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Behavioural assessment

Cognitive reactivity to sad mood: structure and validity of a new measure

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Abstract

Cognitive reactivity to the experimental induction of sad mood has been found to predict relapse in recovered depressed patients. The present report describes the development and test of a questionnaire that aims to measure cognitive reactivity independently from a mood induction procedure. The Leiden Index of Depression Sensitivity (LEIDS) was filled out by 198 participants. After Principal Components Analysis, 26 items were retained, which comprised four factors with good psychometric properties: Negative Self-Evaluation; Acceptance/Coping; Indifference; and Harm Avoidance. In a sample of 48 college students, LEIDS scores — particularly Negative Self-Evaluation and Harm Avoidance — were rather strong predictors of cognitive reactivity in a mood induction procedure. In contrast, baseline depression and baseline cognitive dysfunction did not predict cognitive reactivity. It is concluded that the LEIDS is a promising measure of cognitive reactivity, and that clinical studies need to be carried out to test its ability to predict relapse of depression.

Keywords: Depression; Vulnerability; Cognition; Mood Induction; Reactivity; Relapse

1. Introduction

Dysfunctional cognitions are thought to be important causative and maintaining factors of depression (Beck, 1967). Individuals who endorse statements like “It is important that everyone likes me” are thought to be more prone to develop depression than people who do not. Research has shown, however, that the dysfunctional cognitions of depressed patients disappear after treatment, regardless of whether treatment was biological or psychological (Simons, Garfield, & Murphy, 1984). At first, this finding may seem to indicate that cognitive dysfunctions are symptoms

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or by-products, not causes or vulnerability markers of depression. Modern cognitive theories have accommodated this finding by stating that dysfunctional cognitions do not disappear during remissions of depressive episodes, but become inactive ('latently present') (Teasdale, 1988; Miranda & Persons, 1988; Segal, Williams, Teasdale, & Gemar, 1996). When these cognitions have not been targeted by treatment, they may be easily activated (e.g., during a state of mild dysphoria), increasing the risk of a recurrence of depression (Hollon, DeRubeis, & Evans, 1987). Some support for this contention comes from studies that demonstrated an association between sad mood and dysfunctional cognitions in recovered depressed patients, but not in never-depressed individuals (Miranda & Persons, 1988; Miranda, Persons, & Byers, 1990). Other studies have found information processing differences between formerly-depressed and never-depressed participants after experimental induction of a dysphoric mood (Teasdale & Dent, 1987; Ingram, Bernet, & McLaughlin, 1994).

These studies suggest that there may be a residual cognitive deficit that is only measurable during (naturally occurring or induced) sad mood. They do not prove, however, that these deficits are causally involved in recurrences of depression. Much stronger support for this idea has recently become available in a study by Segal, Gemar, and Williams (1999). These authors used a mood induction procedure to induce a transient sad mood in patients who had recovered from depression, either through cognitive therapy or through pharmacotherapy. Dysfunctional cognitions were measured immediately before and after the induction of sad mood. The change in dysfunctional cognitions ('cognitive reactivity') reflects the ease with which latent cognitions may be activated. It appeared that the mean cognitive reactivity score of 29 patients treated with antidepressants was indeed greater than that of 25 patients treated with cognitive therapy. Furthermore, cognitive reactivity contributed significantly to the prediction of depressive relapses at 1 year follow up, regardless of prior treatment modality. If these findings prove to be reliable (replicable), they provide strong support for cognitive theory and treatment of depression. Considering the relatively small sample sizes of this study, a replication seems warranted. An obstacle to replication studies, however, is the fact that the measurement of cognitive reactivity is not very easy. In the procedure as used by Segal et al. (1999), patients were asked to listen to a piece of music and to focus on a sad memory for ca 7 min. Although the mood effects of this procedure seem to be reliable, about 25% of participants may fail to respond with a sad mood (Martin, 1990). A second problem is that the dysfunctional cognitions are typically measured by administration of the 40-item Dysfunctional Attitude Scale (DAS) (Weissman, 1979) both before and after the music. To preclude artifactual effects of repeated administration of the same questionnaire within ten minutes, two parallel forms of the DAS are often used. However, since there are some doubts about the interchangeability of the two DAS forms, some authors have preferred to use the same form twice (e.g., Brosse, Craighead, & Craighead, 1999). Segal et al. (1999) found it necessary to use complicated statistical procedures to control for possible systematic differences between the two DAS forms. Either way, clinical applications are limited, whether one uses the same or different forms of the DAS, especially when one considers the fact that mean cognitive change scores are rather small (4–8 points on a scale with a possible range of 0–280, and a typical mean score of 110). In summary, research could benefit if a questionnaire were available that measures reactivity directly, that is, without mood induction procedure and without the need to statistically control for possible artifacts.

Despite the large number of cognitive measures that already exist in depression research, the

possibility of construing a new measure for cognitive reactivity may not be as unlikely as it seems. A notable example in the field of anxiety disorders is the Anxiety Sensitivity Index (ASI) (Peterson & Reiss, 1992). This 16-item questionnaire has been found to predict the occurrence of panic attacks in healthy individuals who were entering a very stressful period in their lives (Schmidt, Lerew, & Jackson, 1999). What distinguishes the ASI from the DAS and other cognitive measures of depression, is the conditional wording of the items. For instance, a typical DAS item is "You can only be happy if you're good-looking, rich, and smart". An example of an item from the ASI is: "*If* I notice that my heart is beating rapidly, I worry that I might have a heart attack" (*emphasis* added). Note that the wording allows individuals who know that palpitations are not a sign of heart attacks, but who nevertheless doubt this when they occur, to endorse this item.

The primary goal of the present study was the development of a measure of cognitive reactivity that can be administered independently from a mood induction procedure. The first part of this paper (Study 1) describes the construction of the questionnaire and its psychometric properties. The second part (Study 2) tests whether the questionnaire predicts cognitive changes during a mood induction procedure.

2. Study 1: scale development and psychometric evaluation

2.1. Method

2.1.1. Construction of the questionnaire

A pool of items was generated that were intended to measure cognitive changes that may occur during depressed mood. This was done by drawing upon clinical experience and by checking textbooks and cognitive treatment books and manuals. A first draft (75 items with a Likert-type 0–4 scale and the instructions) was reviewed by five experts (therapists and researchers). Subsequently, the wording of the instructions and of some items was changed, and 23 items were removed because of redundancy. The research version of the questionnaire contained 52 items, and was named the *Leiden Index of Depression Sensitivity (LEIDS)*. The items of the LEIDS aim to assess general effects of sad mood on cognition (e.g., *I can only think positively if I am feeling well*) and more specific effects (e.g., "*When I am in a sad mood, I have a more negative view on my youth*", and "*In a sad mood, I think that fewer people appreciate me*"). Furthermore, a number of items were included that measure changes that may be viewed as positive, or as reflecting an accepting attitude towards dysphoria (e.g., "*When I am sad, I am more ready to help others*" and "*In a sad mood, I feel more like myself*"). These were included because patients occasionally report such thoughts. Also, inclusion of these items could counter response set tendencies.

In the instructions it was explained that the questionnaire aims to measure thoughts that occur during a sad mood. Sad mood was defined as 'a score of 3 or 4 on a scale of 0–10' (where 10=extremely sad), meaning 'definitely not a good day, but not really depressed'. And: "…this may be a prelude to worse, but you may also feel better by tomorrow…". Participants were instructed to take a couple of moments to imagine this.

2.1.2. Instruments

In addition to the LEIDS, the following instruments were administered.

2.1.2.1. Demographic and clinical variables Participants were asked to indicate their age, sex and education level. Furthermore, they were asked "Have you ever experienced a period in which you were continuously sad and/or in which you lost interest in things that you usually enjoy?". If the answer to this question was affirmative, the next question was "Did this period last two weeks or longer?"

2.1.2.2. Hospital Anxiety and Depression Scale (HADS) (Zigmund & Snaith, 1983) The HADS is a self-report screening scale for anxiety and depression. In the present study, only the depression subscale (seven items) was used. Scores on the HADS range from 0 to 21. An authorized Dutch translation of the HADS and large normative groups are available (Spinhoven et al., 1997).

2.1.2.3. Dysfunctional Attitudes Scale — shortened version (DAS-13) This is a shortened version of Weissman's (1979) original 40-item DAS. In a mixed sample of 121 patients, the correlation between the DAS-13 and a 32-item version of the DAS was r=0.90 (Douma, Van de Bosch, Van Dongen, & Jansen, 1991), which makes it reasonable to assume that the correlation between the DAS-13 and the full-length DAS is also quite high.

2.1.3. Participants and procedure

The instruments listed above (a total of 77 items) were put on an internet page of Leiden University. The website of the Psychology department contained a link to the introductory page, that invited people to participate in an on-line research project about depression. It was stressed that everyone could participate, regardless of age or whether or not people had any personal experience with depression. Furthermore, anonymity of participants was guaranteed; there would be no link to e-mail-addresses, for instance.

Items were presented one at the time in a fixed order (demographic, clinical variables; HADS; DAS-13; LEIDS-52). Participants responded by choosing one of several alternatives with a mouse-click. The next question was presented after respondents clicked a 'continue' button on the screen. In principle, respondents could use the 'back' button of their browsers to return to previous questions and change answers. However, this possibility was not pointed out.

Eight students who were participating in an undergraduate research project sent out a standard text by e-mail to friends and family members. The e-mail message contained a hyperlink to the webpage of the study, with an invitation to participate and a request to forward the e-mail message unchanged to others.

One hundred and fifty individuals visited the web page and filled out the questionnaires. Their data were supplemented with the data of 48 individuals who filled out paper-and-pencil versions of the same questionnaires while participating in Phase 2 of this study.

2.2. Results

2.2.1. Participants

The sample consisted of 128 women and 70 men. Mean age was 24.7 years (SD=8.6; range: 16–56 years). The mean age of men was somewhat higher [M=26.8; SD=10.7 versus M=23.6;

SD=6.9; $t(196)=2.5$; $p=0.012$]. Mean HADS depression score was 2.2 (SD=2.5), and mean DAS-13 score was 30.2 (SD=11.1). There were no sex differences in HADS and DAS-13 scores. Education level was rather roughly measured: 83.8% of participants had at least a high school education. Almost all (98.0%) participants indicated that they were at least reasonably successful in imagining a situation as requested by the instructions to the LEIDS.

2.2.2. Data screening

All data were checked through various SPSS commands for missing values and fit of their distributions with the requirements of multivariate analysis. There were six cases with one missing HADS item. These missing values were replaced with the mean item score for that particular case. Seven items of the LEIDS were not normally distributed. Square root transformation was examined, but this worsened skewness and kurtosis for a number of other LEIDS items. Because the deviations were small, untransformed data were used.

2.2.3. Factor analysis

The data of the LEIDS were subjected to a Principal Components Analysis (PCA), using oblique rotation to permit correlations among the components. The Kaiser–Meyer–Olkin index of sampling adequacy was 0.91. Ten factors had eigenvalues >1, but the scree plot suggested either a one- or five-factor solution. The five-factor solution was examined, but was clearly over-extracted: the fifth factor had only two unique items with bipolar loadings. The four-factor solution, which accounted for 51.1% of the overall variance, gave an interpretable result. Twenty-five of the 52 LEIDS items appeared in factor 1 (loadings$>$0.40). Eight of these 25 items were selected on the basis of high factor loadings ($>$0.60), item-total correlations ($>$0.40), moderate inter-item correlations, uniqueness of factor loadings and usefulness for a clinical scale. The items in this scale reflects negative evaluation, either self-evaluation or presumed judgment by others. Factor 1 was labeled *Negative Self-Evaluation* (NSE).

Factors 2, 3 and 4 each had six items with unique loadings $>$0.40. Most of the items measuring positive changes appeared in factor 2. This factor was difficult to label: some items may reflect interpersonal sensitivity (e.g., readiness to help, sense of others' intentions), other items may reflect acceptance ('feel more like myself') or coping behavior or distraction ('work harder'). This factor was (provisionally) labeled *Acceptance/Coping* (A/C). The items of factor 3 reflect indifference to oneself and to other people; this factor was labeled *Indifference* (IND). Factor 4 contains items reflecting avoidance of problems, conflicts and risks, and perfectionism and control. This factor was labeled *Harm Avoidance* (HA). Nine items did not appear (uniquely) in any factor. The factor loadings of the 26 items that were retained are shown in Table 1.

Since the PCA was dominated by a first factor that contained almost half of the items, the analysis was repeated using only the 26 items that were selected. Furthermore, separate PCAs were carried out for the complete sample, and for the subsamples with and without a history of sad mood. Finally, a PCA with varimax rotation was also examined. None of these alternative PCAs appreciably altered the solution as presented in Table 1. In the PCA with oblique rotation, factor 1 correlated $r=0.43$ with factor 3 and $r=0.37$ with factor 4. The remaining correlations among factors varied from $r=0.13$ to $r=0.22$.

Table 1
PCA with oblique rotation of LEIDS items[a]

	I	II	III	IV
Factor I: NSE				
Presumed lack of appreciation by others	0.83	.	.	.
Perceived physical inattractiveness	0.83	.	.	.
Perceived inability to make others happy	0.81	.	.	.
Lack of confidence in future	0.71	.	.	.
Inability to think positively	0.67	.	.	.
Self-blame	0.65	.	.	.
Expected persistence of sad mood	0.62	.	.	.
Negative evaluation of accomplishments	0.60	.	.	.
Factor II: A/C				
Kindness	.	0.72	.	.
Readiness to help others	.	0.66	.	.
Egosyntonic quality of sad mood	.	0.65	.	.
Increased diligence	.	0.59	.	0.49
Enhanced creativity	.	0.57	.	.
Better sense of others' intentions	.	0.42	.	0.35
Factor III: IND				
Lack of interest in what others think	−0.45	.	0.79	.
Indifference	.	.	0.67	.
Concentration problems	.	.	0.65	.
Negligence	.	.	0.57	.
Cynism, sarcasm	.	.	0.55	.
Reduced creativity	.	−0.33	0.51	.
Factor IV: HA				
Avoidance of problems, conflicts	.	.	.	0.61
Reduced self-confidence	0.33	.	.	0.54
Tendency to control things	.	.	.	0.52
Avoidance of risks	.	.	.	0.51
Bothered by perfectionism	0.31	.	.	0.49
Sub-assertiveness	.	.	.	0.40

[a] Note: loadings <0.30 were omitted.

2.2.4. Reliability of the subscales

The psychometric properties of the subscales are shown in Table 2. The internal consistencies (Cronbach's alpha) of all subscales are satisfactory, considering the limited number of items per scale, and the fact that the inter-item correlations are not too high.

2.3. Relationship with demographic and clinical variables

Mean scores and standard deviations are shown in Table 3, subdivided for past history of 'depression'. Participants who indicated to have experienced 'a period of persistent sad mood and/or loss of interest or pleasure' ('depression') score higher on each scale of the LEIDS than participants who had never experienced such an episode. Participants whose 'depression' lasted shorter than 2 weeks have similar scores on the LEIDS as those whose 'depression' lasted longer

Table 2
Psychometric properties of the four LEIDS scales

	Cronbach's alpha	Range inter-item	Range item-total
NSE	0.89	0.33–0.65	0.62–0.70
A/C	0.77	0.19–0.58	0.40–0.65
IND	0.72	0.17–0.46	0.30–0.57
HA	0.79	0.25–0.60	0.49–0.63

Table 3
Means and standard deviations of the LEIDS scales and total score, subdivided by past history of 'depression'[a]

LEIDS scale	Prior 'depression'	*N*	Mean	SD	Oneway ANOVA
NSE	0	111	12.8	6.8	$F(2,195)=27.2$; $p<0.001$
	1	26	18.4	5.6	Scheffé contrasts: 2=1>0
	2	61	20.5	7.3	
	Total	*198*	*15.9*	*7.6*	
AC	0	111	3.8	3.6	$F(2,195)=14.9$; $p<0.001$
	1	26	7.5	3.8	Scheffé contrasts: 2=1>0
	2	61	6.0	3.5	
	Total	*198*	*5.0*	*3.9*	
IND	0	111	10.5	4.9	$F(2,195)=15.9$; $p<0.001$
	1	26	14.1	4.5	Scheffé contrasts: 2=1>0
	2	61	14.4	4.6	
	Total	*198*	*12.2*	*5.1*	
HA	0	111	8.0	4.7	$F(2,195)=13.3$; $p<0.001$
	1	26	11.8	3.9	Scheffé contrasts: 2=1>0
	2	61	11.6	5.6	
	Total	*198*	*9.6*	*5.2*	
Total LEIDS score	0	111	35.1	15.3	$F(2,195)=33.6$; $p<0.001$
	1	26	51.8	10.7	Scheffé contrasts: 2=1>0
	2	61	52.5	15.0	
	Total	*198*	*42.6*	*16.9*	

[a] Note: prior 'depression': 0=no; 1=yes, but <2 weeks duration; 2=yes, and 2 weeks or longer.

than 2 weeks. An exception is the 'A/C' scale, where participants with a short 'depressions' get the highest score, although the difference with the participants with longer periods was only a trend ($p=0.07$).

Female participants scored somewhat higher than males on the NSE scale [$M=16.9$; SD=7.3 versus $M=14.1$; SD=7.9; $t(196)=-2.6$; $p=0.011$]. The other subscale scores and the total score were not significantly different for men and women. All correlations of LEIDS scores and age were around zero. HADS depression scores correlated significantly with LEIDS total score ($r=0.41$; $p<0.001$), and with each of the subscales. The correlations with subscales 1, 2, 3 and

4 were 0.39, 0.18, 0.34, and 0.29, respectively (all $p<0.05$). Finally, the correlation of LEIDS and DAS-13 was $r=0.54$ (subscales: 0.53, 0.17, 0.35, 0.46) (all $p<0.05$).

2.4. Discussion

An interpretable four-factor solution was found, that was robust to a number of variations in the specifications of factor analysis. The psychometric properties of these scales are good. It should be noted, however, that the sample largely consisted of anonymous respondents to a website, and that the measurement of prior depression was very rough. However, expected differences were found between the mean scores of previously 'depressed' and never-'depressed' participants. The correlations among LEIDS, DAS-13 and HADS were rather strong, but not so high as to conclude that the LEIDS is identical to either of these scales. Hardly any participant had difficulties with the instructions to the LEIDS, although we do not know how many potential participants visited the website but decided not to participate after reading the instructions.

2.5. Study 2: prediction of cognitive reactivity

In the next phase of the study, it was investigated how well LEIDS scores predict cognitive changes during experimentally induced sad mood. A secondary goal was to investigate possible differential effects of two mood induction procedures. The present report presents the results of one of these procedures, which was also used in the Segal et al. (1999) study. The other results will be reported elsewhere. For the present report it is important to note that there were no order effects in any of the results presented.

2.6. Method

2.6.1. Participants

Participants were recruited through advertisements at the faculty of Social Sciences of Leiden University. Inclusion criteria were age between 18 and 70 years and fluency in Dutch. Exclusion criterion was a current episode of depression according to DSM-IV (APA, 1994). The experiment took ca 80–90 min; participants were paid Dfl. 20 ($8).

2.6.2. Mood induction

The procedure was modeled after Segal et al. (1999). Participants were asked to listen to music presented on audiotape and to try to focus on a time or event in their lives when they felt sad. The music was the orchestral introduction by Prokofiev entitled "Russia under the Mongolian yoke" from the film "Alexander Nevsky". The taped segment played to participants was remastered at half speed.

2.6.3. Instruments

2.6.3.1. Structured Clinical Interview for DSM-IV (SCID) (First, Spitzer, Gibbon, & Williams, 1995) The current and past depression modules of the SCID were administered to check the

exclusion criterion of current depression, and to establish whether participants fulfilled DSM-IV depression criteria anytime in the past.

2.6.3.2. Hospital Anxiety and Depression Scale (HADS) (Zigmund & Snaith, 1983) As in Study 1, the depression subscale was used.

2.6.3.3. Dysfunctional Attitudes Scale — versions A and B (Weissman, 1979) The DAS measures dysfunctional beliefs that, according to cognitive theories, are core concepts of vulnerability to depression. As noted in the Introduction, cognitive vulnerability is conceptualized as the change of DAS scores before and after a mood induction procedure (Segal et al., 1999). Forms A and B of the DAS were used. Both forms have 40 items.

2.6.3.4. Mood ratings Participants gave three ratings of current mood (sadness, irritation, tension) repeatedly throughout the experiment, using 0–10 Likert-type rating scales, with the following anchor points: not at all sad (0); somewhat sad (3–4); sad (6–7); extremely sad (10).

2.6.3.5. Leiden Index of Depression Sensitivity (LEIDS) The 52-item research version of this scale was administered. For analyses, the four subscales were used that were derived in Study 1, and the total score, which is the sum of the subscales.

2.6.3.6. Anxiety Sensitivity Index (ASI) (Peterson & Reiss, 1992) The 16-item ASI measures beliefs about the harmfulness of bodily sensations. The total score ranges from 0 to 64. The ASI was included in order to investigate the relationship of the LEIDS scales, as a putative vulnerability measure of psychopathology, with one of the most robust vulnerability measures available. Specifically, the HA scale could be expected to correlate with the ASI.

2.6.3.7. Behavioral Inhibition/Behavioral Activation Scales (BIS/BAS) (Carver & White, 1994) This is a 24-item self-report scale that measures the behavioral inhibition system (BIS) and the behavioral activation system (BAS). The BIS is sensitive to signals of punishment, non-reward, and novelty, and has been linked to negative feelings such as fear and sadness (Carver & White, 1994). The BAS is sensitive to signals of reward, non-punishment and escape from punishment. The BAS has three subscales: Drive (persistent pursuit of desired goals); Fun Seeking (desire for new rewards); Reward Responsiveness (positive response to rewards).

2.6.4. Design

Participants underwent two mood induction procedures, separated by a 10-min break and by a 7-min neutral distraction task, to counter cross-over of residual mood effects. The results of only one of the mood inductions is reported here. Order of mood induction manipulations was randomly varied across participants. To counter any systematic differences between the two DAS versions, forms A and B were maximally counterbalanced across participants and procedures, with the restriction that different DAS forms were administered before and after a particular mood induction.

2.6.5. Procedure

After signing up, participants received written information about the study by mail or e-mail. The study was presented as a study on the effects of sad mood on attention and memory. All participants were tested in a single session that lasted between 75 and 85 min. After opportunity for questions was given and informed consent was obtained, participants were interviewed with the SCID modules and they filled out the HADS, ASI, and LEIDS. Next, a short (2 min) vocabulary test was administered as an IQ estimate. Since all participants were students, this test did not provide much information, but was included to counteract any mood-inducing effects of the SCID interview and questionnaires. After this, participants filled out the BIS/BAS. Next, the first mood induction was administered, preceded by and followed by the DAS and the three mood ratings. This was followed by a neutral attention task that lasted ca 7 min, and a short coffee or tea break. Finally, the second mood induction was administered, again preceded and following by the DAS and mood ratings. Participants were then debriefed. To lift any residual mood effects, participants were shown a brief humorous movie fragment.

An experimenter was present in the test room, except during the mood induction procedure when participants were left alone. As known to the participants, the experimenter went to an adjacent room and followed the procedure via one-way screen and intercom. Participants were signaled through the intercom after 7 min to begin filling out the mood ratings and DAS. The music continued while the participants filled out the questionnaires, and the experimenter returned when the questionnaires were completed. Before the mood manipulation, participants were told that they could probably easily prevent or counter any effects of the music, but they were asked to cooperate by trying to increase the effect.

2.7. Results

2.7.1. Participants

Forty-eight participants (33 women and 15 men) completed the experiment. There were no drop-outs and no adverse events. All participants were college students. Their mean age was 21.1 years (SD=1.9). None of the participants was currently depressed, but eight (16.7%) had experienced a depressive episode in the past. Current level of depressive symptoms (HADS score) was low and equivalent for previously and never-depressed participants [mean=1.5 (SD=1.2) and mean=1.6 (SD=2.0), respectively].

2.7.2. Effects of the mood induction

As expected, the mood induction had a significant effect on sadness. The effects on irritation and tension were also significant, but these effects were much smaller. DAS scores were also affected by the procedure. The correlation between change in sadness and change in DAS score was r=0.30 (p=0.038) (Table 4).

2.7.3. Effects of the mood inductions and past history of depression

Contrary to their predictions based on Miranda and Persons' mood-state theory, Brosse et al. (1999) found equivalent changes in mood and dysfunctional attitudes for previously depressed and never-depressed individuals. To investigate this in the present sample, the MANOVAs were

Table 4
Effects of sad mood induction on mood and cognition[a]

	Pre	Post	Pre/post difference
Sadness	0.8 (1.2)	3.6 (1.7)	$t(47)=-11.0$; $p<0.001$
Irritability	0.4 (0.8)	1.5 (1.9)	$t(47)=-4.5$; $p<0.001$
Tension	1.3 (1.5)	2.0 (2.0)	$t(47)=-2.5$; $p=0.017$
DAS	115.7 (19.7)	123.1 (28.2)	$t(47)=-2.6$; $p=0.012$

[a] Note: mean scores, standard deviations in parentheses.

carried out with 'past history of depression' as between-subjects factor. To control for an obvious confounder, 'gender' was added as between-subjects factor.

With sad mood as the dependent variable, all main and interaction effects involving gender and past depression were non-significant, indicating that the mood effects were equally strong for men and women, and equally strong for previously depressed [change score: 2.9 (SD=1.6)] and never-depressed individuals [change score: 2.8 (SD=1.8); between-group difference: $t(46)=-0.1$; NS].

However, with dysfunctional attitudes as the dependent variable, a significant interaction appeared of time and past history of depression: $F(44,1)=5.5$; $p=0.02$. Previously depressed individuals changed their DAS scores from 114.2 (SD=10.7) to 133.0 (SD=38.0), whereas the change was much less for never-depressed participants: 116.0 (SD=21.1) to 121.1 (SD=26.0). The between-group difference was significant: $t(46)=-1.8$; $p=0.04$ (one-tailed significance).

2.8. Correlations of LEIDS with change scores and questionnaire scores

LEIDS scores, particularly the total score and the subscale NSE and HA, correlated significantly and strongly with change of DAS scores but not with change in mood scores (see Table 5). Table 5 also shows a moderately strong correlation of the same scales with anxiety sensitivity. The correlations with HADS depression scores, however, are low and non-significant, in contrast to the same correlations in the 198 participants of Study 1. This is due to the more restricted range of HADS scores in the sample of 48 students. Furthermore, Table 6 shows that each LEIDS scale correlates significantly with a different subscale of the BIS/BAS, providing some further support for the utility of the four-factor solution. As would be expected, LEIDS NSE correlates significantly with Behavioral Inhibition, and inversely with BAS subscales Drive and Fun Seeking. Furthermore, there is a positive correlation between LEIDS Indifference and BAS Drive, and a negative correlation between LEIDS HA and BAS Fun Seeking. LEIDS A/C has a negative correlation with BAS Reward Responsiveness, indicating that individuals who have strong positive reactions to the occurrence or anticipation of reward tend to have low Acceptance scores.

Table 5
Pearson correlations of LEIDS scores with mood induction change scores and with questionnaire scores[a]

LEIDS scale	Δ mood	Δ DAS	HADS	ASI	BIS/BAS scales			
					Drive	Fun S	Rew	Inhib
NSE	0.06	0.52***	0.18	0.42**	−0.36*	−0.32*	−0.21	0.55***
A/C	0.02	−0.15	0.15	0.07	−0.14	0.05	−0.40**	−0.17
IND	0.22	0.06	0.02	0.24	0.37*	0.23	0.14	−0.00
HA	0.13	0.47**	0.16	0.30*	0.05	−0.39*	−0.01	0.28
Total LEIDS score	0.16	0.43**	0.20	0.44**	−0.06	−0.22	−0.15	0.35*

[a] Notes: two-tailed significance: *$p<0.05$; **$p<0.01$; ***$p<0.001$. N=48. Abbreviations: Δmood, change of mood scores; ΔDAS, change of dysfunctional attitude scale scores; HADS, Hospital Anxiety and Depression Scale; ASI, Anxiety Sensitivity Scale; BIS/BAS, Behavioral Inhibition/behavioral activation scale, with subscales: Drive (Drive); Fun Seeking (Fun S); Reward Responsiveness (Rew); Inhibition (Inhib).

Table 6
Prediction of cognitive reactivity[a]

Step	Variable	R	R^2	Fchange	p	Beta	t	p
Stepwise multiple regression analysis								
1	NSE	0.52	0.27	16.9	<0.001	0.42	3.2	0.002
2	ΔMood	0.59	0.34	5.1	0.03	0.25	2.2	0.036
3	A/C	0.63	0.40	4.2	<0.05	−0.27	−2.3	0.025
4	HA	0.68	0.46	4.3	0.04	0.27	2.1	0.043
Hierarchical multiple regression analysis								
1	DAS order	0.02	0.00	0.01	0.91	0.24	0.32	0.75
2	Mood change	0.30	0.09	4.45	0.04	0.44	0.32	0.76
3	Mood ind order	0.31	0.09	0.13	0.72	0.08	0.10	0.92
4	DAS order×Mood change					−0.52	−0.36	0.72
	DAS order×Mood ind order	0.37	0.14	1.12	0.34	−0.45	−0.43	0.67
5	Mood ind order×Mood change	0.41	0.17	1.31	0.26	−0.37	−0.25	0.80
6	DAS order×Mood Change×Mood ind order	0.42	0.18	0.67	0.42	0.71	0.52	0.60
7	LEIDS scales	0.70	0.49	5.46	0.002			
	NSE					0.45	3.03	0.005
	A/C					−0.24	−1.69	0.100
	IND					−0.15	−1.11	0.273
	HA					0.34	1.96	0.058

[a] Not in the equation: DAS Pre; IND; History of Depression; HADS Depression; Anxiety Sensitivity. Abbreviations: LEIDS, Leiden Index of Depression Sensitivity; NSE, Negative Self-Evaluation; A/C, Acceptance/Coping; IND=Indifference; HA, Harm Avoidance; DAS, Dysfunctional Attitude Scale; DAS Pre, DAS baseline score; ΔMood, Change of sadness before and after mood induction; Mood ind, Mood induction; HADS, Hospital Anxiety and Depression Scale.

2.8.1. Prediction of the cognitive effects of mood induction

The primary goal of this study was to develop a questionnaire that measures cognitive reactivity. To investigate whether the LEIDS is suitable for this purpose, two multiple regression analyses were carried out. In the first (with as dependent variable the cognitive change scores) the following variables were entered into a stepwise multiple regression analysis: the four LEIDS scales; mood change before and after mood induction; baseline DAS score; anxiety sensitivity; HADS depression score; and past history of depression.

Because of concerns that Forms A and B of the DAS might not be equivalent, the second analysis involved hierarchical multiple regression analysis. Again, change in DAS score before and after the mood induction was the dependent variable. To control for possible order effects of the DAS, the same strategy was used as in Segal et al. (1999). The first step of the regression entered into the equation the order of administration of DAS forms. The second and entered mood change. The third step entered order of administration of mood induction. The fourth step simultaneously entered the interactions of Form Order×Mood Change and Form Order×Mood Induction Order. The interactions of Mood Change×Mood Induction Order was entered as the fifth step. The three-way interaction of Form Order×Mood Induction Order×Mood Change was entered as the sixth step. Finally, after all these variables were entered (forced entry), the four LEIDS scales were entered simultaneously as the seventh step. Because of the ratio cases: variables, no further clinical variables were included in the hierarchical regressions. The results of the analyses are shown in Table 6.

In the hierarchical multiple regression analysis, none of the terms involving DAS Form Order or Mood Induction Order produced significant changes in explained variance. Mood Change before and after the procedure, that was entered at step 2, produced a small but significant change. In contrast, with all other terms in the model, the addition of the four LEIDS scales produced a large and significant increase of R^2 (0.31 increase).

In the stepwise multiple regression analysis, NSE entered at the first step. Mood Change before and after the induction entered at the second step, followed by A/C (negative Beta) and HA.

2.9. Discussion

In Study 2, the LEIDS was correlated with a number of additional questionnaires as compared with Study 1. Furthermore, it was investigated whether LEIDS scores predict DAS change scores before and after experimental induction of sad mood (‘cognitive reactivity’). Results showed differential and theoretically meaningful correlations of the LEIDS scales with Behavioral Inhibition and Behavioral Activation, supporting the four-factor solution presented in Study 1. Furthermore, the LEIDS scales NSE and HA correlated significantly with cognitive change scores, but not with mood change scores. More importantly, LEIDS scores proved to be predictors of cognitive reactivity in multiple regression analyses, competing with the effects of baseline dysfunctional attitudes, history of depression, current depressive symptomatology and anxiety sensitivity. In particular, NSE and HA accounted for independent amounts of variance, along with mood change. A/C also contributed, but in the opposite direction. Thus, high cognitive reactivity was predicted by high NSE and HA, and low A/C.

Results also showed that the effects of mood induction were specific: a larger increase of sadness was observed than of irritability or tension. Furthermore, there was a significant, but not

very strong correlation between change in sadness and change in cognition. Participants who had been depressed in the past showed a larger mean cognitive reactivity than never-depressed participants. The present findings support the mood-state dependent nature of depressive cognitions (Miranda & Persons, 1988; Miranda et al., 1990; Miranda, Gross, Persons, & Hahn, 1998).

3. General discussion

By showing that formerly depressed patients who had been treated with antidepressants have larger cognitive reactivity scores than formerly depressed patients who had been treated with cognitive therapy, Segal et al. (1999) have demonstrated an important difference in the mechanism of effect between the two main therapies of depression. Their findings suggest that cognitive dysfunctions may be latently present, and also that cognitive therapy may specifically ameliorate these dysfunctions or make them less easily accessible. Furthermore, cognitive reactivity to induced sad mood appeared to be predictive of recurrence of depression over a period of 30 months. Important as these findings may be, it needs to be considered that the sample sizes were relatively small (combined N=54). A replication of these findings would be very important. As argued in the Introduction, the relatively complicated nature of the assessment of cognitive reactivity could form an obstacle to replication studies.

The present report has demonstrated that the LEIDS, a 26-item self-report questionnaire, might be useful as an alternative measure of cognitive reactivity. If the LEIDS would prove to be a useful measure of cognitive reactivity in clinical studies, another important research question would become more open to research. As noted by Segal et al. (1999), the fact that cognitive reactivity predicts recurrences of depression leaves undetermined whether cognitive reactivity is causally implicated in first episodes of depression. To investigate this question, prospective research needs to be carried out, following general population or at-risk samples. These kinds of studies require large numbers of participants, and would be difficult to complete using the methodology of experimental mood induction with pre- and post assessment of dysfunctional attitudes. A relatively brief self-report measure could greatly benefit this line of investigation. A further advantage of the LEIDS lies in the fact that the conventional procedure to assess cognitive reactivity is not very practical in clinical settings.

Of course, a lot of additional work needs to be done before these questions can be addressed. An important limitation of the present study is that the sample investigated in Study 2 included only eight participants who had been depressed in the past. A logical question for future studies would be to replicate the present study in a group of recovered depressed individuals, in order to determine whether LEIDS scores also predict DAS change scores before and after mood induction in a clinical sample. A next step would be to compare LEIDS scores of patients who have been treated with medication or cognitive therapy.

Another question that needs to be addressed is the relationship with other measures of vulnerability to psychopathology, for example, neuroticism. It may also be investigated whether there is overlap between the LEIDS and measures of rumination (Nolen-Hoeksema, 1991). Conceptually these scales are not the same, since the LEIDS aims to assess accessibility of cognitions, and not necessarily ruminative response style. It would be expected, however, that individuals who ruminate on their depressive symptoms have low scores on the A/C scale and high scores on the other three scales. However, the reverse is not necessarily true.

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References

American Psychiatric Association (APA) (1994). *Diagnostic and statistical manual of mental disorders.* (4th ed.). Washington DC: American Psychiatric Association.

Beck, A. T. (1967). *Depression: clinical, experimental and theoretical aspects.* New York: Harper & Row.

Brosse, A. L., Craighead, L. W., & Craighead, W. E. (1999). Testing the mood-state hypothesis among previously depressed and never-depressed individuals. *Behavior Therapy*, *30*, 97–115.

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. *Journal of Personality and Social Psychology*, *67*, 319–333.

Douma, M., Van De Bosch, J., Van Dongen, P. H. M., & Jansen, A. E. (1991). *Construction of a Dutch translation of Weissman's Dysfunctional Attitude Scale, including a short version.* Meerssen, The Netherlands: Louis Marie Jamin Foundation Internal report.

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (1995). *Structured Clinical Interview for DSM-IV Axis I Disorders.* (Patient ed. (SCID-I/P)). New York: Biometrics Research Department, NYSPI.

Hollon, S. D., DeRubeis, R. J., & Evans, M. D. (1987). Causal mediation of change in treatment for depression: Discriminating between nonspecificity and noncausality. *Psychological Bulletin*, *102*, 139–149.

Ingram, R. E., Bernet, C. Z., & McLaughlin, S. C. (1994). Attention allocation processes in depressed individuals. *Cognitive Therapy and Research*, *18*, 317–332.

Martin, M. (1990). On the induction of mood. *Clinical Psychology Review*, *10*, 669–697.

Miranda, J., & Persons, J. B. (1988). Dysfunctional attitudes are mood-state dependent. *Journal of Abnormal Psychology*, *97*, 76–79.

Miranda, J., Gross, J. J., Persons, J. B., & Hahn, J. (1998). Mood matters: Negative mood induction activates dysfunctional attitudes in women vulnerable to depression. *Cognitive Therapy and Research*, *22*, 363–376.

Miranda, J., Persons, J. B., & Byers, C. (1990). Endorsement of dysfunctional beliefs depends on current mood state. *Journal of Abnormal Psychology*, *99*, 237–241.

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*, 569–582.

Peterson, R. A., & Reiss, S. (1992). *Anxiety sensitivity index manual.* (2nd ed.). Worthington, OH: International Diagnostic Systems.

Schmidt, N. B., Lerew, D. R., & Jackson, R. J. (1999). Prospective evaluation of anxiety sensitivity in the pathogenesis of panic: Replication and extension. *Journal of Abnormal Psychology*, *108*, 532–537.

Segal, Z. V., Gemar, M., & Williams, S. (1999). Differential cognitive response to a mood challenge following successful cognitive therapy or pharmacotherapy for unipolar depression. *Journal of Abnormal Psychology*, *108*, 3–10.

Segal, Z. V., Williams, J. M., Teasdale, J. D., & Gemar, M. (1996). A cognitive science perspective on kindling and episode sensitization in recurrent affective disorder. *Psychological Medicine*, *26*, 371–380.

Simons, A. D., Garfield, S. L., & Murphy, G. E. (1984). The process of change in cognitive therapy and pharmacotherapy for depression: changes in mood and cognition. *Archives of General Psychiatry*, *41*, 45–51.

Spinhoven, PH., Ormel, J., Sloekers, P. P. A., Kempen, G. I. J. M., Speckens, A. E. M., & Van Hemert, A. M. (1997). A validation study of the Hospital Anxiety and Depression Scale (HADS) in different groups of Dutch subjects. *Psychological Medicine*, *27*, 363–370.

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion*, *2*, 247–274.
Teasdale, J. D., & Dent, J. (1987). Cognitive vulnerability to depression: An investigation of two hypotheses. *British Journal of Clinical Psychology*, *26*, 113–126.
Weissman, A. N. (1979). *The Dysfunctional attitude scale*. Philadelphia PA: University of Pennsylvania (*Dissertation Abstracts International* 40, 1389B–1390B).
Zigmund, A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*, 361–370.