An indirect measure of negative self reference interacts with academic failure to predict continuing depressive symptomatology

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ABSTRACT

According to the dual-process theory of cognitive vulnerability to depression, two types of measures assess processes which influence individuals' depressive responses to stress. Automatic associative processes are evaluated using implicit measures to predict individuals' initial depressive reaction to stressful situations. Effortful reflective processes are evaluated using explicit self report measures to predict continuing depressive responses. The present study extends this view by examining for the first time, the predictive validity of the dual process stress–diathesis model of depression using two indirect performance based measures. Results showed that reflective Negativity Aversion that examines implicit difficulties in maintaining active negative self reference, but not associative Implicit Association Test, predicted longitudinally future continuing depressive responses among individuals who failed to meet their academic expectations.

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1. Introduction

Four decades ago, the study of vulnerability to depression was highly influenced by major advances in cognitive theories of depression (e.g., Abramson, Metalsky, & Alloy, 1989; Beck, 1976). These theoretical perspectives led to numerous empirical examinations, culminating in complex dual process models that integrate implicit and explicit mechanisms (see Beevers (2005) for a review).

Pioneering work addressing cognitive vulnerability to depression searched for differences in the cognitive profiles of non-depressed, remitted, and depressed individuals. Initial findings were discouraging; although depressed individuals were distinct from non-depressed in their cognitive profile, the non-depressed individuals appeared similar to remitted participants. These findings led to an intermediate conclusion that the cognitive profile of depressed individuals is transient or perhaps merely a consequence or a correlate of the depressive episode (e.g., Coyne, 1992; Shahar & Davidson, 2003).

A second generation of studies addressed this puzzling pattern by relying on a stress–diathesis conceptualization. Specifically, cognitive vulnerability was posited to be long lasting, but it also lays dormant unless activated during stressful life events (e.g., Segal & Ingram, 1994). Numerous studies have shown that under conditions of increased stress, or negative affect, cognitive vulner-

ability factors predict onset, relapse and recurrence of depression (see Scher, Ingram, and Segal (2005) for a recent review).

A recent advancement in the study of cognitive vulnerability to depression was enabled by the introduction of implicit measures of the self concept. These measures involve automatic activation of stable memory constructs, which arise without intention or effort, and consequently do not tax cognitive resources. At a first glance, implicit measures appear to be ideal for the study of cognitive vulnerability of depression, in that they purport to reveal the dormant cognitive schemas constituting the depressive diathesis. However, a host of studies, resting primarily on a cross-sectional design, largely failed to support the stress–diathesis model of depression (e.g., De Raedt, Schacht, Franck, & De Houwer, 2006; Franck, De Raedt, & De Houwer, 2007; Franck, De Raedt, Dereu, & Abbeele, 2007; Gemar, Segal, Sagrati, & Kennedy, 2001). For example, Gemar and colleagues (2001) used an elegant stress–diathesis laboratory procedure, whereby remitted and non-depressed individuals were administered the widely accepted Implicit Association Test (IAT, Greenwald & Farnham, 2000) before and after a negative mood induction. This reaction time test yields an index for implicit positive self bias, reflected in quicker responses in conditions in which "self" and positive" attributes were associated as compared to conditions in which "self" and "negative" were associated. Confirming their predictions the authors found that remitted individuals (but not the control group) showed a decrease in their implicit positive self view following the negative mood induction, suggestive of stress induced activation of depresogenic schemas. However, as De Raedt et al. (2006) noted, both groups showed similar levels

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of *positive* implicit self view following the mood induction, suggesting that the decrease found for the remitted group resulted from higher implicit self view prior the mood induction.

This paradoxical result of an implicit positive self bias in vulnerable remitted individuals appears to be genuine and even more extensive than had been initially thought, as it was also observed among dysphoric individuals (Sheppes, Meiran, Gilboa-Schechtman, & Shahar, 2008), depressed individuals (Franck, De Raedt, & De Houwer, 2007), suicidal depressed individuals (Franck, De Raedt, Dereu, et al., 2007) and using different implicit measures (De Raedt et al., 2006).

In an attempt to address this apparent paradox, we looked into the underlying cognitive operations that constitute the self concept in dysphoria (Sheppes et al., 2008). In doing so, we relied on a recent dual-process theory of cognitive vulnerability to depression (e.g., Beevers, 2005; Haeffel et al., 2007) that differentiates between two modes of information processing. An associative mode that involves automatic, effortless processing that does not recruit cognitive control, and a reflective mode that engages deliberate, effortful processing that recruits cognitive control. According to this view, immediate depressive responses to stressful events result from activation of automatic associative processing (as measured by the IAT). However, effortful reflective processing is later initiated in order to reinterpret the immediate automatic response to a stressful event. This final effortful interpretation dictates the final response, and accordingly better predicts continuing depressive symptoms. Consequently, we predicted that dysphoric individuals, which by definition show continuing depressive symptoms (i.e., symptoms lasting for at least 2 weeks for the diagnosis of dysphoria), are likely to differ from non-dysphoric individuals in effortful reflective processes rather than simple automatic processes.

To check this prediction, we had dysphoric and non-dysphoric individuals perform a simple associative-mode measure (the IAT), and a reflective processing measure that we developed (Sheppes et al., 2008). Utilizing task switching theorizing (see Meiran, 2010; Monsell, 2003 for reviews), we developed a modified IAT task-switching paradigm (IAT–TS) that involves continuously alternating between a self reference IAT task and a matched neutral task. This task allows evaluating how hard it is to switch from a negative (or positive) self reference task to a neutral task. In this task switching procedure effortful reflective processing is needed every time the task changes in order to activate the new relevant mental set. This reflective process, which is considered as a clear paradigmatic case of effortful cognitive control processing entails how difficult it is to initiate a mental set and to hold it in an active state in the focus of attention.

Supporting our predictions, dysphoric and non-dysphoric individuals did not differ in the associative-mode measure (IAT). However, significant differences were obtained in our reflective mode measure. Specifically, non-dysphoric individuals exhibited a substantial difficulty in maintaining a negative self-schema active, whereas dysphoric individuals did not. That is non-dysphorics showed difficulties in switching from a negative self reference task to a neutral task, and dysphorics did not.

At first sight this result may seem counterintuitive, because it suggests that dysphorics have better reflective processing relative to non-dysphorics. However, it is important to notice that this difference was limited to reflective processes that maintain the *negative* self-schema active. Furthermore, this trend of results is widely expected according to central task switching phenomenon called task set inertia (e.g., Allport, Styles, & Hsieh, 1994). Specifically, for non-dysphorics, maintaining the negative self-schema is demanding and effortful, and requires a heightened activation. This heightened state of activation persists into the next (neutral) task and causes response slowing. By contrast, for dysphorics maintaining the negative self reference mental set is effortless and does not

require a heightened state of activation. This low activation hardly persists when the neutral task needs to be adopted. Therefore, we define non-dysphorics' performance in this task as denoting a *Negativity Aversion* – a protective shield against negative self-related cognition demonstrated in substantial difficulties in the ability to focus on negative self reference.

Though we provided a reasonable solution to the paradox of implicit positive bias in dysphoria, our previous study fell short of testing the dual process stress–diathesis model of depressive vulnerability, both because we relied on a cross sectional study and because we did not separately evaluate the stress component.

Indeed, we are aware of only two longitudinal studies that tested the predictive validity of dual process stress–diathesis models of depression. The first (Franck, De Raedt, & De Houwer, 2007) is difficult to interpret within a stress–diathesis framework, since its longitudinal part did not include evaluation of stress. In addition and contrary to the aforementioned dual process logic, automatic associative but not effortful reflective processing predicted continuing depressive symptoms. Furthermore, this result was in the opposite direction to stress–diathesis rationale, since higher implicit positive self reference at Time 1 predicted *higher* depression scores at Time 2. By contrast, and consistent with the dual process stress–diathesis account, Haeffel and colleagues (2007) were the only ones to show that under conditions of high (but not low) reported life stress, high positive implicit self reference predicted *lower* levels of depressive symptoms. Furthermore, when both reflective (evaluated using a self report explicit measure) and associative (the IAT) were used simultaneously as predictors, only the reflective measure remained a reliable predictor of depressive symptoms.

It is important to mention that in Haeffel et al. (2007) the associative process was evaluated using an implicit measure (i.e., the IAT) and the reflective process was evaluated using an explicit self report measure (the Cognitive Style Questionnaire, CSQ). Furthermore, this process-measure categorization is not restricted to that study, rather it is common in dual-process theories in general, where effortful reflective processes were evaluated solely using explicit self report measures (e.g., Hofman, Friese, & Strack, 2009; Strack & Deutsch, 2004, for reviews).

As was described above, we have already shown that a reflective process (Negativity Aversion) can be evaluated using an indirect measure (IAT–TS), and that this indirect measure differentiates between dysphoric and non-dysphoric individuals (Sheppes et al., 2008). Accordingly, in the present study we sought to test, to the best of our knowledge for the first time, the predictive validity of the dual process stress–diathesis model of depression using two indirect performance based measures. Specifically, the assessment of the effortful reflective process was evaluated using our newly developed IAT–TS measure and the automatic associative measure using the IAT. By contrasting these two indirect measures that differ in the processes they assess, we were hoping to show for the first time that continuing depressive responses can be predicted using a reflective indirect measure.

The well known stress–diathesis longitudinal mid-term paradigm was used in the present study. In this paradigm naturally occurring stress is hypothesized to evoke among students who show discrepancies between anticipated and actual performance on a central mid-term exam. Previous work with this paradigm consistently showed that explicit dysfunctional attitudes (a standard reflective measure) towards the self interacted with discrepancies between anticipated and actual performance to predict continuing, but not immediate, depressive symptoms (Brown, Hammen, Craske, & Wickens, 1995; Hankin, Abramson, Miller, & Haeffel, 2004; Joiner, Metalsky, Lew, & Klocek, 1999; Metalsky, Halberstadt, & Abramson, 1987; Metalsky, Joiner, Hardin, & Abramson, 1993; but see Abela & D'Alessandro, 2002). As was stated above the ability of reflective (explicit) measures to predict

continuing, but not immediate, responses to academic failure is predicted by the dual process conceptualization provided by Haeffel and co-workers (2007) according to which reflective processes, dictate the final interpretation to a negative event.

Therefore, in the present study we predicted that continuing depressive reactions that result from the stressful situation of failing to meet academic expectations would be predicted by effortful reflective ability to maintain a negative self reference active (Negativity Aversion in the IAT–TS), but not from automatic associative processing (IAT).

2. Method

2.1. Participants and procedure

In the present study we wanted to check the unique influence of two indirect diathesis performance based measures beyond other explicit potent measures. Haeffel and colleagues (2007) have shown that the Cognitive Style Questionnaire (CSQ) which is an explicit diathesis measure can be more potent than an implicit measure in predicting future depressive symptomatology. The CSQ has also been proven potent in stress–diathesis studies using the mid-term paradigm (e.g., Metalsky et al., 1993). Accordingly, in our participants' selection criteria we sought a representative sample of the negative Cognitive Style Questionnaire (CSQ, composite of the stability, globality, consequences, and self dimensions for negative events. See, Alloy et al., 2000). To that end, we selected our participants out of a larger sample who completed a different study, which involved an administration of the CSQ. This larger sample consisted of 200 and 36 freshmen (53 males) participating in an introductory psychology class who participated as part of their course requirements at Ben Gurion University in Israel (Spivak & Shahar, submitted for publication). We picked our sample using three equal slices that cover the CSQ distribution including: "high negative CSQ slice" ($n = 30$, CSQ range between 4.85 and 5.35; percentile range between 80 and 95), "intermediate negative CSQ slice" ($n = 32$, CSQ range 4.06–4.38 percentile range 42.5–57.5) and "low negative CSQ slice" ($n = 27$, CSQ range 2.92–3.54; percentile range 5–20) for depression according to the negative CSQ.[1]

Accordingly, several months prior to the Introduction to Psychology exam (a key class in their curriculum), 89 participants completed the IAT–TS paradigm followed by the IAT. Two participants were excluded from all analyses because they showed extremely high errors rates during the IAT–TS paradigm (92.5% and 100% error rate in one of the conditions of the IAT–TS paradigm). Four weeks prior to the exam, participants reported their expected grade, completed their levels of depressive symptoms on the BDI-II, and several questionnaires unrelated to the present study. Two to five days after participants received their exam grades, participants reported their actual grade, and again assessed their levels of depressive symptoms.[2] Seventy participants completed both follow up assessments, but our final sample consisted of 67 participants (see below Footnote 3). Of these 67 participants, 49 were female, and the mean age was 22.78.

2.2. Materials

Beck Depression Inventory-II (*BDI-II*) (Beck, Steer, & Brown, 1996): The extensively used BDI-II was employed to assess depressive symptoms. It consists of 21 items, which participants are asked to indicate the highest (i.e., most negative) statement which they agree with. Each item is rated on a 0–3 scale with summary scores ranging between 0 and 63. The BDI–II has been found to demonstrate high internal consistency among college students (Cronbach's alpha = 0.93), and adequate content and factorial validity (Beck et al., 1996). In the current study one item was omitted, pertaining to suicidality. Mean responses of the BDI were computed in the present study.

Mid-term questionnaire: Following Brown and colleagues (1995) participants were asked to indicate which numeric grade they expect to receive in this course. After participants received their grade, they were asked to indicate the grade they actually got. To evaluate the Academic Stressor we first subtracted the exam expectation score from the actual grade. The Academic Stressor variable was categorized into two levels: non-failure ($n = 15$) – a negative score where actual grade is higher than expected grade, and failure ($n = 52$) – a positive score where actual grade is lower than the expected grade[3] (*cf.*, Brown et al., 1995; Metalsky et al., 1993, where supporting analyses that evaluated the contribution of the Academic Stressor involved the same categorization).

IAT–TS (Sheppes et al., 2008, see Fig. 1): This performance based measure was used in order to evaluate indirect effortful reflective measure. In the IAT–TS participants continuously alternate between two tasks: they perform series of 16 trials, involving eight trials of a self task, and eight trials of a matched neutral task. The self task is a new variant of the IAT (single category IAT; Karpinski & Steinman, 2006). It includes one target concept (self) and two attributes (positive and negative attributes). The self target concept is composed of four word stimuli: participant's first name, last name, and the Hebrew words for "I" and "mine". The positive and negative attributes consisted of four participant-generated word attributes describing positive or negative character traits. In this task the target concept "self" is mapped with either the positive or negative attributes in separate blocks of trials. That is in one condition participants press one key for self and positive words and a second key for negative words, and in a second condition keyboard mappings are reversed.

The neutral task is closely matched to the self task in perceptual and response related processing demands (see Sheppes et al., 2008 for details). It also includes one target concept (shape words) and two attributes (dark and light color words). The shape target concept also includes four stimuli (two shapes that the participants chose, and the Hebrew words for "ellipse" and "rhombus"). The dark and light color stimuli consist of four words chosen by each participant. The target concept "shape" is mapped with either the dark or light color words in separate blocks of trials.

In some blocks of the IAT–TS participants switch between a self = positive mental set (the IAT condition where self is paired with positive attributes) and a neutral mental set. In other blocks participants alternate between a self = negative mental set and a

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[1] Our sampling procedure was not predicted to affect our main results using implicit measures. Previous research has repeatedly showed that the correlation between explicit (and specifically the CSQ) and implicit measures is very low (e.g., Haeffel et al., 2007). Importantly, all of the regression analyses reported below were not affected when CSQ was entered as a categorical or a continuous predictor. Note that our results provide a more stringent test for the two indirect measures because we made sure to include a sufficient representation of both the high and low risk groups which were potent predictors of depression in former research (e.g., Alloy et al., 2000).

[2] Previous mid-term studies demonstrated that the ability of cognitive vulnerability measures to predict continuing depressive reactions changes to some extent according to the time interval between the receipt of the grade and the depressive measurement. However, the basic stress diathesis interaction predicted depressive responses during the whole 2–5 days interval following the receipt of the grade exam (Metalsky et al., 1987, 1993; Joiner et al., 1999; Hankin et al., 2004). Accordingly in the present study we made sure participants reported their depressive responses during this time interval.

[3] The results of three participants who received the same grade they had expected were discarded from all analyses because they could not be adequately categorized as experiencing failure or success. Including these participants in either group did not change any of the reported results.
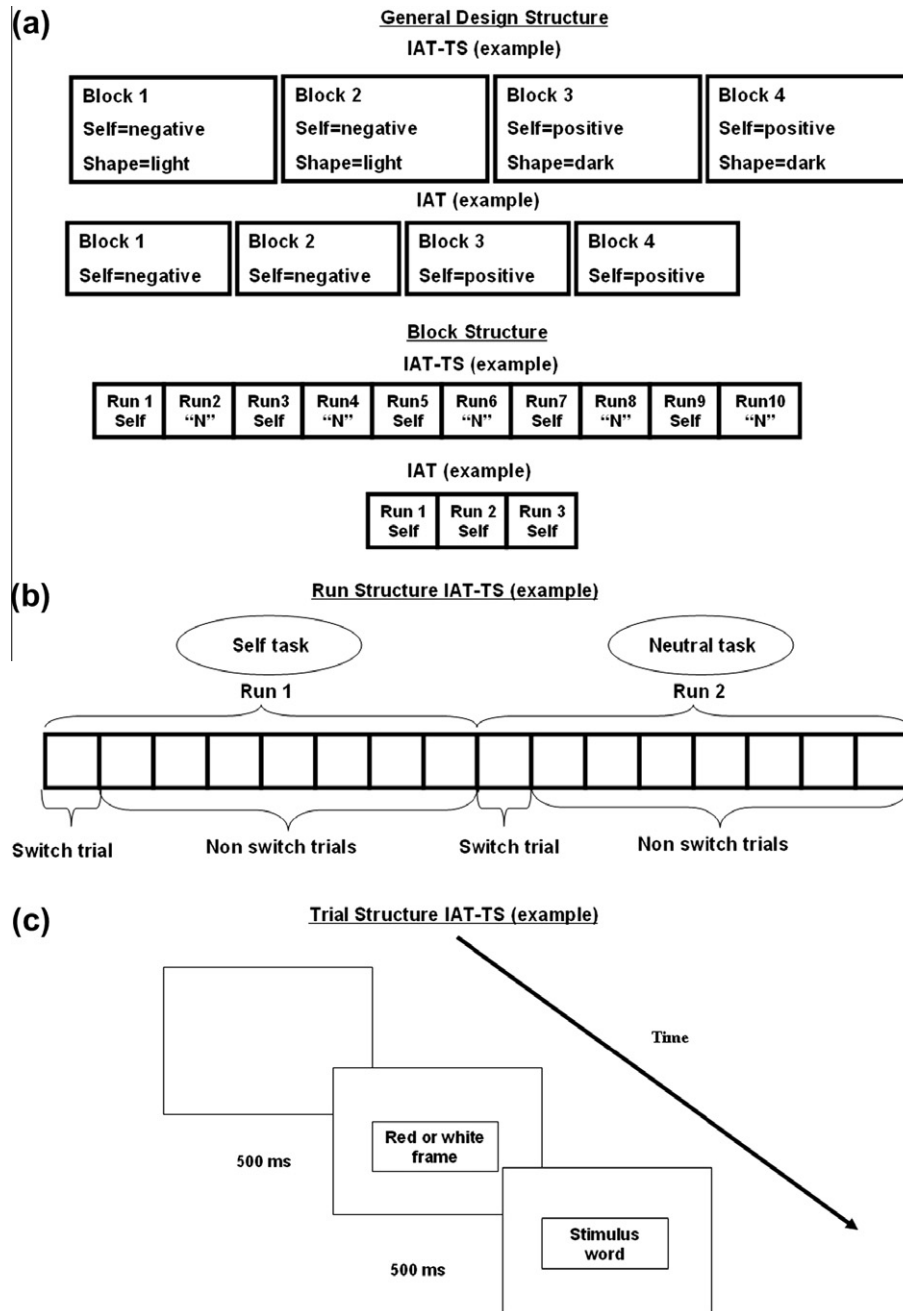
Fig. 1. (a) General design and block structure of the IAT–TS task; (b) two runs in the IAT–TS part; (c) trial sequence IAT–TS.

neutral mental set. Effortful reflective processing is indexed by the response slowing observed in the first trial of performance in a given task (which requires the activation of the new mental set due to switching from the preceding task) relative to the remaining trials of that task. Based on our former findings we concentrated on assessing Negativity Aversion (i.e., difficulties in the ability to focus on negative self reference). This variable is evaluated by assessing the relative difficulty to maintain active the neutral task relative to the (negative) self task: [neutral(first trial–remaining trials)–negative self(first trial–remaining trials)].[4] The more positive score on

this measure the more difficult it is to maintain active the negative self reference mental set. Note that the variables' order in this equation may seem counterintuitive since it suggests that the self reflective process score is manifested in the neutral task. However, as was described above, it totally agrees with the task set inertia effect (Allport et al., 1994), where mental sets that are difficult to maintain require a heightened state of activation for a substantial amount of time. Consequently, if the next trial requires one to adopt a different mental set from the previous trial, the lingering activation of the previous mental set causes performance in the following task to deteriorate.

IAT: To evaluate the automatic associative process participants completed the single category IAT (i.e., performance of both conditions of the self task of the IAT–TS paradigm in separate blocks

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[4] This variable was computed for correct responses. In addition, the first trial following errors was also eliminated.

without switching to the neutral task) following their performance in the IAT–TS.[5] In general lines the automatic associative measure is composed of a difference score between mean response times in the self = positive condition (where self and positive attributes are mapped together to the same key) and a self = negative condition. Faster performance on the self = positive condition indicates that the relative strength of this association is larger than relative strength of the self = negative association. In the present study we calculated the improved scoring algorithm suggested by Karpinski and Steinman (2006) which was shown to increase both the reliability and validity of the IAT.

3. Results

Prior to performing the main data analyses we computed the split-half reliability of Negativity Aversion. In the IAT–TS people perform two blocks of the self = negative condition. We therefore, computed a measure of Negativity Aversion score for each block separately, and then estimated the correlation between these two scores. After Spearman–Brown, the reliability obtained reasonable levels $r = .51$. Overall, the reliability of Negativity Aversion is roughly the same to the internal reliability obtained for the single category IAT (see Karpinski & Steinman, 2006 Experiment 1).

Data analyses focused on testing the dual process diathesis stress model using two indirect measures. Specifically, our hypothesis was that effortful reflective Negativity Aversion (NA, difficulties in focusing on negative self reference), but not automatic associative process (IAT) would predict continuing depressive responses, among participants who fail to meet their academic expectations. We tested our hypothesis using three hierarchical linear multiple regression analysis with multiplicative interaction terms. All continuous predictors were centered (Aiken & West, 1991). Analysis 1 focused on Negativity Aversion as representing a depressive diathesis, Analysis 2 focused on IAT as diathesis. Analysis 3 provided a stringent test of our prediction, as it pitted Negativity Aversion vs. IAT as putative depressive diatheses. The outcome variable in all analyses was Time 2 average score of BDI depression. The first block included Time 1 average of BDI depression, so as to control for baseline depression when examining prospective effects of the diathesis, the stress, and their interaction.[6] Block 2 included the main effects of diathesis (NA or IAT) and naturally occurring stress (Academic Stressor). In Block 3 we entered a multiplicative term representing the interaction between Diathesis and Academic Stressor (NA × Academic Stressor, or IAT × Academic Stressor, or NA × Academic Stressor and IAT × Academic Stressor). In Table 1 we present means, standard deviations, and inter-correlations among the study variables.

Results are presented in Table 2. Confirming our hypotheses, Analysis 1 showed that NA interacted significantly with Academic Stressor to predict changes in BDI depression over time. This was clearly not the case for the IAT, as is indicted by Analysis 2. Importantly, Analysis 3 provided the strongest evidence in favor of our

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[5] In order to evaluate the automatic associative process we could not have used the performance in the self task of the IAT–TS paradigm, rather we had to have participants perform a separate section where they perform the IAT without switching to a neutral task. The task switching literature has differentiated between performance that involves switching between two tasks (e.g., IAT–TS), and performance where only one condition is performed at a time (e.g., the IAT). Specifically, a task switching context demands an ongoing state of readiness which is not needed in a single task performance (see Rubin & Meiran, 2005 for a review).

[6] Since the BDI is known to be skewed, we wanted to check the robustness of our results by repeating our analyses after normalizing the BDI scores. Therefore, we performed a log transformation to the original BDI scores (log[0.05 + BDI]). We then repeated Analysis 3 which provides the most stringent test of our predictions. Specifically, we performed a GLM model where T2BDI was predicted by T1BDI, AS, NA, IAT and the interactions NA × AS, IAT × AS. As expected, the two way interaction between NA and AS was statistically significant $F(1, 60) = 4.64$, $p < .04$. Importantly, the two way interaction between IAT and AS was not significant $F(1, 60) < 1$.

Table 1
Means, standard deviations, and correlations.

	1	2	3	4	5
1. NA					
2. IAT	−0.03				
3. AS	0.12	−0.19			
4. T1 BDI	0.20	−0.15	0.09		
5. T2 BDI	0.05	−0.08	0.21	0.77	
M	29.51	0.30		0.47	0.41
SD	226.48	0.30		0.38	0.34

Note: $N = 67$; NA = Negativity Aversion; IAT = Implicit Association Test; AS = Academic Stressor; T1 BDI = Beck Depression Inventory at Time 1; T2 BDI = Beck Depression Inventory at Time 1. Correlations concerning Academic Stressor were computed using bi-serial correlations. Higher scores on BDI represent higher levels of depression. By contrast lower levels on NA and IAT represent higher vulnerability. Only the T1 BDI T2 BDI correlation is significant at the 0.05 level.

Table 2
Diathesis stress interactions predicting Time 2 depressive responses.

	df	β	t	Step R^2 change
NA measure analysis				
Step 1				0.59
T1 BDI covariate	65	0.77	9.61***	
Step 2				0.03
NA	63	−0.12	−1.5	
AS	63	0.15	1.97	
Step 3				0.03
NA × AS	62	−0.36	−2.14*	
IAT measure analysis				
Step 1				0.59
T1 BDI covariate	65	0.77	9.61***	
Step 2				0.02
IAT	63	0.07	0.84	
AS	63	0.15	1.92	
Step 3				0.001
IAT × AS	62	0.11	0.5	
NA vs. IAT analysis				
Step 1				0.59
T1 BDI covariate	65	0.77	9.61***	
Step 2				0.04
NA	62	−0.12	−1.51	
IAT	62	0.07	0.87	
AS	62	0.17	2.09*	
Step 3				0.03
NA × AS	60	−0.36	−2.12*	
IAT × AS	60	0.15	0.68	

Note: $N = 67$. NA = Negativity Aversion; IAT = Implicit Association Test; AS = Academic Stressor; T1 BDI = Beck Depression Inventory at Time 1; T2 BDI = Beck depression Inventory at Time 1. Higher scores on BDI represent higher levels of depression. By contrast lower levels on NA and IAT represent higher vulnerability.
* $p < 0.05$.
*** $p < 0.0001$.

prediction. Specifically, when the two diatheses were pitted against each other, Negativity Aversion, but not the IAT interacted with Academic Stressor to predict changes in depression over time.

To gain a better appreciation of the pattern of interaction between Negativity Aversion and Academic Stressor, we probed this interaction based on recommendations put forth by Aiken and West (1991). Specifically, we calculated the simple slope of Negativity Aversion under conditions of failure and success (see Fig. 2). We found that this simple slope was statistically significant for failure ($\beta = -0.20$, $t(62) = -2.31$, $p < 0.03$) but not for success
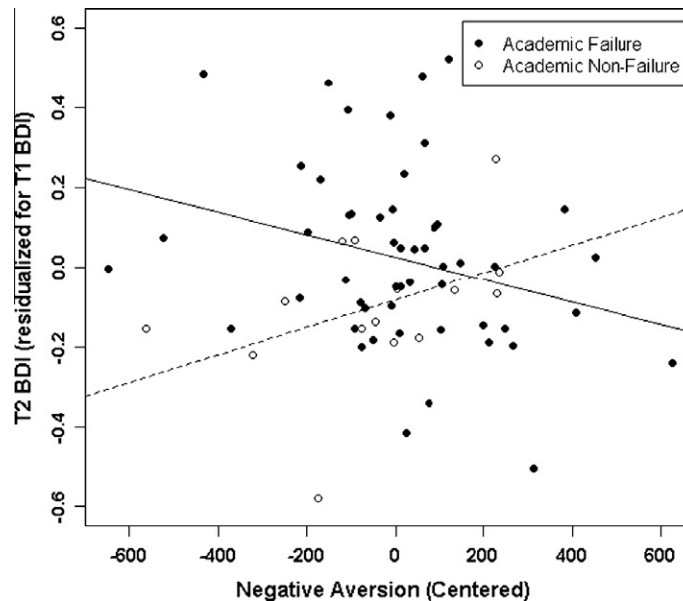
Fig. 2. Regression slopes between Negativity Aversion and T2 BDI residualized for T1 BDI for individuals who failed to meet their expectations and for individuals who did not fail to meet their academic expectations.

($\beta = 0.20$, $t(62) = 1.20$, ns).[7] As predicted and in line with diathesis stress logic, this result indicates that for participants who failed to meet their academic expectations, higher NA resulted in lower depressive response.

4. Discussion

The present longitudinal study tested, to the best of our knowledge for the first time, the predictive effect of two indirect performance based diathesis measures in predicting depressive responses following a naturally occurring stress. In doing so we relied on a dual-process theory of cognitive vulnerability to depression, which suggests that effortful reflective processes but not automatic associative processes determine the final response to stressful situations (Beevers, 2005; Haeffel et al., 2007). Accordingly, we assessed two indirect diatheses measures: effortful reflective Negativity Aversion that examines difficulties in maintaining active a negative self reference mental set, and a measure of automatic associative process (IAT). The basic finding was that reflective Negativity Aversion, but not associative IAT, predicted future depressive responses following an academic aspirations stressor. This result was in the expected direction, showing that among individuals who failed to meet their academic expectations, higher Negativity Aversion was related to lower depressive responses. Furthermore, the core finding remained valid even when we pitted Negativity Aversion and the IAT in the same analysis.

How does our differentiation between effortful reflective Negativity Aversion and automatic associative IAT relate to the dual-process theory of cognitive vulnerability to depression (Beevers, 2005; Haeffel et al., 2007)? According to this account, a certain stressor initially activates simple automatic depressive responses.

However, the long term depressive response to a stressor depends on effortful reflective processes that may correct or exacerbate the initial automatic activation. Accordingly, in the present case, individuals who fail to meet their academic expectations will immediately experience differing levels of depressive mood responses, depending on the strength of the automatic negative associations of their self concepts. However, continuing depressive responses are likely to persevere among individuals who continuously activate, maintain and consequently dwell on their negative self reference mental set.

Our results have important clinical implications. We suggest that continuing vulnerability to depression may not depend on the negativity of the contents within the self concept (as measured by the IAT). Rather, it is contingent upon the increased focus on such negative contents (i.e., Negativity Aversion). This conceptualization agrees with those offered by other authors (e.g., Ingram, Miranda, and Segal (1988); Persons & Miranda, 1992; Teasdale, 1983, 1988), who state that depressed individuals are different from non-depressed in terms of the ease with which depressed focus their attention on negative aspects of the self, and not on the relative strength of the negative toned associations towards the self.

Our Negativity Aversion measure also agrees with the underlying mechanism in rumination – a strong predictor of depression's onset (see Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008 for a recent review). The active ingredient in rumination is the perseverative focus of attention on negative aspects of the self, rather than the specific contents that constitute the negative self. In the same vein, a recent influential dual process account of vulnerability to depression suggests that low serotonergic function together with a deficit in executive reflective processing may result in failure to override a hyperactive negative associative system which would result in prolonged negative associations (Carver, Johnson, & Joormann, 2008). Accordingly, low levels of Negativity Aversion which involve inability to overcome activation of negative self reference could potentially evolve to repetitive and continuous negative self deliberation.

Our conceptualization and related findings contribute not only to dual-process theories of cognitive vulnerability to depression, but also to dual-process theories in general. In these theories there

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[7] The trend of results we found for people who outperformed their academic expectations showed that negative aversion was *positively* related to depressive symptoms. Even though the present study, which relies on a stress–diathesis model of depression, has clear predictions only for stressful (i.e., failure) situations, this result was in the opposite direction. Though intriguing, we are hesitant to interpret this finding as meaningful because this association was non-significant, and because the magnitude of the correlation is likely to be inflated and biased given that it is based on a relatively small subsample of individuals ($n = 15$. see Yarkoni, 2009 for a recent discussion).

is a fixed categorization according to which automatic associative processes are evaluated using *implicit* measures (e.g., IAT) and effortful reflective processes are always evaluated using *explicit self report* measures (e.g., CSQ) (Hofman et al., 2009; Strack & Deutsch, 2004 for reviews). In the present investigation, we used two *indirect performance based* measures to assess both automatic associative processes via the IAT, and effortful reflective processes via the IAT–TS. We argue that Negativity Aversion is clearly an indirect measure and also a clear paradigmatic case of effortful executive process (e.g., Logan, 2003; Monsell, 2003). Furthermore, the findings obtained via our indirect Negativity Aversion measure converge with a majority of studies that have used explicit self report measures (e.g., CSQ) and the same mid-term stressor paradigm (Brown et al., 1995; Hankin et al., 2004; Joiner et al., 1999; Metalsky et al., 1987, 1993).

Accordingly, we argue that effortful reflective processes that predict continuing responses to threat are not the sole possessions of explicit self report measures. This may be important for two reasons. First, it is well known that self report measures are more susceptible to a variety of biases, such as demand characteristics and tacit knowledge, relative to performance based measures such as the IAT–TS. Second, it could be that previous demonstrations of the superiority of explicit measures over implicit measures in predicting continuing results is partially inflated due to shared self report method variance between the explicit measure and the dependent variable (e.g., Haeffel et al., 2007).

The results concerning Negativity Aversion raise another important theoretical issue that relates to dual-process theories. In particular, the question is whether Negativity Aversion reflects a general processing characteristic (such as general task switching ability) or whether it reflects a characteristic of a specific reflective system that is related to a particular content (such as maintaining active *negative* self reference). This issue seems important because a recent influential dual process formulation suggested that general dispositional moderators (e.g., general working memory capacity) operate independently of the associative and reflective systems and moderate their relative impact (Hofman et al., 2009).

The results of both Sheppes et al.'s (2008) study and the present study indicate that Negativity Aversion represents the operation of a content specific reflective system (avoiding a particular content domain, namely the domain of associating one's self with negative attributes). We reached this conclusion utilizing the fact that the IAT–TS paradigm yields two main measures that require the same task switching demand but that differ in content specificity (i.e., Negativity Aversion and Positivity Bias – how difficult it is to focus on positive self reference). Accordingly, if general task switching ability was the driving force of our results then both measures should have equally predicted depressive symptomatology. However, if a content specific reflective system is involved, then Negativity Aversion but not Positivity Bias would be related to depression. Results from Sheppes et al.'s (2008) study, demonstrated that dysphoric individuals were differentiated from non-dysphoric individuals in Negativity Aversion but not in Positivity Bias. Furthermore, in the present study, repeating our analyses with Positivity Bias demonstrated that it did not interact with academic failure and that it did not predict depressive sympotomatology.[8]

Limitations of the present study should be noted. First, though we used the improved scoring algorithm for the IAT, it may have been influenced by an order effect since it was administered following the IAT–TS. However, our previous study (Sheppes et al., 2008) that used the same task order found compatible results for the IAT as previous research (e.g., De Raedt et al., 2006; Gemar

et al., 2001). In addition, in the present study the trend of results in the IAT replicated the expected positive bias found in former research ($M = 0.30$. i.e., faster performance on self = positive relative to self = negative). Furthermore, many task switching experiments which resemble our own design involve performing mixed blocks (blocks where two tasks are performed like the IAT–TS) followed by single blocks (where one task is performed like the IAT) (e.g., Meiran, 2005; Meiran, Gotler, & Perlman, 2001; Yehene & Meiran, 2007).

Second, our participants' selection criteria involved sampling from three slices of the explicit CSQ. We did so because we wanted a representative sample of this potent predictor when evaluating the influence of two indirect performance based measures. Furthermore, when we repeated our core analyses with the CSQ as an additional predictor we reached similar conclusions. However, we wish to mention that this selection criterion may have created a sample that has unique characteristics relative to other samples.

Third, we argued that incorporating indirect measures to evaluate both associative and reflective processes may enhance and challenge the common view of dual-process theories that assessed associative processes using implicit measures and reflective processes using self report explicit measures (e.g., Hofman et al., 2009). However, it is important to state that any given measure is unlikely to be evaluating only one type of process. That is the IAT which in almost all dual process accounts (and in our investigation) has been conceptualized as a clear associative measure, was in fact shown to be a compound measure that encompasses both associative and reflective processes (see Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005; Klauer, Voss, Schmitz, & Teige-Mocigemba, 2007), with even some demonstrations of task switching effects in the classical IAT (e.g., Klauer & Mierke, 2005). Furthermore, it may well be that our reflective IAT-TS measure also encompasses associative processing. Therefore, we argue that the IAT–TS is relatively more reflective than the IAT because it represents a clear paradigmatic case of effortful executive process (e.g., Logan, 2003; Monsell, 2003). Accordingly, our demonstration that a relatively reflective measure but not a relatively associative measure predicts continuing depressive symptoms provides an important contribution to dual process accounts of cognitive vulnerability to depression.

Fourth, our longitudinal design did not include a measurement wave of depressive responses immediately following students' receipt of their academic grade. Therefore, the present study cannot provide a complete test of the dual-process theory of cognitive vulnerability to depression, where one would expect that immediate depressive responses would be predicted by the associative measure (IAT) but not the reflective measure (IAT–TS). Future studies should aim to offer a complete double dissociation between associative and reflective measures in the context of dual process accounts of cognitive vulnerability to depression.

To conclude, in this study we have demonstrated that a newly developed Negativity Aversion performance based measure, which formerly differentiated between dysphoric and non-dysphoric individuals (Sheppes et al., 2008), predicted an increase in depressive symptoms among individuals who failed to meet their academic expectations. This measure outperformed the well studied IAT. This suggests that the indirect effortful reflective process with which individuals maintain active their negative self reference mental set is an important depressive diathesis, and encourage its future study in the context of dual process models of cognitive vulnerability to depression.

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[8] $F_{(1, 62)} < 1$.

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