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An Experimental Analysis of the Role of Cognitive Errors in the Development of Depressed Mood Following Negative Social Feedback

Gregg Henriques[1,2] **and Harold Leitenberg**[1]

This study compared the extent to which negative and positive cognitive errors, dysfunctional attitudes, and self-reported symptoms of depression predicted change in college students' depressed mood and social self-esteem following an experimentally arranged negative social event. The amount of negative cognitive errors, the ratio of negative-to-positive cognitive errors, the amount of dysfunctional attitudes, and the amount of depressive symptoms obtained several weeks earlier each separately predicted change in depressed mood following the receipt of bogus negative social feedback. A subsequent 4-step hierarchical regression analysis found that the ratio of negative-to-positive cognitive errors contributed unique variance to the prediction of change in depressed mood after controlling for prior self-reported symptoms of depression and dysfunctional attitudes. Further, only the ratio score significantly predicted change in social self-esteem. Implications for Beck's cognitive model of depression, the limitations of the current study, and suggestions for further research are discussed.

KEY WORDS: cognitive errors; cognitive distortions; dysfunctional attitudes; depression.

INTRODUCTION

Over three decades ago, Beck (1967, 1976) developed a cognitive model of depression, which postulated that the way in which information is organized, processed, and interpreted has dramatic consequences for affective reactions and functioning. Beck's theory has generated a substantial body of research and has led to the development of a relatively effective treatment for unipolar depression (Antonuccio, Thomas, & Danton, 1997; Beck, Rush, Shaw, & Emery, 1979; Dobson, 1989). Beck suggested that three cognitive constructs played an important role in the etiology and

[1]Department of Psychology, University of Vermont, Vermont.
[2]Correspondence should be directed to Gregg Henriques, Department of Psychiatry, University of Pennsylvania, 754 Science Center, 3600 Market Street, Philadelphia, Pennsylvania 19104-2648; e-mail: henri@landru.cpr.upenn.edu.

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phenomenology of depression: dysfunctional attitudes, which are relatively stable belief systems that are unrealistic and perfectionistic in nature; cognitive errors which involve the process of interpreting information in an overly negative or pessimistic manner; and negative automatic thoughts which refer to the more immediate negative evaluations individuals make about themselves, their situation, and their future. Research has consistently documented that individuals with depressive symptoms exhibit more dysfunctional attitudes, make more negative cognitive errors, and have more negative automatic thoughts than controls (see Clark, Beck, & Alford, 1999, for an extensive review of this literature).

Beck's cognitive model of depression is generally considered a diathesis-stress model in which dysfunctional attitudes (often referred to as core beliefs or schemata) are proposed to be deeply held beliefs that create a distal cognitive vulnerability that, when combined with negative life events, often lead to the development of a depressive disorder (Haaga, Dyck, & Ernst, 1991). Empirical investigations of this aspect of Beck's model have yielded mixed results. Some studies found that dysfunctional attitudes do predict later depression (Brown, Hammen, Craske, & Wickens, 1995; Clark, Beck, & Brown, 1992; Hammen, Ellicott, Gitlin, & Jamison, 1989; Hammen, Marks, Mayol, & deMayo, 1985; Klocek, Oliver, & Ross, 1997; Robins, Hayes, Block, Kramer, & Villena, 1995), whereas others reported that they do not (Hammen, Marks, deMayo, & Mayol, 1985; Lewinsohn, Steinmetz, Larson, & Franklin, 1981). Further, a number of studies have found that, contrary to Beck's model, dysfunctional attitudes do not appear to be stable or trait-like, but seem to wax and wane with depressed mood, suggesting that dysfunctional attitudes might result from depressed mood rather than vice versa (e.g., Blackburn, Jones, & Lewin, 1986; Dohr, Rush, & Bernstein, 1989; Hollon, Kendall, & Lumry, 1986; see Ingram, Miranda, & Segal, 1998, for a review). A possible reason for this ostensibly contradictory result is that dysfunctional attitudes remain latent or inaccessible until an individual is confronted with a negative circumstance that activates the beliefs (e.g., Persons & Miranda, 1992).

While these studies have attempted to analyze the legitimacy of dysfunctional attitudes as a distal diathesis in the ultimate development of a depressive disorder, other studies have attempted to examine the more proximal relationship between negative thinking styles and dysphoric mood. Integral to Beck's model is that individuals with depression process information in an overly negative or biased way. These processing distortions are proposed by Beck (1976) to produce more negative automatic thoughts, which in turn lead to more negative feelings. Beck referred to these processing distortions as cognitive errors. Beck et al. (1979) originally identified seven types of negative cognitive errors frequently made by depressed individuals: overgeneralization (assuming that if a negative outcome occurred in one case, it will occur in another case that is the slightest bit similar); selective abstraction (exclusively attending to the negative features of an event); excessive responsibility (seeing oneself as responsible for any bad occurrence); predicting without evidence (expecting bad outcomes with no evidence for such); self-referencing (believing one's poor performances are the center of everyone's attention); catastrophizing (always thinking the worst possible event will occur); and dichotomous thinking (seeing an event

as either being all good or all bad). Beck's model suggests an intimate connection between these negative processing errors or biases and dysphoric mood and at least two predictions arise from this formulation. First, the model predicts that individuals who are depressed will make more negative information processing errors. Second, those individuals who tend to make more negative cognitive errors should tend to experience more negative affect when confronted with a negative event (A. T. Beck, 2001, personal communication).

Several different scales and methods for assessing the tendency of depressed and dysphoric individuals to make more negative interpretations of information have been developed. Krantz and Hammen (1979) developed the Cognitive Bias Questionnaire, which asks individuals to choose responses to ambiguous events that best represent the manner in which they would think about the situation. Research with this measure found that depressed individuals endorse more depressed–distorted options than nondepressed individuals (Krantz & Hammen, 1979; Krantz & Lui, 1987). Researchers have also found that depressed individuals will report more negative irrational initial interpretations to open-ended vignettes (Watkins & Rush, 1983).

In an attempt to explicitly measure the seven types of cognitive errors described by Beck et al. (1979), Lefebvre (1981) developed the Cognitive Error Questionnaire. He was unable to obtain adequate discrimination and interrater reliability when all seven error types were included. Instead, he developed a measure with just four error types, catastrophizing, overgeneralizing, personalizing, and selective abstraction, which raters could reliably discriminate. He found that both depressed psychiatric inpatients and depressed outpatients with lower back pain evidenced significantly greater negative cognitive errors than did nondepressed controls. Following Lefebvre, Smith, and colleagues (Smith, Aberger, Follick, & Ahern, 1986; Smith, Follick, Ahern, & Adams, 1986) found that negative cognitive errors concerning low back pain situations were a much better predictor of overall disability than was the general tendency toward negative distortion. This finding suggests that, consistent with Beck's formulation, the propensity to make cognitive errors in a specific domain might lead one to be particularly vulnerable to feeling depressed if one experiences distressing events in that domain. Research on a similar measure developed for children found that depressed children reported more negative distortions than did nondepressed children (Leitenberg, Yost, & Carroll-Wilson, 1986). This research also found that children with low self-esteem and children high in evaluation anxiety also exhibited higher rates of negative cognitive errors than did controls.

Cumulatively, this research provides solid support for the first prediction, namely that depressed individuals tend to process ambiguous information in a more negative manner than do controls (Clark et al., 1999). Less research has focused on the second prediction mentioned above, which is that individuals who tend to process information in a negative way will experience a more negative mood when confronted with a negative event. Experimental research examining this question has focused primarily on dysfunctional attitudes and negative automatic thoughts. Stiles and Gotestam (1989) found that participants who had elevated scores on the Automatic Thoughts Questionnaire experienced a proportionately greater increase in negative affect following the induction of a negative mood than did those with

lower ATQ scores. Kuiper, Olinger, and Martin (1988) found participants with higher scores on the Dysfunctional Attitude Scale (DAS) experienced more discomfort and anxiety, exhibited greater physiological arousal, and perceived the experimenter as more critical, disapproving, and hostile when placed in a moderately stressful situation than did those with lower scores. Whittal and Dobson (1991) similarly reported that subjects with higher DAS scores experienced more depressed mood following experimentally arranged negative interpersonal feedback than did those with lower scores on the DAS. These studies suggest that having dysfunctional attitudes and negative automatic thoughts increases susceptibility to negative mood following exposure to negative stimuli. To our knowledge, no studies have utilized an experimental paradigm to specifically examine the extent to which the tendency to make cognitive errors influences how individuals affectively respond to negative events.

The primary purpose of this study was to fill this gap. To do so, we exposed participants to negative social feedback and examined the extent to which dysfunctional attitudes and the tendency to make cognitive errors predicted change in dysphoric mood and social self-esteem. We also wanted to determine if cognitive errors could account for unique variance in changes in negative mood and social self-esteem above and beyond dysfunctional attitudes and self-reported symptoms of depression as measured by the Beck Depression Inventory (BDI).

We decided to expose individuals to a negative social event because social successes and failures are some of the most salient concerns to depressed individuals (Beck et al., 1979). In addition, Whittal and Dobson (1991) found that the DAS predicted mood reactions following negative interpersonal feedback, and this allowed us to replicate their findings and compare the predictive power of cognitive errors with dysfunctional attitudes. We chose to examine changes in social self-esteem in addition to depressed mood because negative evaluations of the self are considered to be an integral part of the cognitive phenomenology of depression (Beck, 1976). Indeed, Beck's theory suggests individuals who process information more negatively will be more likely to generate negative evaluations about themselves.

We tested three separate, but related, hypotheses regarding the relationship between cognitive errors and the receipt of negative social feedback. First, we examined the degree to which negative cognitive errors predicts change in mood and social self-esteem following negative social feedback, with the hypothesis that individuals who tend to make more negative errors should experience more negative reactions. Second, because some theorists (e.g., Lightsey, 1994; Taylor & Brown, 1994) have proposed that the tendency to focus on positive information and interpret events in an overly positive manner (i.e., make positive cognitive errors) might serve as a buffer against distress following a negative event, we hypothesized that the propensity to make positive cognitive errors might serve as a buffer against the development of a negative mood following a negative event. Finally, Schwartz et al. (1986; Schwartz & Garamoni, 1989) have developed a cognitive model called the States of Mind Model, which proposes that it is not the absolute frequency of negative or positive cognitions that determines one's state of mind, but instead it is the ratio of negative-to-positive thinking that is the crucial measure of mental health functioning. On the basis of Schwartz's formulation, we tested the degree to which the tendency to make

negative cognitive errors *relative* to positive cognitive errors predicts an individual's affective reaction after receiving negative social feedback.

METHOD

Participants and Recruitment Procedure

Four hundred and forty-nine (301 female, 148 male) introductory psychology students from a mid-sized northeastern university initially filled out the Negative and Positive Cognitive Error Questionnaire (NPCEQ), the DAS, and the BDI 2 weeks prior to the experimental phase of the study (see below for a description of the measures). Two hundred and 92 of these 449 students indicated a willingness to participate in the follow-up experimental study. Participants received extra course credit in exchange for their participation.

Time and other practical constraints prevented us from trying to include all 292 interested students in the experimental phase of the study. Given this logistical problem and because this was a nonclinical sample with a possible limited range of scores on the NPCEQ, we wanted to try and ensure that the final experimental sample had as heterogeneous range of scores on this measure as possible. To this end, we ranked the initial 292 students on the basis of their Ratio of Negative-to-Positive Cognitive Error Scores on the NPCEQ. Then, to maximize the likelihood of including students with more extreme NPCEQ scores in the experimental stage, students were eligible for inclusion only if their Ratio Scores placed them in the lowest fifth (high Positive Cognitive Error Score [PCES] relative to Negative Cognitive Error Score [NCES]), the middle fifth or the highest fifth (high Negative Cognitive Error Score relative to Positive Cognitive Error Score) of the distribution. This procedure resulted in a total of 174 students (58 from each of the lowest, middle, and highest fifth) being eligible to participate in the experimental study. Each eligible student was then contacted to take part in the study. Forty-seven students from the lowest fifth, 34 students from the middle fifth, and 36 students from the highest fifth, for a total of 117 students (76 female and 41 male) agreed to participate. They consisted mostly of 1st year students and their mean age was 18.79. Eighty-nine percent described themselves as Caucasian, 6% African American, 2% Asian American, and 3% as other, reflecting the demographic composition of the university.

Measures

Negative and Positive Cognitive Error Questionnaire (NPCEQ)

The NPCEQ is a 32-item measure that evaluates the tendency of young adults to interpret situations in an overly negative and overly positive manner (McKenna, 1987). It is an extension of Lefebvre's Negative Cognitive Error Questionnaire, which consisted of just negative cognitive error items (Lefebvre, 1981). Each item consists of a vignette describing an event, which is followed by a thought about that event. The participant ranks the degree to which the thought is similar to a thought they might

have if they were in that situation on a 5-point Likert type scale, ranging from 1 (*Not at all what I would think*) to 5 (*Almost exactly what I would think*). Negative cognitive errors are assessed by 16 items that describe somewhat negative occurrences that are then followed by overly negative interpretations, whereas positive cognitive errors are assessed by 16 items that describe somewhat positive occurrences that are then followed by overly positive interpretations.

The four types of cognitive errors assessed are "catastrophizing" (or "magnification" in the positive direction) which is assuming that the worst (or best) possible outcome will occur; "overgeneralization" which is assuming that if a negative (positive) outcome occurred in one case, it will in another case that is the slightest bit similar; "selective abstraction" which is exclusively attending to the negative (positive) features of an event; and "personalizing" which is seeing oneself as responsible for any bad (good) occurrence. There are four items for each type of error in both the negative and positive direction. The errors are combined to compute a total negative cognitive error score and a total positive cognitive error score. Lefebvre's study (Lefevre, 1981), as well as a study using the children's version of the Negative Cognitive Error Questionnaire (Messer, Kempton, VanHasselt, Null, & Bukstein, 1994), suggests the appropriateness of using a single combined score rather than analyzing each type of error separately. The scale can also be divided up into two content areas because half of the vignettes describe social situations, and half describe academic situations.

The following is an example of a negative cognitive error item:

> Some new friends asked you to join them for an evening on the town. You agree to go. The next day you heard that some people did not have that good of time. You think: "They probably didn't enjoy themselves because I wasn't good company."

An example of a positive cognitive error item is as follows:

> A paper you turned in for a history course was selected by the instructor as an example of how a good paper should be written. You are about to do a presentation in a business class. You think: "I'll probably get an excellent grade for this too."

McKenna (1987) found test-retest reliability for the entire NPCEQ to be .72 over an 11-week period, which suggests that the scores from the NPCEQ remain fairly stable, at least over relatively short periods of time. Internal consistency was found to be .86 for the negative cognitive error factor and .83 for the positive cognitive error factor (McKenna, 1987).

For this study, three scores were derived from the NPCEQ: a mean NCES, a mean PCES, and a Ratio Score (NCES/PCES). The Ratio Score collapses negative and positive cognitive errors onto a single dimension and measures the tendency to commit cognitive errors in a negative relative to positive direction, with a higher Ratio Score indicating a greater tendency to make errors in the negative direction.

Dysfunctional Attitudes Scale (DAS)

The DAS (version A) is a 40-item self-report survey designed to measure the presence of dysfunctional attitudes and depressogenic schemata (Oliver & Baumgart, 1985). Items are scored on a 7-point Likert type scale, and possible scores range

from 40 to 280, with higher scores indicating greater dysfunctional attitudes. Test-retest reliabilities for a college population range from .79 to .86 whereas internal consistencies range from .79 to .93 (e.g., Dobson & Shaw, 1986).

Beck Depression Inventory (BDI)

The BDI is a frequently used 21-item self-report measure that assesses cognitive, affective, motivational, and physiological aspects of depression (Beck et al., 1961). Reliability and validity coefficients of the BDI have been found to be high; a meta-analysis of the BDI's internal consistency yielded a mean coefficient alpha of .86 for psychiatric patients and .81 for nonpsychiatric populations (Beck, Steer, & Garbin, 1988). Given the debate about the relevance of self-report measures of depressive symptoms to clinical depression (c.f. Coyne, 1994; Kendall, Hollon, Beck, Hammen, & Ingram, 1987; Vredenburg, Flett, & Krames, 1993), we emphasize that we are not using this measure to define a clinically depressed group, and high scores can be thought of as indicating dysphoria rather than clinical depression. In addition, it should be noted that Item 9 on the BDI, which assesses suicidal ideation, was removed at the insistence of the University Committee on Human Research and scores were thus based on the 20 remaining items.

Profile of Mood States-Short Form (POMS-SF)

The POMS (McNair, Loor, & Droppleman, 1971) is a self-report questionnaire developed to assess transient, mood states. Participants were asked to respond to the items on the basis of how they currently felt. Six factors and subscales have been derived from the POMS, which include tension–anxiety (TA), depression–dejection (DD), anger–hostility (AH), fatigue–inertia (FI), vigor–activity (VA), and confusion–bewilderment (CB). When the POMS is used as a measure of general mood, high internal consistency for each of the mood state scales and a test-retest reliability ranging from .65 to .74 has been found (McNair et al., 1971). The original POMS consists of 65 mood adjectives that are rated on a 5-point scale that ranges from *not at all* to *extremely* whereas the short form consists of 37 items (Shacham, 1983). Recent studies have documented that the short form subscales correlate .95 or higher with the original (Curran, Andrykowski, & Studts, 1995).

For this study, only the DD subscale was used in the main analyses. We had also planned to use the tension–anxiety scale. However, there was no significant increase in anxiety as a result of the negative feedback; in fact, there was a drop in anxiety. This makes sense because participants were more apprehensive about the task itself (first impressions) than they were about the subsequent feedback a week later. Whittal and Dobson (1991) also found greater anxiety prior to the social interaction than that after the later feedback. There were no significant changes in any of the other subscales as a function of the experimental manipulations.

The Texas Social Behavior Inventory-Form A (TSBI-A)

The TSBI is a self-report questionnaire that measures social self-esteem (Helmreich & Stapp, 1974). The TSBI-A is a 16-item short form that correlates

.94–.97 with the original 32-item TSBI. The scale is designed to assess an individual's self-esteem as a function of his or her perceived level of social competence, social dominance, and self-confidence. Items are ranked on a 5-point Likert scale, with a 0 representing *not at all characteristic of me* and a 4 representing *very much characteristic of me*. A higher score represents greater social self-esteem. Test-retest reliability for the short form was .91 for college students (Helmreich & Stapp, 1974).

Experimental Procedure

The experiment proper was conducted in five separate groups of approximately 20–25 participants and consisted of two separate sessions, 1 week apart. During the first session, the participants were given an overview of what would take place in the next 2 weeks. They were told that the researcher was examining the relationship between first impressions and a variety of personal characteristics. Participants were then given questionnaire folders that included the POMS-SF, TSBI-A, and a demographic questionnaire. After all participants had completed the questionnaires, they were asked to form smaller groups of four or five on the basis of a randomly assigned group number found on the corner of their folder. The participants were told that they had 7 min to introduce themselves and to interact with one another. Participants were also given a Social Rating Scale (SRS) that would be used to rank the social skills of other group members. The SRS lists four attributes that supposedly relate to social skills (conversation skills, interpersonal skills, friendliness, and overall first impression) and each attribute is rated on a 6-point scale in which a higher number represents a more favorable rating. After the interaction, the participants ranked other group members on the SRS and handed this in along with their completed questionnaire packets. This concluded the first session.

The second session, 1 week later, began with the participants receiving the feedback manipulation. Every participant again received a folder of questionnaires with their name on it. The first page inside each folder was an individual printout created by the experimenter and had the participant's name on it. It consisted of scores and percentile rankings of the four categories on the SRS and instructions for how to interpret the scale. The participants' scores had supposedly been calculated from the aggregate ratings other students had given them. Before opening the folders, the participants were verbally instructed on how to interpret the SRS (i.e., that higher scores meant a better rating). In actuality, the printout scores were bogus and each participant received scores that ranked them between the 7th and 12th percentile on each of the four attributes on the SRS. After viewing their scores, the participants then filled out the TSBI-A and POMS-SF in random order for a second time.

After completing these questionnaires, the participants were given a questionnaire stating that the National Psychological Association was conducting a survey on the experience of participants in experiments. Imbedded in this brief questionnaire was a question asking the subjects to report and describe any deception involved in the experiment. This was designed to assess whether they did not believe the feedback, and participants who correctly saw that the feedback was false were excluded from all subsequent analyses ($n = 4$). When every participant had finished

with the questionnaires, they were completely debriefed regarding the true nature of the scores and experiment.

RESULTS

Eight participants did not show up for their initial appointment, 6 participants who completed the first session did not return for the second session, and 4 participants correctly guessed the true nature of the study. None of the scores from these participants were included in any of the analyses.

The data from the remaining 99 participants were used in the analyses. There were 43 participants (29 women, 15 men) from the lowest ratio group (high positive cognitive errors relative to negative cognitive errors), 27 participants (17 women, 10 men) from the middle ratio group, and 29 participants (23 women, 6 men) from the highest ratio group (high negative cognitive errors relative to positive cognitive errors). There was no significant group by gender interaction so the results for males and females were combined. Four subjects were lost from the lowest fifth and, 7 were lost from the middle and highest fifths respectively. The mean scores for these three groups separately and for the combined sample on the NPCEQ and the DAS and BDI are displayed in Table I. As can be seen, the final sample had an adequate range of scores on these measures. However, it should be pointed out that few participants were in the "clinical range" on the BDI, and the mean cognitive error scores in either a negative or positive direction were not too extreme (maximum possible score of 5 per item), reflecting the nonclinical nature of this sample.

Experimental Manipulation Checks

It was predicted that the negative social feedback would have an effect on the participants' depressed mood and social self-esteem. A paired sample *t* test comparing the Time 1 POMS-SF depression–dejection subscale scores ($M = 12.35$, $SD = 4.95$) with the Time 2 POMS-SF depression–dejection score ($M = 13.62$, $SD = 5.58$) revealed that the manipulation had a significant effect on the participants' mood,

Table I. Mean Scores on the Positive and Negative Cognitive Error Questionnaire, the DAS, and BDI for the Three Ratio Groups and Total Sample

	Low ratio ($n = 43$)		Middle ratio ($n = 27$)		High ratio ($n = 29$)		Total sample $n = 99$	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Ratio Score	0.64	0.10	0.91	0.35	1.38	0.53	0.93	0.43
Mean per item NCES	1.59	0.45	2.00	0.63	2.52	0.69	1.98	0.68
Mean per item PCES	2.51	0.67	2.17	0.61	1.90	0.53	2.24	0.65
DAS	115.4	22.6	121.5	2.84	135.9	34.3	123.0	29.1
BDI	5.16	4.34	9.22	6.68	11.45	7.24	8.11	6.51

Note. Ratio = Negative/Positive Cognitive Errors; NCES = Negative Cognitive Errors; PCES = Positive Cognitive Errors; DAS = Dysfunctional Attitudes Scale; BDI = Beck Depression Inventory.

$t(98) = 3.25$, $p < .01$. Although the shift in mood was significant, it was not very substantial, reflecting a per item average of about 1.8–2.0 on a 5-point Likert scale. A second paired sample t test comparing the Time 1 Texas Social Behavior Inventory-A scores ($M = 42.35$, $SD = 8.06$) with the Time 2 TSBI-A scores ($M = 41.46$, $SD = 8.47$) revealed that the manipulation also had a significant effect on the participants' social self-esteem, $t(98) = 2.35$, $p < .05$, in the expected direction. Thus, receiving the negative feedback did result in significantly greater depressed affect and lower social self-esteem, although these were not very large changes.

Correlational Analyses Between the Cognitive Error Scores, DAS, and BDI

Dysfunctional attitudes and cognitive errors are considered by Beck's theory to be separate but related constructs. Table II displays the correlations between the three cognitive error scores (PCES, NCES, and Ratio), the DAS and BDI. As expected, there was a significant, moderate correlation between the NCES, Ratio Score, DAS, and BDI. The PCES failed to significantly correlate with either the DAS or BDI. However, it was positively correlated with the NCES. McKenna (1987) also found that the NCES and the PCES were moderately correlated ($r = .35$). when he developed the scale. This findings suggests that part of what the NPCEQ measures is a general tendency to distort information. By dividing the NCES by the PCES, the Ratio Score controls for the general tendency to distort information and obtains an index of the tendency to distort in a positive or negative direction.

Regression Analyses on Change in Depressed Mood Following the Negative Feedback

A primary purpose of this study was to test the degree to which scores on the NPCEQ, DAS, and BDI obtained several weeks prior to the experimental manipulation would predict change in participants' depressed affect following the receipt of negative social feedback. We were interested in analyzing the predictive power of five different variables; the three scores from the NPCEQ (the NCES, PCES, and the Ratio Score), the DAS score, and the BDI score. Because we initially wanted to isolate the predictive power of each score independently of each other on the change

Table II. Correlations Between the Three Cognitive Error Scores, the DAS, and BDI

	NCES	PCES	Ratio	DAS
NCES	—	—	—	—
PCES	.342*	—	—	—
Ratio	.616*	−.420*	—	—
DAS	.663*	.167	.554*	—
BDI	.573*	.004	.501*	.389*

Note. Ratio = Negative/Positive Cognitive Errors; NCES = Negative Cognitive Errors; PCES = Positive Cognitive Errors; DAS = Dysfunctional Attitudes Scale; BDI = Beck Depression Inventory.
*$p < .01$.

in depressed mood, we first ran five separate hierarchical regression analyses on the DD Time 2 scores. For each of the five analyses, the DD Time 1 score was entered in the first step to control for initial level of depressed mood. As expected, the contribution of the DD Time 1 scores were both significant and substantial to the prediction of DD Time 2 scores, $F(1, 97) = 114.63$, $R^2 = .542$, $p < .000$. This first step was then followed by entering one of the five predictor variables on Step 2 (the NCES, the PCES, the Ratio Score, the DAS, and the BDI). We ran the first regression analysis on the NCES, and its contribution to the prediction of the DD Time 2 scores was significant, $F(1, 96) = 6.27$, R^2 change $= .028$, $p < .014$, and in the expected direction, indicating that the tendency to make negative cognitive errors was associated with a tendency toward a more negative mood following the feedback. The second regression analysis was with the PCES and the contribution of the PCES to the prediction of the DD Time 2 scores in Step 2 was not significant, $F(1, 96) = -1.07$, R^2 change $= .005$, $p > .05$. However, the third regression analysis with the Ratio Score, $F(1, 96) = 10.88$, R^2 change $= .047$, $p < .001$, the fourth regression analysis with the DAS, $F(1, 96) = 5.26$, R^2 change $= .024$, $p < .024$, and the fifth regression analysis with the BDI, $F(1, 96) = 5.70$, R^2 change $= .026$, $p < .019$, all were significant in the prediction of DD Time 2 scores after the DD Time 1 scores had been entered in Step 1.

Although these separate stepwise regression analyses demonstrated that the BDI, DAS, NCES, and Ratio Score independently predicted change in depressed mood, the question remained if the ratio of negative-to-positive cognitive errors would contribute unique variance to change in depressed mood after controlling for the self-reported symptoms of depression and dysfunctional attitudes. To analyze this question, we conducted a stepwise regression analysis with four predictor variables: DD Time 1 in Step 1, BDI in Step 2, DAS in Step 3, and the Ratio Scores in Step 4. The results of this regression analysis are presented in Table III. As depicted, the Ratio Score significantly contributed unique variance beyond the contribution of both the BDI and DAS scores.

We originally hypothesized that cognitive errors in the social domain might be more strongly predictive of mood change following negative social feedback than are cognitive errors in the academic domain. However, we were not able to detect domain specific effects in any analyses. Mean scores and ratio scores for both the social and academic domains yielded identical patterns of significance as the overall scores. This finding is likely due to the fact that the correlation between negative cognitive errors for social and academic vignettes was so high ($r = .80$).

Table III. A Four-Step Hierarchical Regression Analyses on DD Time 2

Step predictor	R^2 change	Beta	Degrees of freedom	F change	Sig. of F change
1. DD Time 1	.542	.736	1, 97	114.63	.000
2. BDI	.026	.193	1, 96	5.70	.019
3. DAS	.005	.105	1, 95	1.26	.224
4. Ratio score	.016	.166	1, 94	3.92	.047

Note. DD = Depression-Dejection Subscale; BDI = Beck Depression Inventory; DAS = Dysfunctional Attitudes Scale; Ratio = Negative/Positive Cognitive Errors.

Regression Analyses on Change in Social Self-Esteem Following the Feedback Manipulation

Another goal of this study was to determine whether or not the NCES, the PCES, the Ratio score, the DAS, or the BDI would predict changes in social self-esteem following the negative social feedback. As with the analyses on depressed mood, we were interested in isolating and comparing the five predictor variables and thus used five separate two-step regression analyses. The same procedure described above for the DD subscale was used, only this time the dependent variable was the Time 2 score of the TSBI-A, and the Time 1 TSBI-A was entered on the first step. As expected, the contribution of the Time 1 TSBI-A was significant and substantial, $F(1, 97) = 400.31$, $R^2 = .805$, $p < .000$. When we examined each of the five predictor variables separately, we found that only the Ratio Score significantly predicted change in the social self-esteem scores, $F(1, 96) = 11.77$, R^2 change $= .021$, $p = .001$. The NCES, $F(1, 96) = 3.38$, R^2 change $= .007$, $p < .069$; PCES, $F(1, 96) = -.96$, R^2 change $= .002$, $p = .331$; DAS, $F(1, 96) = .31$, R^2 change $= .001$, $p = .576$; and BDI, $F(1, 96) = .19$, R^2 change $= .000$, $p < .662$, all failed to significantly contribute to the prediction of change in TSBI-A scores. Because only the Ratio Score was significant in the separate hierarchical regression analyses, it was deemed unnecessary to run another regression analysis to examine the additive effects of the Ratio Score after controlling for the BDI and DAS.

DISCUSSION

Beck's cognitive theory of depression posits that the tendency to make negative cognitive errors should be associated with a more intense negative reaction following the occurrence of a negative event (Beck, 1967, 1976; A. T. Beck, 2001, personal communication). Although this is an important implication of Beck's cognitive theory, we did not locate any prior experimental studies that specifically addressed this issue for cognitive errors as distinguished from dysfunctional attitudes. The primary purpose of the current study was to begin to fill this gap. We examined the degree to which the tendency to make cognitive errors, either negative or positive, predicted the impact that negative social feedback had on depressed mood and social self-esteem. Consistent with Beck's model, the NCES, as well as the ratio of negative-to-positive cognitive errors, did significantly predict a change in depressed affect following a negative event in the expected direction, demonstrating that the tendency to make more negative cognitive errors was associated with a greater increase in depressed mood following negative social feedback. The hypothesis that positive cognitive errors might buffer against a negative reaction to a negative event (e.g., Lightsey, 1994) did not receive support in this study. The PCES failed to significantly predict change in either depressed mood or social self-esteem following negative feedback.

Comparisons between the extent to which cognitive errors, dysfunctional attitudes, and self-reported symptoms of depression predicted change in depressed mood and social self-esteem following the negative social feedback were also conducted. Separate regression analyses found the NCES, the DAS, and the BDI each

accounted for similar amounts of variance in predicting the Time 2 DD scores after controlling for Time 1 DD scores. The Ratio of Negative-to-Positive Cognitive Errors, however, accounted for almost twice as much variance as the other variables. Further, in a subsequent stepwise regression, the Ratio Score accounted for unique variance in predicting change in mood after controlling for Time 1 DD Scores, BDI scores, and DAS scores. This finding suggests that, in accordance with the basic tenets of Beck's model, that the tendency to make cognitive errors is an important variable in determining how individuals react when faced with distressing events. In addition, these results support Schwartz's state of mind model (e.g., Schwartz & Garamoni, 1989) and suggest that the relative extent of negative-to-positive cognitive errors is a construct that deserves further attention in the study of cognitive vulnerability to depression.

In addition to accounting for unique variance in predicting change in mood, the Ratio Score also significantly predicted change in social self-esteem following the negative social feedback. This finding broadly supports Beck's model that the tendency to process information in a certain way influences the eventual evaluations that people make of themselves. However, neither the DAS nor the NCES predicted change in social self-esteem. These findings again suggest that, consistent with Schwartz's model, the ratio of negative-to-positive cognitive errors may be a more sensitive measure of bias or distortion in information processing.

An advantage of the experimental paradigm used in this study is that it allows for a clearer delineation of the connection between the tendency to process information in a particular manner and the subsequent tendency to experience certain affective reactions in response to negative social feedback. A limitation of the experimental paradigm, however, is that for ethical and practical reasons, experimenters can obviously only induce a mild, transient change in mood state, as opposed to a full depressive syndrome. As such, the question of the degree to which these results are generalizable to a clinical population experiencing clinical depression is an open one. Another limitation of the study is that the scores for the predictor variables were obtained several weeks prior to the experimental feedback, thus raising the possibility that participants' scores had changed in the interim.

It is also noteworthy that in this experimental paradigm, no mood priming procedure (e.g., Miranda & Persons, 1988) had to be conducted in order to detect an association between prior cognitive errors and subsequent reactions to a negative event. Presumably the relationship would have been even stronger if such a priming procedure had been employed just prior to administering the NPCEQ. The question is also open as to whether mood influences cognitive errors just as cognitive errors influences mood. Because prior research has demonstrated that dysfunctional attitudes are affected by depressed mood as well as vice versa, one might expect the same for cognitive errors. On the other hand, it is our impression by examining the items on both the NPCEQ and the DAS, that many of the items on the DAS, such as "My life is wasted if I am not a success," may be more dependent on mood than on the logical errors measured by the NPCEQ. Obviously, future research is necessary to answer this question.

There is also nothing in the current study that would suggest that a unique association exists between cognitive errors and depressed mood as opposed to other

dysphoric mood states such as anxiety. Because this study did not find an increase in anxiety following negative social feedback, we could not test such a mood specificity hypothesis. In any case, this is not a hypothesis that we would make because there is ample clinical and research evidence that these sorts of cognitive errors are often related to anxiety as well as to depression (e.g., Beck & Emery, 1985; Leitenberg et al., 1986; Weems, Berman, Silverman, & Saavedra, in press).

In conclusion, the results of the present investigation suggest that negative cognitive errors such as personalization, overgeneralization, selective abstraction, and catastrophization may play a role in the etiology and maintenance of dysphoric mood and are therefore deserving of more research separate from dysfunctional attitudes and automatic thoughts. In particular, researchers are encouraged to examine the relationship between the ratio of negative-to-positive cognitive errors to changes in mood following exposure to various stimuli.

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