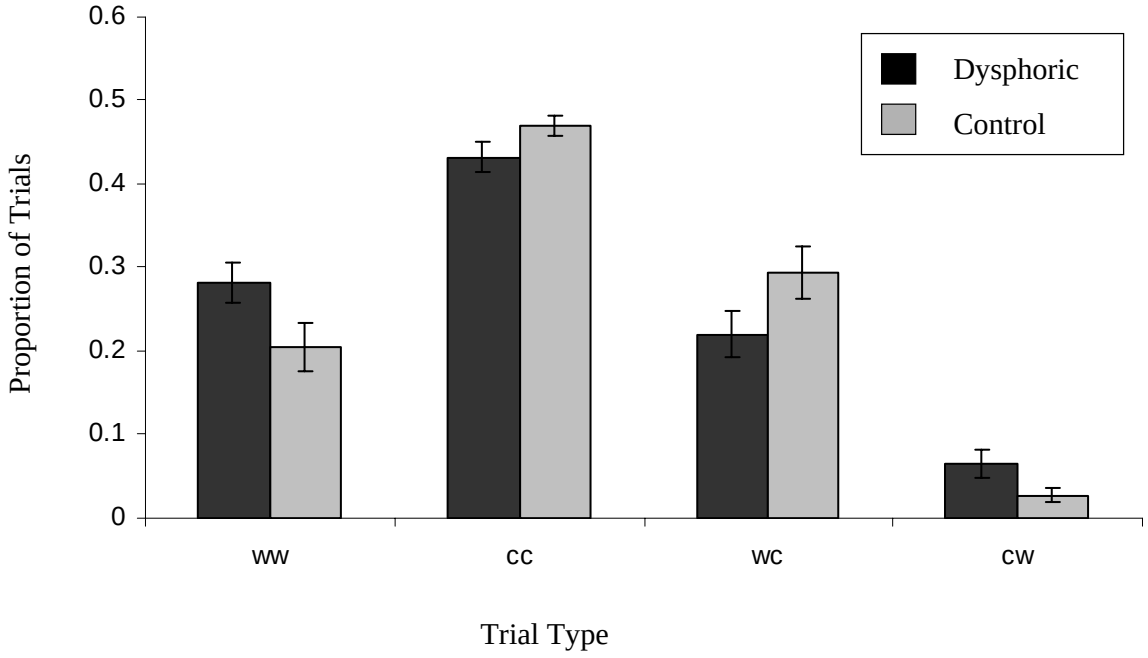
Note -

Data are mean (standard deviation) values unless specified. NART = National Adult Reading Test; HDRS = Hamilton Depression Rating Scale; BDI = Beck Depression Inventory; STAI = Spielberger State Trait Anxiety Inventory; HADS = Hospital Anxiety and Depression Scale; SCS = Fenigstein Self Consciousness Scale. Groups compared using independent sample t-tests. Effect size calculated using Cohen's d (Cohen, 1988).

Figures

Figure 1

Relationship between performance accuracy and judgment accuracy on the spatial span working memory task in Study One (Control and Dysphoric Groups)

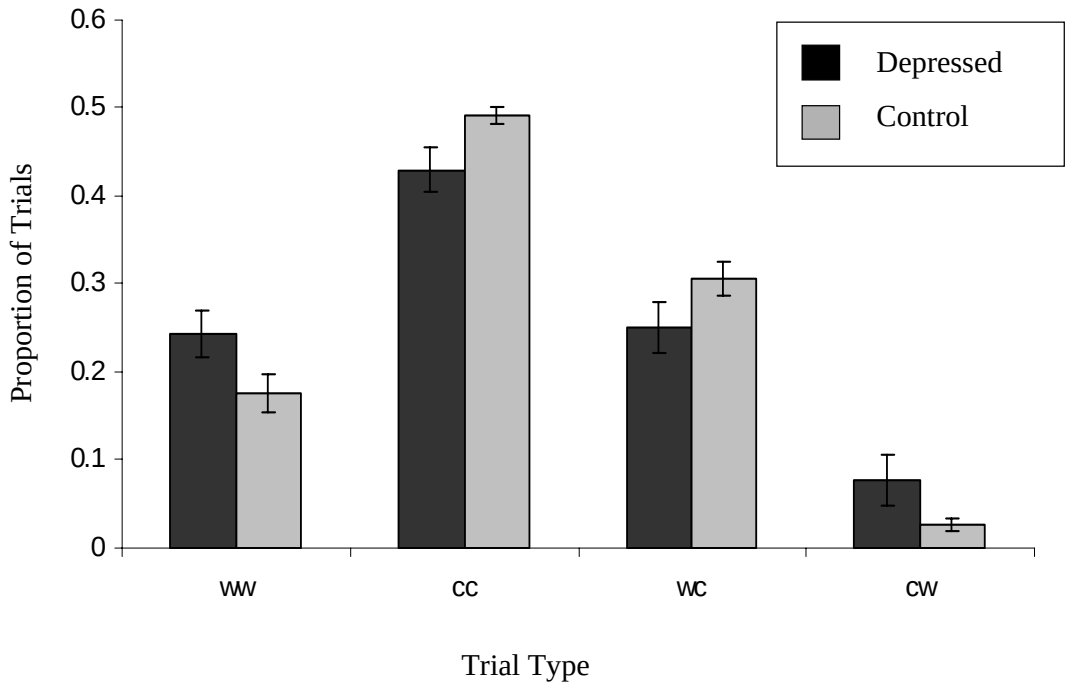


Note -

Error bars are one standard error of the mean values. ww = trials performed wrongly and judged as wrong; cc = trials performed correctly and judged as correct; wc = trials performed wrongly and judged as correct; cw = trials performed correctly and judged as wrong.

Figure 2

Relationship between performance accuracy and judgment accuracy on the spatial span working memory task in Study Two (Control and Depressed Groups)



Note -

Error bars are one standard error of the mean values. ww = trials performed wrongly and judged as wrong; cc = trials performed correctly and judged as correct; wc = trials performed wrongly and judged as correct; cw = trials performed correctly and judged as wrong.

Author note

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Footnotes

1 - A slightly different conceptualization of self-focus in depression is provided by response styles theory (e.g. Nolen-Hoeksema, 1991). This argues that a ruminative self-focusing style, where individuals focus attention on their depressive symptoms and the implications of those symptoms, exacerbates depressed mood and cognition (e.g. Nolen-Hoeksema & Morrow, 1991; Lyubomirsky & Nolen-Hoeksema, 1993; Nolen-Hoeksema, 2000) and may represent a trait vulnerability to depression (Roberts, Gilboa & Gotlib, 1998). This differs from other self-awareness theories of depression (e.g. Pyszczynski & Greenberg, 1987) in that focusing on negative mood per se, even in the absence of an actual-ideal discrepancy, is sufficient to maintain depression. Further, response styles theory argues that this ruminative coping style tends to be used across situations, rather than principally in response to negative events. Therefore it can contribute to longer term depressed mood, even when there is no clear cause for the low mood.

2 - SFA has been conceptualized as both a trait (a habitual tendency to chronically self-focus across situations) and a state (a temporary increase in levels of self-focus in response to particular circumstances) construct (for a review see Mor & Winquist, 2002). This duality is also apparent in the depression literature. Ingram (1990) uses the term 'self-absorption' to describe a chronic, inflexible self-focusing style that is believed to confer general vulnerability to psychopathology, whereas Pyszczynski and Greenberg (1987) instead concentrate on variation in adoption of a self-focusing style in response to success or failure. Consequently, there are interesting questions regarding the relationships between judgment accuracy and both state and trait SFA. In the present study we decided to focus on the relationship between judgment accuracy and trait, rather than state, SFA as measured by the SCS for a number of reasons. First, a very clear link has been demonstrated between elevations in trait SFA (particularly using the SCS) and depression in a wide range of studies. The SCS has also been the most widely used scale in the normative literature (see Mor & Winquist, 2002) and, crucially, is the only measure of self-focus that has so far been related to the sort of performance monitoring paradigm used here, as far as we are aware (Eisenberger, Lieberman & Satpute, 2005). This extensive use of the SCS makes it easier to interpret the current data with regards to other findings in the SFA and performance monitoring literature. Second, the SCS most closely resembles the way SFA is conceptualized in cybernetic models of self-regulation (Duval & Wicklund, 1971;

Carver & Scheier, 1991, 1998). Third, legitimate concerns have been raised about the extent to which asking participants to reflect on their current attentional style actually serves as a self-focus induction (e.g. Osberg, 1985). Of particular interest in the current study was the accuracy of SFA in depression in typical circumstances rather than when heightened SFA has been artificially induced. To minimize this possible problem, we decided to administer a trait measure separated by a fifteen-minute break from the mental-monitoring task. Such an approach would not have been possible using a state measure.

3 - A number of earlier studies have examined task performance in depression when feedback is present (e.g. DeMonbreun & Craighead, 1977; Beats, Sahakian & Levy, 1996; Elliot, Sahakian, Herrod, Robbins & Paykel., 1997; Shah et al., 1999; Tucker, Luu, Frishkoff, Quiring & Poulson, 2003). Because these studies have used experimenter-generated, external feedback signals, however, they have not examined the internal aspects of self-regulation judgment accuracy in which we are presently interested.

4 - There is some controversy in the literature about whether it is beneficial to dichotomize continuous variables in analysis (e.g. MacCallum, Zhang, Preacher & Rucker, 2002). However, we have not continuously sampled BDI scores in Study One, since no participants with a BDI score between 10 and 15 were recruited. This means that the assumption that the BDI will be continuously distributed in the study population cannot be supported.

5 - We originally analyzed this particular finding using a one-tailed statistical test. Based on the comments of an anonymous reviewer we subsequently reported all of the present results based on two-tailed analyses, since it was plausible for effects to go in either direction. For this particular finding, it is important to note that this change inflated the Type I error rate to 7.5%; i.e. there is a higher than usual chance of falsely rejecting the null hypothesis. However, an identical pattern of results emerged in our subsequent replication (see Study Two) using two tailed tests from the outset, suggesting that our positive results in Study One are unlikely to be due to increased Type I error rate. Moreover, comparable results were also obtained using signal detection analysis (based on recommendations of McNicol, 1972), classifying correct span repetitions as targets and incorrect span repetitions as distracters. This found no significant difference between groups on the accuracy measure d-prime (dysphoric group: mean = -0.00, SD = 0.83; control group: mean = 0.00, SD = 0.94), $F(1, 37) < 1$.

The dysphoric group did however exhibit a significantly more conservative response bias (C) than the control group (dysphoric group: mean = 0.30, SD = 1.00; control group: mean = -0.30, SD = 0.68), $F(1, 37) = 6.51$, $p = .02$, $f = .42$. This response bias finding supports the view that the dysphoric group was negatively biased when judging trials they had performed correctly but more realistic when judging trials they had performed incorrectly, relative to the control group.

6 - In addition to these correlations, we also ran a series of mediational analyses (using the SPSS macro developed by Preacher & Hayes, 2004) to investigate whether self-report of the extent of Private SFA mediated any relationship between group and judgment accuracy (cf. Baron & Kenny, 1986). These found no significant mediating role for the Private factor of the SCS on the relationship between group and any of the judgment accuracy or performance accuracy measures on the performance monitoring task (Sobel tests of indirect effect all non-significant; Sobel, 1982).

7 - As in Study One, we found no mediating role of self-report of the degree of Private SFA on the relationship between group and the performance-monitoring task (Sobel, 1982). Also replicating Study One, signal detection analysis found there was no difference between groups on the d-prime accuracy measure (depressed group: mean = 0.20, SD 1.21; control group: mean = -0.02, SD 0.82), $F(1, 46) < 1$. The depressed had a significantly more conservative response bias (depressed group: mean = 0.27, SD = 1.06; control group: mean = -0.26, SD = 0.52), $F(1, 46) = 9.35$, $p < .01$, $f = .45$.

8 - While we believe this is the first demonstration of positive *distortion* bias in self-related judgments in clinical depression, there have been previous findings of an attenuated positive bias in terms of relative *discrepancy*. For example, dysphoric and depressed individuals have been found to exhibit an attenuated self-serving attributional bias, characterized by a less marked tendency to attribute success internally and failure externally relative to control participants (e.g. Haack, Metalsky, Dykman & Abramson, 1996; see Mezulis et al., 2004 for a meta-analytic review). Relatedly, it has been shown that under certain feedback conditions dysphoric individuals can show a positive bias (Dykman, Abramson, Alloy & Hartlage, 1989). Crucially, however, none of these earlier studies assessed positive bias relative to objective performance criteria in both dysphoria and clinical depression.

9 - Of course, there may be times when clinicians do wish to modify positively biased beliefs in the treatment of depression, for example when evaluating beliefs about how effective rumination is in alleviating depressed mood (Nolen-Hoeksema, 1991).

10 - Analysis did reveal a significant *difference* in the pattern of associations between SFA and judgment accuracy across the groups. In Study One, Private SCS was positively partially correlated with mean number of spans performed correctly in the control group ($r = .52$, $p = .02$), whereas there was a negative partial correlation in the dysphoric group ($r = -.41$, $p = .08$); difference – Fisher's $z = 2.95$, $p < .01$. Similarly, in Study Two, the association between Private SCS and the proportion of spans repeated correctly was positive in the control group ($r = .38$, $p = .08$) and negative in the depressed group ($r = -.28$, $p = .19$); difference – Fisher's $z = 2.25$, $p = .02$. This supports the general intuition that SFA, while adaptive in the general population (as predicted by the perceptual accuracy hypothesis; Silvia & Gendolla, 2001), somehow becomes problematic in depression (cf. Pyszczynski & Greenberg, 1987). However, given that none of the individual group correlations was significantly different from zero at $p < .01$ (to correct for multiple comparisons), it is important not to over-interpret this result. Additional work is clearly needed to replicate this effect with a more powerful design and to examine possible mechanisms that might underpin this behavioral disturbance.