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Explicit and implicit cognition: A preliminary test of a dual-process theory of cognitive vulnerability to depression

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Abstract

Two studies were conducted to test a dual-process theory of cognitive vulnerability to depression. According to this theory, implicit and explicit cognitive processes have differential effects on depressive reactions to stressful life events. Implicit processes are hypothesized to be critical in determining an individual's immediate affective reaction to stress whereas explicit cognitions are thought to be more involved in long-term depressive reactions. Consistent with hypotheses, the results of study 1 (cross-sectional; $N = 237$) showed that implicit, but not explicit, cognitions predicted immediate affective reactions to a lab stressor. Study 2 (longitudinal; $N = 251$) also supported the dual-process model of cognitive vulnerability to depression. Results showed that both the implicit and explicit measures interacted with life stress to predict prospective changes in depressive symptoms, respectively. However, when both implicit and explicit predictors were entered into a regression equation simultaneously, only the explicit measure interacted with stress to remain a unique predictor of depressive symptoms over the five-week prospective interval.

Keywords: Cognitive vulnerability; Depression; Implicit; Explicit; Dual-process

Over the past 30 years, many investigators have underscored the importance of cognitive processes in the etiology, maintenance, and treatment of depression. According to this view, some individuals possess a *cognitive vulnerability* that interacts with stressful life events to produce depression. This cognitive vulnerability-stress hypothesis has generated both enthusiasm and controversy among clinical researchers.

One area of contention among researchers is how to best conceptualize and measure cognitive vulnerability. In general, researchers appear to be divided into two camps on the issue. One camp tends to focus on explicit cognitions (e.g., cognitive products) whereas the other camp focuses on implicit cognitions (e.g., cognitive processes/information-processing). Researchers in the "explicit camp" investigate the particular types of negative cognitions that compose vulnerability to depression (e.g., hopelessness theory Abramson, Metalsky, & Alloy,

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1989). According to these theories, the types of interpretations that people generate for stressful life events determine their risk for depression. These researchers use self-report paper-and-pencil questionnaires to measure cognitive vulnerability, and then examine how individual differences on these measures predict the prospective development of depressive symptoms and depressive disorders (see Abramson et al., 2002 for review).

Researchers in the "implicit camp" argue that cognitive vulnerability consists of negative schemas—cognitive frameworks that are latent, outside of awareness, and activated by stress (see Scher, Ingram, & Segal, 2005 for review). Because these implicit schemas are outside of awareness, the self-report questionnaires used by researchers in the explicit camp may not be capable of detecting cognitive vulnerability. Self-report measures are also susceptible to conscious explicit processing, whereby a person can alter their more automatic, schema-driven responses on a questionnaire. To overcome the limitations of self-report questionnaires, these researchers have modified cognitive paradigms such as the Stroop task, self-referent encoding tasks, dichotic listening tasks, deployment of attention tasks, negative priming tasks, and memory recall tasks (see Gotlib & Neubauer, 2000, for a review). These tasks have been used most often in cross-sectional designs that compare depressed (or remitted depressed) and nondepressed groups.

Each camp has generated solid empirical support for their respective theoretical frameworks, but few studies have tried to integrate these relatively independent lines of research. To date, little is known about the unique contribution of explicit and implicit processes to cognitive vulnerability to depression. It is not known whether the negative cognitions that confer risk for depression are generated explicitly and effortfully or whether they are generated automatically from implicit schemas (i.e., without conscious control). Integrating these two lines of research is difficult because, until recently, there was not a theoretical framework for understanding the role of both explicit and implicit cognition. Thus, the goal of the current research was to: (1) propose a testable model of cognitive vulnerability that incorporates both explicit and implicit cognitive processes, and (2) provide a preliminary test of this new dual-process model.

Similar to the model recently proposed by Beevers (2005), we propose a theory of cognitive vulnerability that is based on dual-process theories from social psychology (see Chaiken & Trope, 1999). Although these theories often differ in their labeling of the two processes (e.g., automatic vs. deliberate, heuristic vs. systematic, effortful vs. spontaneous, reflective vs. reflexive, intentional vs. unintentional, etc.), they share common core assumptions. In general, one system is characterized by processes that are guided by the automatic activation of stable memory constructs, occur without intention or effort, and do not tax cognitive resources. We will refer to this as the implicit processing system. In contrast, the explicit processing system is characterized by on-line deliberate processing, active and effortful cognitive control, and the expenditure of cognitive resources. Social psychologists have used the dual-process framework to explain stereotyping, person perception, and social decision-making (e.g., Devine, 1989; Gilbert, Pelham, & Krull, 1988; Wilson, Lindsey, & Schooler, 2000). We will use this framework to explain how people generate cognitive interpretations of stressful life events.

When a person encounters a stressful life event, there are two sets of processes (i.e., dual-process) that determine how that event will be interpreted. First, there is an automatic cognitive response to the event. When the stressful life event occurs, implicit schemas are activated rapidly and unintentionally. If the activated schemas are negative (depressogenic), then a person experiences immediate negative affect. However, a person's initial schema-driven response may not be their final cognitive interpretation. Research from social psychology suggests that a person also can use deliberative, explicit processes to reinterpret the negative event, which may override the implicit cognitive response (cf. Devine, 1989; Gilbert et al., 1988). This may be especially likely if a person's explicit beliefs are not congruent with their activated implicit cognitions. Thus, a person's final interpretation of the event depends on whether they used explicit cognitive processes to accept or change their more automatic, schema-driven response. We hypothesize that it is the final explicit interpretation of a stressful life event that creates the most risk for enduring depressive symptoms. Thus, even if a person has negative implicit schemas, they may not be at risk for an enduring depressive reaction after a stressful life event if they use explicit processes to make more adaptive explicit inferences about the event. Similarly, if a person has positive schemas, they can still be vulnerable to future depression if they make negative explicit interpretations about a stressful life event.[1]

[1]The main difference between the model recently proposed by Beevers (2005) and the current model is with regard to the hypothesized role of explicit processes. Beevers argues that the primary role of explicit cognitive processes is to evaluate and alter negative cognitions

The dual-process model of cognitive vulnerability provides a testable framework for understanding the role of cognition in depressive reactions to stressful life events. According to this theory, implicit cognitions should be particularly potent predictors of immediate affective reactions to stress because they are activated rapidly and unintentionally. However, explicit cognitions should be better predictors of long-term depressive reactions because they will reflect an individual's final cognitive interpretation of the stressful life event. To test this hypothesis, we conducted two studies. The first study employed a cross-sectional design and examined the hypothesis that implicit, but not explicit cognitions, will predict immediate affective reactions to a stressful laboratory event. The second study used a 5-week prospective longitudinal design. The goal of the longitudinal study was to test the hypothesis that explicit cognitions in interaction with life stressors are an especially potent predictor of long-term depressive reactions.

Study 1: Cross-sectional

Method

Overview

Participants completed both an explicit and implicit measure of cognitive vulnerability. After completing the vulnerability measures, participants were randomly assigned to a negative event or control condition in the laboratory. Participants in the negative condition were given an anagram failure task. Participants in the control condition were given a non-evaluative anagram task. Immediately after the lab manipulation, all participants completed a distress scale.

The Cognitive Style Questionnaire (CSQ; Alloy et al., 2000) and the self-worth Implicit Association Test (self-worth IAT; Greenwald & Farnham, 2000; Greenwald, McGhee, & Schwartz, 1998) were used as the explicit and implicit measures of cognitive vulnerability, respectively. Both measures assess self-worth cognitions, which are thought to serve as vulnerability to depression (e.g., Beck's theory; hopelessness theory). The CSQ is one of the most widely used explicit self-report measures for assessing cognitive vulnerability. This measure has been used in behavioral high-risk designs to predict risk for depressive symptoms and depressive disorders. The self-worth IAT was used to measure people's implicit cognitions about their self-worth. Research suggests that the self-worth IAT has good construct validity and reliability (Greenwald & Farnham, 2000).

Participants

Participants were 237 (171 women, 66 men) unselected undergraduates from the Introduction to Psychology participant pool at the University of Wisconsin-Madison. Participants (mean age = 18.79) were recruited through a volunteer folder sign-up procedure and were given extra credit points for their participation.

Materials

Beck Depression Inventory (*BDI;* Beck, Ward, Mendelson, Mock, & Erbaugh, 1961). The BDI, a 21-item self-report inventory, assesses depressive symptoms. Total scores on the BDI can range from 0 to 63, with higher scores reflecting greater levels of depressive symptoms. The BDI has high internal consistency, test–retest reliability, and validity with both psychiatric and normal samples (Beck, Steer, & Garbin, 1988).

Cognitive Style Questionnaire (*CSQ;* Alloy et al., 2000). The CSQ assesses the cognitive vulnerability factor featured in the hopelessness theory of depression (negative inferences for cause, consequence, and self-worth). The CSQ assesses participants' causal attributions for the 12 hypothetical negative events on dimensions of stability and globality; in addition, participants rate the probable consequences of each event and the self-worth implications of each event. Mean-item scores can range from 1 to 7, with higher scores reflecting more negative cognitive styles. Internal consistency for the CSQ composite score for negative events

(*footnote continued*)
that come from implicit schemas. In his model, negative implicit schemas are the primary source of cognitive vulnerability to depression. In contrast, we hypothesize that explicit processes can also be a potent source of cognitive vulnerability for depression (in addition to correcting negative cognitions). According to our theory, an individual could have a positive self-schema, but still be vulnerable to depression if he or she makes negative explicit inferences.

(stability + globality + consequences + self-worth implications) is good: Study 1 alpha = 0.92, Study 2 alpha = 0.91. Scores on the CSQ are also highly stable over time. The one-year test–retest reliability is, $r = 0.80$ (Alloy et al., 2000).

Distress Scale. The distress scale is an 8-item measure of general distress. The scale is a subset of items from the Positive and Negative Affect Scale (PANAS; Watson, Clark, & Tellegen, 1988): upset, proud, enthusiastic, distressed, relaxed, dejected, satisfied, agitated. The eight items were summed (the four positive items were reversed scored) to create a measure of distress. Scores on the distress scale range from 0 to 56 with higher scores indicating greater distress. The scale showed good internal consistency; alpha = 0.87.

Self-worth Implicit Association Test (*self-worth IAT;* Greenwald & Farnham, 2000). The IAT is quite different from self-report measures in that self-worth associations are inferred indirectly based on performance of a categorization task rather than reported directly after an act of introspection. The self-worth IAT measures strength of associations between the self and evaluative qualities. Stimulus sets for four mutually exclusive categories (me, not-me, positive, negative) were defined. The positive and negative adjectives used in the IAT were chosen from a list of adjectives used in Alloy, Abramson, Murray, Whitehouse, & Hogan (1997) self-referent information processing task and equated for length, frequency, and likeability (negative adjectives: stupid, unimportant, nobody, worthless, failure, useless, unlovable, weak, loser, and unable; positive adjectives: smart, motivated, useful, deserving, successful, confident, lovable, worthy, winner, and valuable). Also, prior to the task, participants provided 10 pieces of personal information (e.g., name, city, etc.) that served as "me" stimulus items, and 10 comparable "not me" items from a set list (e.g., if the person's home city was Madison, then a "not me" stimulus might be Springfield).

In the IAT, items from these four categories are presented one at a time in the center of a computer screen in a randomized sequence. Participants must categorize each item into its category—me, not-me, positive, negative—as quickly as possible with one of two response keys. Response assignments are defined by labels on the top left and right of the computer screen. In one IAT condition, items representing the categories 'me' and 'positive' are categorized with the left key, and items representing 'not-me' and 'negative' are categorized with the right key. In the other conditions, items representing 'not-me' and 'positive' are sorted to the left, and 'me' and 'negative' are sorted to the right. Responses should be faster on average when the target (me, not-me) and attribute (positive, negative) category pairings match the individual's automatic associations versus when the target and descriptor category pairings are mismatched. For example, people with greater negative than positive self-worth associations in memory should be faster categorizing "me" with "negative" compared to "me" with "positive". The difference in average response latency between the two conditions indicates the relative strength of associations between self and not-self with positive and negative attributes. Higher IAT scores indicate greater levels of implicit self-worth – i.e., relatively stronger me = positive/not-me = negative associations. IAT scores were calculated using the improved algorithm developed by Greenwald, Nosek, and Banaji (2003). Across a variety of applications, the IAT has demonstrated good convergent validity, construct validity, and reliability (see Nosek, Greenwald, & Banaji, in press for a review). The IAT can be self-administered at http://implicit.harvard.edu/.

Procedure

All participants completed two 1-hour experimental sessions. In the first session, participants completed a questionnaire packet that included: a brief demographics questionnaire, the BDI, and the CSQ. In the second session (typically scheduled for the next day), participants completed the self-worth IAT and were randomly assigned to a negative event or control condition. In the negative event condition, participants were asked to solve a set of 40 difficult and unsolvable anagrams (selected from Tresselt & Mayzner, 1966). The task was presented to participants as a measure of verbal fluency. After completing the anagrams they were given bogus feedback stating that they scored in the 11th percentile on the task, and thus, have low verbal fluency. This combination of difficult anagrams with negative feedback served as a stressor (i.e., negative event) for the participant (e.g., MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002; Martin & Seneviratne, 1997; Mogg, Mathews, Bird, & MocGregor-Morris, 1990). Participants in the control condition were told that they were to "help the experimenter prepare for future computer tasks by rating the degree to which 40 made-up words resembled real English words." To match stimulus presentation between conditions, the anagrams from the negative condition were presented to participants. Participants in the control condition were not given

anagrams to solve because prior studies in our laboratory have indicated that even solving easy anagrams without performance feedback influences affect. After the negative event manipulation, participants completed the distress scale.

Results

We tested whether implicit and explicit measures of cognitive vulnerability interacted with a lab-induced stressor to predict immediate affective reactions. Descriptive statistics and correlations for the measures are listed in Table 1. The distribution of implicit and explicit cognitive vulnerability scores were unimodal and relatively symmetrical.

To determine whether cognitive vulnerability interacts with stress to predict immediate affective reactions to a stressor, we examined the cognitive vulnerability (CSQ or self-worth IAT) × condition (0 = negative event, 1 = control) interaction. The dependent variable was the distress scale score. BDI score was used as a covariate to control for individual differences in depressed mood prior to the lab-induced stressor. Two hierarchical multiple regression equations (Cohen, Cohen, West, & Aiken, 2003) were used to test the interaction between cognitive vulnerability and condition. Consistent with the recommendations of Cohen et al. (2003), all continuous independent variables were centered and individual variables within a given set were not interpreted unless the set as a whole was significant, thereby reducing Type I errors.

Results revealed a significant main effect of condition ($b = -7.68$, $t = -7.14$, $p < 0.001$) that was qualified by a significant self-worth IAT × condition interaction, $b = 6.65$, $t = 1.99$, $p = 0.048$. The CSQ did not interact with condition to predict immediate affective reaction to a negative lab manipulation ($p = 0.97$). The CSQ × self-worth IAT × condition interaction term also did not predict reactions to the lab stressor, $b = -4.21$, $t = -0.77$, $p = 0.44$.

To graphically depict the self-worth IAT × condition interaction, we computed affective scale scores by inserting specific values for predictor variables (i.e., 1 SD above and below the mean) into the regression equation. As can be seen in Fig. 1, participants who had low implicit self-worth and experienced the lab stressor exhibited the greatest amount of distress.

Summary of study 1 results

The cross-sectional study results were consistent with predictions derived from the dual-process theory of cognitive vulnerability. The implicit measure (self-worth IAT) interacted with condition to predict immediate affective reactions to a lab-induced stressor, but the explicit measure (CSQ) did not. Also, the implicit measure of cognitive vulnerability was only weakly correlated with the explicit measure of cognitive vulnerability. The lack of an association between the self-worth IAT and the CSQ is consistent with prior research comparing

Table 1
Means, standard deviations, and correlations: Study 1 (cross-sectional) measures

	1	2	3	4
1 CSQ	—			
2 Self-worth IAT	−0.12	—		
3 BDI	0.27	−0.07	—	
4 Distress	0.15	−0.03	0.19	—
M	4.04	0.81	6.06	31.01
SD	0.71	0.31	5.66	9.05

Note. $N = 237$; CSQ = Cognitive Style Questionnaire; Self-worth IAT = self-worth Implicit Association Test; BDI = Beck Depression Inventory; Distress = Distress Scale.
Note that mean item scores are presented for the CSQ whereas total scores are presented for all other measures. Higher scores on the CSQ, BDI, and Distress Scale indicate greater levels of the construct being measured. In contrast, lower scores on the self-worth IAT indicate greater levels of implicit cognitive vulnerability (i.e., more negative self views). Correlations greater than or equal to 0.14 are significant at the 0.05 level.

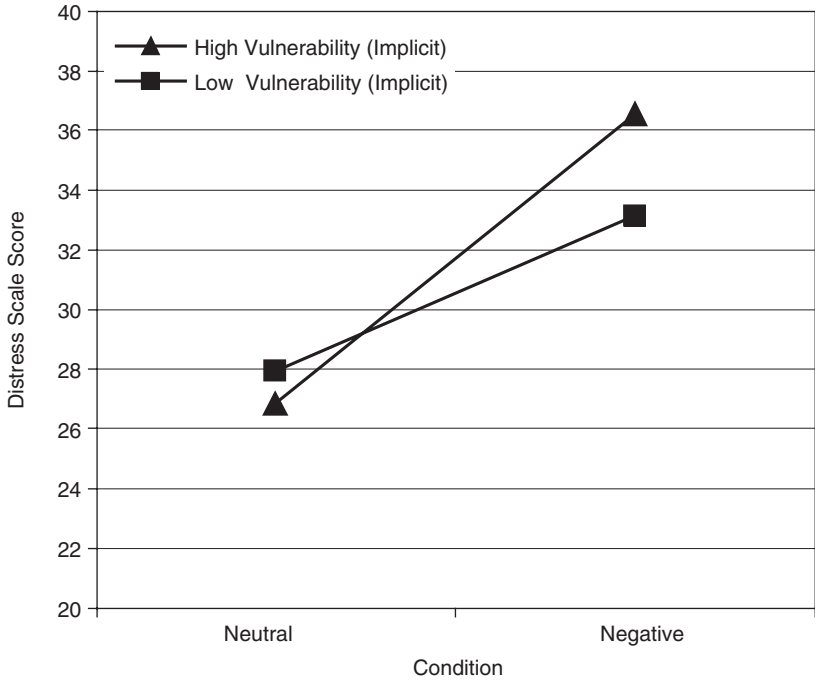

Fig. 1. General distress as a function of self-worth IAT score (high vs. low) and condition (negative vs. neutral).

implicit and explicit measures (e.g. Bosson, Swann, & Pennebaker, 2000; Devine, 1989; Greenwald & Farnham, 2000) and suggests that the measures are tapping distinct constructs.

Study 2: Longitudinal

Method

Participants

Participants were 261 unselected undergraduates from the Introductory to Psychology participant pool at the University of Wisconsin-Madison. Participants were recruited through a volunteer folder sign-up procedure and were given extra credit points for their participation. A total of 251 (167 women, 84 men) participants (mean age = 18.67) completed both the T1 and T2 assessments. There were no significant differences on any T1 measures between participants who completed both assessments and those who did not complete the T2 assessment ($n = 10$).

Materials

The measures used in this study were the same as those used in Study 1 with two exceptions: (1) we did not include the Distress Scale, and (2) we included a measure of stressful life events—the Acute Life Events Questionnaire.

Acute Life Events Questionnaire (*ALEQ*). A modified Life Events Questionnaire (Needles & Abramson, 1990) was used to assess naturally occurring *acute* stressful life events important to college students. Items assessed a broad range of life events from school/achievement to interpersonal/romantic. Participants were instructed to indicate which of the negative life events had occurred to them over the previous 5 weeks (i.e., the time since their first assessment). To aid accurate recall, participants were given calendars with the 5-week interval highlighted. The calendar included the dates of school-related activities and holidays to create memory "anchors" that would help students determine whether particular life events occurred during the

5-week interval. Scores can range from 0 to 30 with higher scores indicating the occurrence of more negative events.

Procedure

The longitudinal study consisted of two time points separated by 5 weeks. At Time 1, participants were administered a brief demographics questionnaire, an explicit measure of cognitive vulnerability (CSQ), an implicit measure of cognitive vulnerability (self-worth IAT), and a measure of depressive symptoms (BDI). Five weeks later (Time 2) participants completed a questionnaire packet with the BDI and a measure of stressful life events (ALEQ).

Results

Data analyses focused on testing the hypothesis that explicit cognitions would be a more potent predictor of long-term depressive reactions in the presence of stressful life events than implicit cognitions. We used hierarchical multiple regression (Cohen et al., 2003) to analyze the data. In all analyses, the Time 1 depression measure (T1 BDI) was entered in the first step of the regression equation to create a residual change score for the same Time 2 measure (T2 BDI). In the second step, the main effects of cognitive vulnerability (e.g., CSQ or self-worth IAT) and stressful life events (ALEQ) were entered. Last, the vulnerability × stress interaction term was entered (e.g., CSQ × ALEQ, or self-worth IAT × ALEQ). To examine the unique contribution of the explicit and implicit measures of cognitive vulnerability toward the prediction of depressive symptoms, we used regression equations with each cognitive vulnerability measure × stressful life event interaction term entered simultaneously. Consistent with the recommendations of Cohen et al. (2003), all continuous independent variables were centered and individual variables within a given set were not interpreted unless the set as a whole was significant, thereby reducing Type I errors. Descriptive statistics and correlations for the measures are listed in Table 2.

In the first regression equation, we tested whether the explicit measure of cognitive vulnerability interacted with stress to predict prospective changes in depressive symptoms as measured by the BDI. As shown in Table 3, the main effect of ALEQ predicted BDI scores at T2 independently of cognitive vulnerability, $b = 0.63$, $t = 4.91$, $p < 0.001$. Consistent with prior research, there also was a significant CSQ × ALEQ interaction, $b = 0.56$, $t = 3.14$, $p = 0.002$. To determine the pattern of the CSQ × ALEQ interaction, we computed T2 BDI scores by inserting specific values for predictor variables (i.e., 1 SD above and below the mean) into the regression equation. As shown in Fig. 2, participants with high CSQ scores and high stress exhibited the greatest level of depressive symptoms at T2, even after controlling for T1 BDI scores.

Table 2
Means, standard deviations, and correlations: Study 2 (longitudinal) measures

	1	2	3	4	5
1 CSQ	—				
2 Self-worth IAT	−0.15	—			
3 ALEQ	0.22	−0.11	—		
4 BDI T1	0.40	−0.08	0.30	—	
5 BDI T2	0.26	−0.20	0.39	0.63	—
M	4.09	0.69	2.90	6.20	5.66
SD	0.73	0.38	2.54	5.57	6.33

Note. $N = 251$; CSQ = Cognitive Style Questionnaire; Self-worth IAT = self-worth Implicit Association Test; ALEQ = Acute Life Events Questionnaire (given at T2); BDI T1 = Beck Depression Inventory at Time 1; BDI T2 = Beck Depression Inventory at Time 2.
Note that mean item scores are presented for the CSQ whereas total scores are presented for all other measures. Higher scores on the CSQ, ALEQ, and BDI indicate greater levels of the construct being measured. In contrast, lower scores on the self-worth IAT indicate greater levels of implicit cognitive vulnerability (i.e., more negative self views). Correlations greater than or equal to 0.13 are significant at the 0.05 level.

Table 3
Cognitive vulnerability–stress interactions predicting time 2 depressive symptoms

Predictor	*b*	*pr*	*t*	Step R^2 Change
Explicit measure analysis				
Step 1				0.40
T1 BDI covariate	0.72	0.63	12.77***	
Step 2				0.05
ALEQ	0.63	0.30	4.91***	
CSQ	−0.18	−0.03	−0.40	
Step 3				0.02
CSQ X ALEQ	0.56	0.20	3.14**	
	Model $R^2 = 0.47$, $F(4, 246) = 54.72$, $p < .001$			
Implicit measure analysis				
Step 1				0.40
T1 BDI covariate	0.72	0.63	12.77***	
Step 2				0.07
ALEQ	0.61	0.29	4.83***	
Self-worth IAT	−2.34	−0.19	−2.98**	
Step 3				0.01
Self-worth IAT X ALEQ	−0.76	−0.14	−2.23*	
	Model $R^2 = 0.48$, $F(4, 246) = 56.51$, $p < 0.001$			
Implicit vs. *explicit measure analysis*				
Step 1				0.40
T1 BDI covariate	0.72	0.63	12.77***	
Step 2				0.07
ALEQ	0.62	0.30	4.89***	
Self-worth IAT	−2.42	−0.19	−3.06**	
CSQ	−0.36	−0.05	−0.80	
Step 3				0.02
Self-worth IAT X ALEQ	−0.56	−0.10	−1.62	
CSQ X ALEQ	0.46	0.16	2.57*	
	Model $R^2 = 0.49$, $F(6, 244) = 39.72$, $p < 0.001$			

Note. ALEQ = Acute Life Events Questionnaire; CSQ = Cognitive Style Questionnaire; Self-worth IAT = self-worth Implicit Association Test; T1 BDI = Beck Depression Inventory at Time 1.*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

In the next regression equation, we tested whether the implicit measure interacted with stress to predict prospective changes in depressive symptoms (BDI). As can be seen in Table 3, there were significant main effects of ALEQ ($b = 0.61$, $t = 4.83$, $p < 0.001$) and self-worth IAT ($b = -2.34$, $t = -2.98$, $p = 0.003$). The self-worth IAT × ALEQ interaction term also was significant, $b = -0.76$, $t = -2.23$, $p = 0.03$. To determine the pattern of this interaction, we computed T2 BDI scores by inserting specific values for predictor variables (i.e., 1 SD above and below the mean) into the regression equation. As can be seen in Fig. 2, participants with low implicit self-worth who experienced high stress levels had the greatest level of depressive symptoms at T2.

To determine the unique contributions of implicit and explicit predictors of depressive symptoms, we conducted a third regression analysis with the explicit and implicit cognitive vulnerability variables entered together. In our earlier analyses, looking at each variable independently, both the CSQ and the self-worth IAT interacted with stress to predict changes in depressive symptoms. Thus, we placed both of these interaction terms into a regression equation simultaneously to determine the unique contribution of each cognitive vulnerability-stress component to predict changes in BDI scores. As shown in Table 3, there was a significant main effect of ALEQ ($b = 0.62$, $t = 4.89$, $p < 0.001$) and self-worth IAT score ($b = -2.42$, $t = -3.06$, $p = 0.002$). With both the implicit and explicit cognitive vulnerability–stress interaction terms in the equation, the CSQ × ALEQ interaction term remained significant, $b = 0.46$, $t = 2.57$, $p = 0.01$, but the IAT × ALEQ

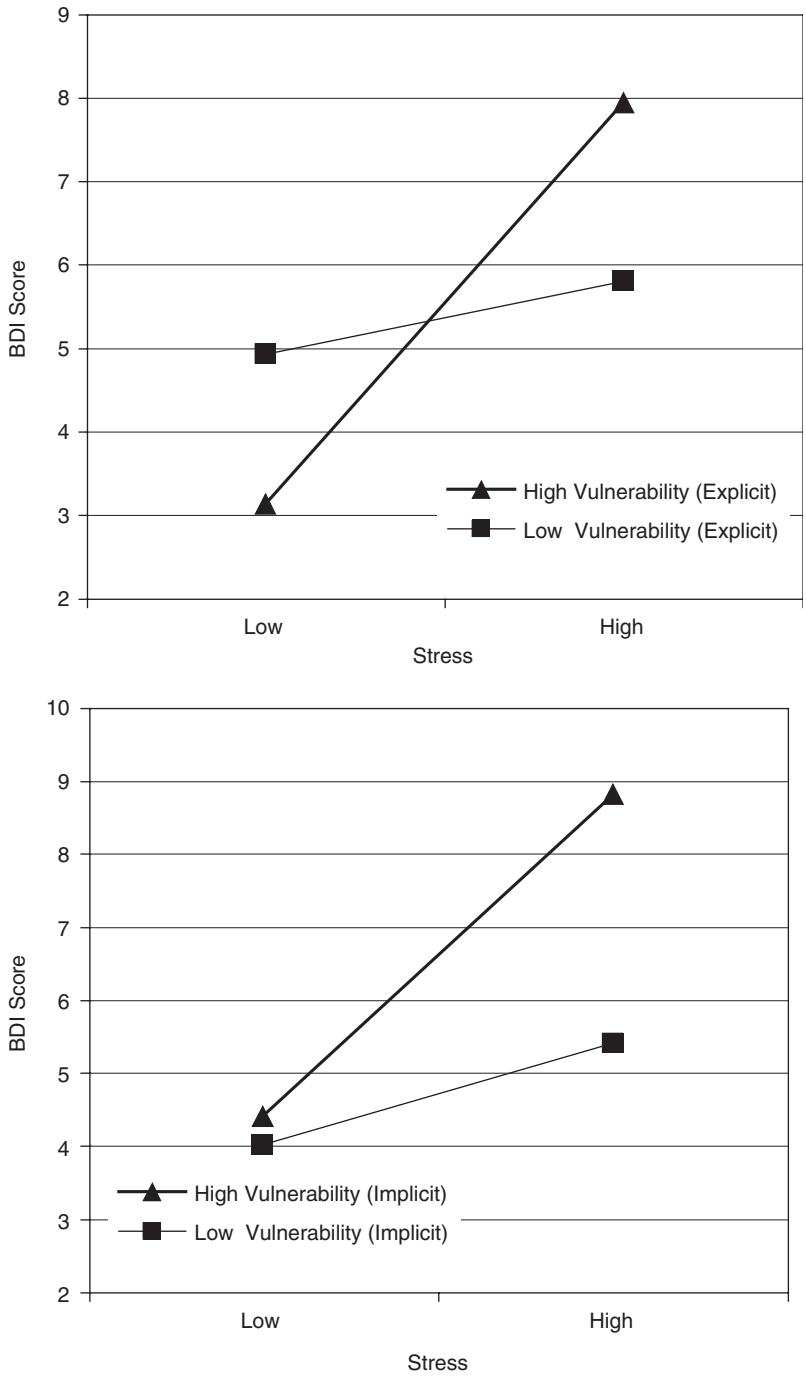

Fig. 2. Top panel: Time 2 BDI score as a function of CSQ score (high vs. low) and ALEQ score (high vs. low). Bottom panel: Time 2 BDI score as a function of self-worth IAT score (high vs. low) and ALEQ score (high vs. low).

interaction term did not, $b = -0.56$, $t = -1.62$, $p = 0.11$. (We also tested whether implicit and explicit measures of cognitive vulnerability interacted with each other to predict prospective changes in depressive symptoms, as measured by the BDI. The CSQ $\times$ self-worth IAT $\times$ ALEQ interaction term did not predict changes in BDI score, $b = 0.30$, $t = 0.54$, $p = 0.59$.)

Summary of study 2 results

As predicted, the explicit measure interacted with stress to predict changes in depressive symptoms as measured by the BDI. This result adds to the growing body of literature supporting the construct validity of the CSQ as a measure of cognitive vulnerability to depression. The self-worth IAT also interacted with life stress to predict depressive symptoms as measured by the BDI. These results provide some of the first evidence that implicit cognitions interact with life stress to confer risk for the prospective development of depressive symptoms. However, when both interaction terms were entered into a regression equation at the same time, only the CSQ X Stress interaction term remained a significant predictor of depressive symptoms. This result supports the prediction generated by the dual-process theory of cognitive vulnerability.

General discussion

We conducted two studies to test a dual-process theory of cognitive vulnerability to depression. According to this theory, implicit processes are key determinants of a person's immediate affective reaction to stress whereas explicit processes have greater importance for predicting long-term depressive reactions. Consistent with hypotheses, results of study 1 (cross-sectional) showed that the implicit, but not explicit, measure of cognitive vulnerability interacted with condition to predict immediate affective responses to a lab-stressor. Study 2 examined more long-term depressive reactions over a 5-week prospective interval. Consistent with hypotheses, when both the explicit and implicit measures were entered into a regression equation simultaneously, only the explicit measure interacted with stress to predict depressive symptoms. These two studies provide preliminary validation of a dual-process model of cognitive vulnerability to depression.[2]

Results of the longitudinal study support the dual-process hypothesis that a person's explicit cognitive style is a more potent vulnerability factor for future depressive symptoms than his or her implicit cognitive style in the presence of life stress. However, it is important to note that this does not mean that implicit processes are not important factors for enduring depressive symptoms. Indeed, prior to controlling for the explicit measure, the implicit measure was a significant predictor of depressive symptoms. Although not predicted a priori, this result also is consistent with the dual-process theory. Unlike implicit processes, explicit processing requires effort, motivation (e.g., Fazio & Towles-Schwen, 1999), and cognitive resources (Gilbert et al., 1988). If a person cannot recruit explicit processes, then vulnerability for depression should be determined by the content of the person's activated schemas (see Beevers, 2005). It is also noteworthy that the main effect of the implicit measure remained a significant predictor of future depressive symptoms, even after controlling for the explicit vulnerability by stress interaction. This result suggests that implicit cognitions may have an impact on depressive symptoms even in the absence of a clearly identifiable stressor. Although this finding does not conform to the vulnerability–stress hypothesis, it highlights the need for future investigations into the conditions under which implicit vulnerability has its effects. We suspect that this will occur most frequently under conditions where the individual does not have opportunity to practice or elaborate on their explicit interpretations (e.g., under significant resource depletion or cognitive load), so their implicit cognitions remain unchanged.

In addition to providing preliminary support for the dual-process model of cognitive vulnerability, the two studies revealed other notable findings. First, the explicit and implicit measures of cognitive vulnerability were only weakly correlated. These results lend further support for the distinction between implicit and explicit cognition. Second, the longitudinal study provided some of the first support for the interaction of implicit processes and stressful life events in the prediction of future depressive symptoms. Third, the supportive results for the CSQ should be highlighted given the criticisms typically waged against explicit self-report measures. Self-report measures often are considered inferior to "more objective" measures such as information-processing tasks and imaging tools because self-report measures allow individuals to use deliberate processing. Ironically, this "weakness" might be the greatest strength of these measures. Indeed, a self-report measure like the CSQ allows participants enough time to "go beyond" their initial inferences, which may be their tendency in everyday life.

[2]The results of both studies remain the same if the self-worth scale of the CSQ is used instead of the full scale (self-worth, consequences, and cause).

The dual-process theory of cognitive vulnerability also provides a framework for understanding prior research. For example, Conner and Barrett (2005) recently found that implicit self-attitudes predicted momentary negative affect more consistently than did explicit self-attitudes. This result is consistent with the hypothesis that implicit cognitions (which are activated automatically) are better predictors of immediate affect than explicit processes (which require deliberation). Similarly, the results of the "mid-term" studies conducted by Metalsky, Halberstadt, & Abramson (1987), Metalsky, Joiner, Hardin, & Abramson (1993) also are consistent with the dual-process theory. Metalsky and colleagues found that the CSQ (measure of explicit cognition) did not predict same-day mood reactions to mid-term grades, but did predict enduring depressive mood reactions. This result is similar to the present findings in which the CSQ did not predict reactions to the lab stressor, but did predict depressive reactions over a five-week interval.

Limitations of the present studies should be noted. First, the distress measure used in the cross-sectional study was a partial PANAS scale (eight items). It will be important to replicate our findings using the full scale PANAS or some other reliable affective measure. Second, in Study 1, the CSQ and BDI were administered in a different experimental session than the IAT and negative event manipulation. It is unclear if the different administration times (typically 1 day apart) had an impact on the results. Third, the present study examined risk for developing depressive symptoms in a sample of college students, perhaps limiting its generalizability. However, it is important to recognize that college students are an ideal population for testing the cognitive theories because they are at the peak age for developing depression (Hankin, Abramson, Moffitt, Silva, & McGee, 1998), and they are likely to experience sufficient levels of stress. The present studies also suggest future research directions. For example, the use of stress interviews or daily diary assessments to measure stressful events may help clarify the temporal relationship among cognitive vulnerability, stress, and depressive reactions. Also, the IAT is only one strategy for measuring implicit cognitions; future studies should examine whether results vary as a function of the type of implicit measure used.

In future research, we will also test other predictions derived from the dual-process theory of cognitive vulnerability. For example, the dual-process theory has intriguing treatment implications. Although there is strong support for the efficacy of cognitively based prevention and treatment interventions for depression (see review by Hollon, Thase, & Markowitz, 2002), the exact mechanism by which cognitive therapy achieves its desired effect remains unclear. According to Beck, Rush, Shaw, & Emery (1979), the mechanism of change in cognitive therapy is the alteration of negative schemas. Changing schemas to be more positive should lead to fewer negative automatic thoughts, and in turn, reduced depression. Outcome research has supported Beck's hypothesis by showing that reductions in negative thoughts mediate the prevention effect and relapse prevention effect of cognitive interventions (e.g., DeRubeis & Hollon, 1995; Gillham, Reivich, Jaycox, & Seligman, 1995; Seligman, Schulman, DeRubeis, & Hollon, 1999). Nonetheless, it is not clear to what extent these reductions in negative thoughts reflect a *process* change versus a change in the *content* of implicit schemas (see Barber & DeRubeis, 1989). That is, cognitive therapy may be successful because it gives people the skills to explicitly "re-think" or override the negative thoughts generated by implicit self-schemas (process), not because it changes the content of those schemas. The dual-process theory suggests that a content change may not be necessary to decrease risk for depression. If explicit processes can override implicit processes, then teaching a person to deliberately generate more adaptive meanings for stressful life events may decrease their vulnerability for depression.

According to the cognitive theories of depression, some people are vulnerable to depression because they tend to generate interpretations of stressful life events that have negative implications for themselves. Recent research has provided solid support for this hypothesis using both implicit and explicit measures, respectively. However, the present work is one of the first to integrate research on both implicit and explicit cognitive processes. We proposed a dual-process theory of cognitive vulnerability to depression and then provided preliminary support for the theory in two studies. We hope that this work leads to a more sophisticated understanding of the cognitive causes of depression.

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References

Abramson, L. Y., Alloy, L. B., Hankin, B. L., Haeffel, G. J., MacCoon, D. G., & Gibb, B. E. (2002). Cognitive vulnerability-stress models of depression in a self-regulatory and psychobiological context. In I. H. Gotlib, & C. L. Hammen (Eds.), *Handbook of depression*. New York: Guilford.

Abramson, L. Y., Metalsky, G. I., & Alloy, L. B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review*, *96*, 358–372.

Alloy, L. B., Abramson, L. Y., Murray, L. A., Whitehouse, W. G., & Hogan, M. E. (1997). Self-referent information-processing in individuals high and low cognitive risk for depression. *Cognition and Emotion*, *11*, 539–568.

Alloy, L. B., Abramson, L. Y., Hogan, M. E., Whitehouse, W. G., Rose, D. T., et al. (2000). The Temple–Wisconsin Cognitive Vulnerability to Depression (CVD) Project: Lifetime history of Axis I psychopathology in individuals at high and low cognitive vulnerability to depression. *Journal of Abnormal Psychology*, *109*, 403–418.

Barber, J. P., & DeRubeis, R. J. (1989). On second thought: Where the action is in cognitive therapy for depression. *Cognitive Therapy and Research*, *13*, 441–457.

Beck, A. T., Rush, A. J., Shaw, B. F., & Emery, G. (1979). *Cognitive therapy of depression*. New York: Guilford Press.

Beck, A. T., Steer, R. A., & Garbin, M. G. (1988). Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clinical Psychology Review*, *8*, 77–100.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*, 53–63.

Beevers, C. G. (2005). Cognitive vulnerability to depression: A dual process model. *Clinical Psychology Review*, *25*, 975–1002.

Bosson, K. J., Swann, W. B., & Pennebaker, J. W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited. *Journal of Personality and Social Psychology*, *79*, 631–643.

Chaiken, S., & Trope, Y. (1999). *Dual-process theories in social psychology*. New York: Guilford Press.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied Multiple Regression/Correlation Analysis for Behavioral Sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Conner, T., & Barrett, L. F. (2005). Implicit self-attitudes predict spontaneous affect in daily life. *Emotion*, *5*, 476–488.

DeRubeis, R. J., & Hollon, S. D. (1995). Explanatory style in the treatment of depression. In G. M. Buchanan, & M. E. P. Seligman (Eds.), *Explanatory style* (pp. 99–111). Hillsdale, NJ: Lawrence Erlbaum Associates.

Devine, P. G. (1989). Stereotypes and Prejudice: Their automatic and controlled components. *Journal of Personality and Social Psychology*, *56*, 5–18.

Fazio, R. H., & Towles-Schwen, T. (1999). The MODE model of attitude-behavior processes. In S. Chaiken, & Y. Trope (Eds.), *Dual-process theories in social psychology*. New York: Guilford Press.

Gilbert, D. T., Pelham, B. W., & Krull, D. S. (1988). On cognitive busyness: When person perceivers meet persons perceived. *Journal of Personality & Social Psychology*, *54*, 733–740.

Gillham, J., Reivich, K., Jaycox, L., & Seligman, M. E. P. (1995). Prevention of depressive symptoms in school children: Two year follow-up. *Psychological Science*, *6*(6), 343–351.

Gotlib, I. H., & Neubauer, D. L. (2000). Information-processing approaches to the study of cognitive biases in depression. In S. L. Johnson, A. M. Hayes, T. M. Field, N. Schneiderman, & P. M. McCabe (Eds.), *Stress, coping, and depression*. Mahwah, NJ: Lawrence Erlbaum Associates.

Greenwald, A. G., & Farnham, S. D. (2000). Using the implicit association test to measure self-esteem & self-concept. *Journal of Personality & Social Psychology*, *79*, 1022–1038.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology*, *74*, 1464–1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology*, *85*, 197–216.

Hankin, B. L., Abramson, L. Y., Moffitt, T. E., Silva, P. A., McGee, R., et al. (1998). Development of depression from preadolesence to young adult: Emerging gender differences in a 10-year longitudinal study. *Journal of Abnormal Psychology*, *107*, 128–140.

Hollon, S. D., Thase, M. E., & Markowitz, J. C. (2002). Treatment and prevention of depression. *Psychological Science in the Public Interest*, *3*.

MacLeod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). *Journal of Abnormal Psychology*, *111*, 107–123.

Martin, P. R., & Seneviratne, H. M. (1997). Effects of food deprivation and a stressor on head pain. *Health Psychology*, *16*, 310–318.

Metalsky, G. I., Halberstadt, L. J., & Abramson, L. Y. (1987). Vulnerability to depressive mood reactions: Toward a more powerful test of the diathesis-stress and causal mediation components of the reformulated theory of depression. *Journal of Personality and Social Psychology*, *52*, 386–393.

Metalsky, G. I., Joiner, T. E., Hardin, T. S., & Abramson, L. Y. (1993). Depressive reactions to failure in a naturalistic setting: A test of the hopelessness and self-esteem theories of depression. *Journal of Abnormal Psychology*, *102*, 101–109.

Mogg, K., Mathews, A., Bird, C., & MacGregor-Morris, R. (1990). Effects of stress and anxiety on the processing of threat stimuli. *Journal of Personality and Social Psychology*, *59*, 1230–1237.

Needles, D. J., & Abramson, L. Y. (1990). Positive life events, attributional style, and hopelessness: Testing a model of recovery from depression. *Journal of Abnormal Psychology*, *99*, 156–165.

Nosek, B.A., Greenwald, A.G., & Banaji, M.R. (in press). The implicit Association Test at age 7: A methodological and conceptual review. In J.A. Bargh (Ed.), *Automatic processes in social thinking and behavior*. Psychology Press.

Scher, C. D., Ingram, R. E., & Segal, Z. V. (2005). Cognitive reactivity and vulnerability: Empirical evaluation of construct activation and cognitive diatheses in unipolar depression. *Clinical Psychology Review*, *25*, 487–510.

Seligman, M.E.P., Schulman, P., DeRubeis, R.J., & Hollon, S.D. (1999). The prevention of depression and anxiety. *Prevention and Treatment*, 2.

Tresselt, M. E., & Mayzner, M. (1966). Normative times for a sample of 134 solution words and 378 associated anagrams. *Psychonomic Monograph Supplements*, *1*, 293–298.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070.

Wilson, T. D., Lindsey, S., & Schooler, T. Y. (2000). A model of dual attitudes. *Psychological Review*, *107*, 101–126.