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Different Types of Experimentally Induced Sad Mood?

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Mood-induction procedures have been useful to investigate the role of dysfunctional cognitions in depression. In general, studies have shown that individuals with a history of depression endorse more dysfunctional attitudes following the induction of sad mood than never-depressed individuals. However, a recent study failed to find the expected differences between previously depressed and never-depressed participants. In the present study, two widely used mood-induction procedures were compared to investigate the possibility that different mood inductions lead to different outcomes. Forty-eight participants underwent two types of sad mood induction: focusing on a sad memory while listening to music and watching a movie fragment. Consistent with modern cognitive theory, mood-state dependency of dysfunctional cognitions (cognitive reactivity) was much higher in vulnerable individuals. This effect occurred during both mood inductions. However, the effects of the music induction were somewhat larger, and the correlation between change of mood and cognitive reactivity was significant in this condition only. Some other subtle differences between both procedures were found. In conclusion, although the effects of both inductions were largely similar, the musical induction is more sensitive, and is preferable for research into cognitive dysfunction in depression.

According to cognitive theory, dysfunctional cognitions (schemas) represent the core vulnerability to depression (Beck, 1967). The status of dysfunctional cognitions has been challenged, however, by a number of problematic findings. For instance, cognitions normalize when depression remits, also when cognitions were not targeted in therapy (Simons, Garfield, & Murphy, 1984). Since recovered depressed patients are quite vulnerable to relapses and recurrences (Judd, 1997; Mueller et al., 1999), one would expect a core vulnerability marker to be measurable in many patients whose depression is in remission. However, not only are dysfunctional cognition scores equal in recovered depressed and never-depressed individuals (after controlling for residual low mood), they also do not predict depressive symptoms over time (Lewinsohn, Steinmetz, Larson, & Franklin, 1981). These findings suggest that we may be dealing with epiphenomena rather than with vulnerability markers.

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Recently, mood inductions have become popular methods of studying the role of dysfunctional cognitions in depression in more detail. The term *mood induction* refers to a variety of procedures that aim to induce a particular mood state in an individual, using psychological methods (see Martin, 1990, for an overview). After the induction of a sad mood, never-depressed individuals and recovered depressed patients typically experience similar changes in mood, but only the latter group also shows higher dysfunctional cognition scores (Miranda, Gross, Persons, & Hahn, 1998; Miranda & Persons, 1988). Similar findings have been obtained when cognitions were assessed during naturally occurring mood fluctuations (Miranda, Persons, & Byers, 1990). Also, individuals at risk for depression have shown negative information processing biases following a priming manipulation (Hedlund & Rude, 1995; Taylor & Ingram, 1999). These data suggest that formerly depressed patients may have a residual cognitive deficit that is only measurable during sad mood. This residual deficit has been labeled *cognitive reactivity*. The importance of this finding was shown by Segal, Gemar, and Williams (1999), who found that the mean cognitive reactivity score of 29 patients treated with antidepressants was greater than that of 25 patients treated with cognitive therapy. Furthermore, cognitive reactivity predicted depressive relapses, regardless of prior treatment modality. In conclusion, individuals whose cognitions change in reaction to mild dysphoria may be particularly prone to depressive relapse. If replicated, these findings may provide clinicians with a tool to assess the need for (continued) cognitive therapy in patients whose overt symptoms are in remission.

However, one attempt to replicate the findings of Miranda et al. (1998) has failed. In a sample of formerly depressed and never-depressed college students, the association between sad mood and dysfunctional cognitions was investigated before and after the induction of sad mood (Brosse, Craighead, & Craighead, 1999). Unexpectedly, the correlation between mood and cognition scores at baseline was equal in both groups. Furthermore, after the induction of sad mood, the magnitudes of cognitive change and the correlations between cognitive change and mood change were also equally strong in both groups. This study therefore failed to confirm the mood-state dependency of dysfunctional cognitions in vulnerable (recovered depressed) individuals. The authors discuss several possibilities—most of these pertaining to sample differences—to explain the differences between their findings and Miranda et al. There was one procedural difference between both studies. Both used the same mood-induction procedure, but Miranda et al. conducted a diagnostic interview before the mood induction, whereas Brosse et al. did the reverse. Possibly, a diagnostic interview before mood induction acts as an additional cognitive prime (Brosse et al., 1999). This raises the possibility that the type of mood-induction procedure may be crucial to observed associations between changes in mood and cognition. The mood induction used by Brosse et al. and by Miranda et al. is a brief fragment of the movie *The Champ*, which shows the sadness and despair of a little boy who has just learned that his

father died in a fight. Saddening as this fragment may be, it may not be an ideal probe in the context of depression research, because the scene does not necessarily have a personal significance to the people who watch it. In contrast, in the procedure used by Segal et al. (1999), participants, while listening to sad music, are asked to focus on a time or event in their own lives when they felt sad. In other words, this procedure is more self-referent. The film procedure is not self-referent, although it is certainly possible that the film fragment triggers some personal memories. Whether or not this occurs is unpredictable; the extent to which it occurs has not been assessed in studies that used this method.

The goal of the present study was to investigate whether these two types of mood inductions have different effects on mood, cognition, and the association between these two. The results of one of these mood inductions and its relationship to a new questionnaire have been presented elsewhere (Van der Does, 2002). The present report focuses on the comparison between the two methods.

Method

Participants

Participants were recruited through advertisements at the faculty of social sciences of Leiden University, The Netherlands. 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* criteria (American Psychiatric Association, 1994).

Mood Inductions

Music. This procedure was modeled after Segal et al. (1999). Participants were asked to listen to music, presented on audiotape, for 7 minutes, 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.

Film. Participants were shown a brief (2 minutes, 51 seconds) fragment from the movie *The Champ*, which has been shown to induce sadness reliably, and which was also used by Brosse et al. (1999).

Instruments

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.

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 (7 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, Ormel, Sloekers, Kempen, Speckens, & Van Hemert, 1997).

Dysfunctional Attitudes Scale–Versions A and B (Weissman, 1979). The DAS measures dysfunctional beliefs that, according to cognitive theory, are core concepts of vulnerability to depression. Cognitive reactivity is 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.

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

Reminiscence of personal loss. The extent to which the film fragment reminded participants of a personal loss was measured by a single rating on a 0-to-10 Likert-type scale.

Leiden Index of Depression Sensitivity (LEIDS; Van der Does, 2002). The LEIDS aims to measure cognitive reactivity to sad mood independently from mood-induction procedures. Twenty-six items of this scale form four dimensions with good psychometric properties: Negative Self-Evaluation (NSE), Acceptance/Coping (A/C), Indifference (IND), Harm Avoidance (HA). The LEIDS appears to predict cognitive change following a mood induction procedure (Van der Does).

Design

Participants underwent both mood-induction procedures, separated by a 10-minute break and by a 7-minute neutral distraction task, to counter crossover of residual mood and cognitive effects. Order of mood-induction manipulations was randomly varied across participants. Because it has been suggested that Forms A and B of the DAS are not equivalent (Power et al., 1994), both forms were maximally counterbalanced across participants and procedures, with the restriction that different DAS forms were administered before and after a particular mood induction. Form A of the DAS was administered before the first mood induction in half of the participants. Half of these participants also received Form A before the second mood induction; the other half received Form B first. Thus, there were four possible DAS orders: AB-AB; AB-BA; BA-BA; BA-AB. With two orders of mood inductions, there were eight orders overall, with six participants in each cell.

Procedure

Participants who signed up for the experiment 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 minutes. Participants were paid Dfl. 20 ($8). After opportunity for questions was given and informed consent was obtained, participants were interviewed with the SCID modules. Next,

they filled out the HADS and LEIDS. A short (2 minutes) vocabulary test was administered as an IQ estimate. Since all participants were students, this IQ estimate did not provide much information, but was included to counteract possible mood-inducing effects of the SCID interview and questionnaires. Next, the first mood induction was administered, preceded by and followed by the DAS and the three mood ratings. This was followed by the neutral attention task, which lasted approximately 7 minutes, and a 10-minute coffee or tea break. Finally, the second mood induction was administered, again preceded and followed by the DAS and mood ratings. Participants were then paid and 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 both mood-induction procedures 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. In the music (self-referent) procedure, participants were signaled through the intercom after 7 minutes 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. In the film procedure, the experimenter stopped the video with a remote control, which was the signal to begin filling out questionnaires. The experimenter returned when these were completed. Both mood-induction procedures were presented in the same way: Participants were told that they could probably easily prevent or counter any effects of the music or film, but they were asked to allow the effects to happen.

Results

Participants

Forty-eight participants (33 women and 15 men) completed the experiment. There were no dropouts 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 8 (16.7%) had experienced a depressive episode in the past. Furthermore, 7 participants had experienced a minor or subthreshold depression: a period of sad mood or anhedonia that lasted at least 2 weeks, but with fewer than five *DSM-IV* symptoms during that period. Current level of depressive symptoms was low and equivalent for previously and never-depressed participants: mean HADS scores = 1.5 (SD = 1.2) and 1.6 (SD = 2.0), respectively.

Effects of the Mood Inductions

The effects of both mood manipulations are shown in Table 1. Both manipulations had a significant effect on sadness. Furthermore, the change score after the music induction was significantly bigger than after the film induction. A 2 × 2 × 2 repeated-measures MANOVA with type of induction (film, music) and time (before, after induction) as within-subjects variables and

TABLE 1
EFFECTS OF THE MOOD MANIPULATIONS ON MOOD AND COGNITIONS

	Type of Sad Mood Induction				Significance of Main and Interaction Effects		
	Music		Film				
	Pre	Post	Pre	Post	Pre/Post	Music/Film	Interaction
Sadness	0.8 (1.2)	3.6 (1.7)	1.0 (1.2)	2.8 (1.5)	$p < 0.001$	$p = 0.045$	$p < 0.001$
Irritability	0.4 (0.8)	1.5 (1.9)	0.4 (0.7)	0.6 (1.2)	$p < 0.001$	$p = 0.003$	$p = 0.002$
Tension	1.3 (1.5)	2.0 (2.0)	1.4 (1.7)	1.8 (2.0)	$p = 0.007$	$p = 0.593$	$p = 0.169$
Dysfunctional Attitudes (DAS)	115.7 (19.7)	123.1 (28.2)	116.1 (20.6)	119.6 (27.9)	$p = 0.039$	$p = 0.230$	$p = 0.111$

Note. Mean scores, standard deviations in parentheses.

administration order as between-subjects factor, gave significant main effects for type, $F(1, 46) = 4.2, p = 0.045$, and time, $F(1, 46) = 159.7, p < 0.001$. The interaction was also significant, $F(1, 46) = 14.7, p < 0.001$, indicating that the magnitude of the effect differed between manipulations. The main effect of administration order and all interactions involving order were not significant. Both inductions, particularly the music manipulation, also had effects on irritation and tension, but these effects were much smaller than the effect on sadness.

Using DAS scores as the dependent variables, the 2 × 2 × 2 repeated-measures MANOVA yielded a main effect of time, $F(1, 46) = 4.5, p = 0.04$, indicating that the manipulations also had an effect on dysfunctional attitudes. The change was somewhat bigger in the self-referent condition (5.4 versus 3.5), but this difference was not statistically significant: Time × Type interaction, $F(1, 46) = 2.6; p = 0.11$. Again, all effects involving administration order were nonsignificant.

During the film induction, some participants were reminded of a personal loss. The mean score of this variable was $M = 1.5$ ($SD = 2.2$; range: 0 to 10). Twenty-two participants scored zero on this measure, 15 participants scored 1 or 2, and 11 participants scored higher than 2. The extent to which the fragment reminded participants of a personal loss correlated significantly with cognitive change (Spearman's rho = 0.35; $p = 0.014$). There was some evidence of an order effect here: The correlation was significant only in the participants who received the film as the second mood induction: rho = 0.41 ($p < 0.05$). In these participants, the correlation with change of sadness was also significant: rho = 0.44 ($p < 0.05$). When the film was presented first, both correlations were low and nonsignificant. There was no evidence for a

mood-induction order effect on reminiscence score per se, only on its correlations with mood and cognitive change scores. In other words, the effects of the musical induction may have selectively carried over to the film induction: If the film reminded participants of a personal loss, the result was a larger change of sadness and dysfunctional cognitions, but only if participants had already undergone the musical induction. Further inspection indicated that this effect may have occurred primarily in the formerly depressed group, but the numbers were too small to conduct meaningful statistical analyses.

During the musical induction, reminiscence of personal loss (of the film) did not correlate with mood or cognitive effects, suggesting no carryover effect from the film to the musical condition.

The correlation between change in sadness and change in DAS score was significant in the music condition: $r = 0.30$ ($p = 0.038$). In the film condition, this correlation was nonsignificant at $r = 0.13$. There was no evidence for nonlinear relationships (threshold effect) for either mood induction. Furthermore, reminiscence of personal loss did not affect the strength of the correlation in the film induction, as it was low and nonsignificant in participants with low, intermediate, and high scores for reminiscence.

Effects of the Mood Inductions and Past History of Depression

Contrary to their predictions based on Miranda and Persons's (1988) 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 repeated, with past history of depression added as a between-subjects factor. To control for a possible confounder, gender was also added as between-subjects factor.

With sad mood as the dependent variable, all main and interaction effects involving gender and past depression were nonsignificant, indicating that the mood effects were equally strong for men and women, and equally strong for previously depressed and never-depressed individuals.

However, with dysfunctional attitudes as the dependent variable, a significant interaction appeared of time and past history of depression: $F(44, 1) = 5.5$; $p = 0.02$. The interaction is depicted in Table 2, top half. Across both mood inductions, the change of DAS scores was much bigger for previously depressed than for never-depressed participants. An interesting difference appeared when the seven participants who had a subthreshold depressive episode in the past (i.e., fewer than five symptoms) were examined separately. The bottom half of Table 2 shows that these individuals' cognitive reactivity appeared to be stronger in the self-referent than in the non-self-referent mood induction. Although the ANOVAs comparing never-, partially, and previously depressed participants were statistically significant for neither mood induction, a paired-samples t test indicated a significant pre-post difference for cognitive scores in the musical condition, $t(6) = -2.3$, p(one-tailed) $= 0.03$, but not in the film condition.

TABLE 2
MOOD CHANGE AND COGNITIVE CHANGE AND PAST HISTORY OF DEPRESSION

		Music		Film	
	Past depression	Mean (*SD*)	Contrast	Mean (*SD*)	Contrast
Mood change	No ($N = 40$)	2.8 (1.8)	$t(46) = -0.1$;	1.9 (1.3)	$t(46) = 0.9$;
	Yes ($N = 8$)	2.9 (1.6)	*ns*	1.5 (0.8)	*ns*
Cognitive change	No ($N = 40$)	5.2 (15.8)	$t(46) = -1.8$;	1.3 (14.6)	$t(46) = -1.8$;
	Yes ($N = 8$)	18.7 (31.8)	$p = 0.04$	14.4 (34.3)	$p = 0.04$
Mood change	No ($N = 33$)	2.8 (2.0)		2.0 (1.3)	
	Partial ($N = 7$)	3.0 (1.0)	$F(2, 45) = 0.04$;	1.7 (1.7)	$F(2, 45) = 0.48$;
	Yes ($N = 8$)	2.9 (1.6)	$p = 0.96$	1.5 (0.8)	$p = 0.62$
Cognitive change	No ($N = 33$)	3.9 (16.2)		1.4 (15.2)	
	Partial ($N = 7$)	11.1 (12.7)	$F(2, 45) = 2.09$;	1.0 (12.4)	$F(2, 45) = 1.55$;
	Yes ($N = 8$)	18.7 (31.8)	$p = 0.14$	14.4 (34.3)	$p = 0.22$

Note. Contrast refers to *t* test for independent samples (one-tailed significance) and one-way analysis of variance.

Finally, current level of depressive symptoms did not correlate with the effects of either mood induction, after the exclusion of one statistical outlier.

Cognitive change scores were predicted by LEIDS scores about equally well in both procedures, but partly by different subscales (see Table 3). In both mood inductions, negative self-evaluation and harm avoidance entered the stepwise regression equation. In the music induction, acceptance/coping also entered (with a negative β), whereas indifference entered in the film condition (also with a negative β).

Discussion

The present study revealed important similarities between two types of sad mood induction. Both procedures had similar mood effects for never-depressed and previously depressed individuals, and both had much higher cognitive effects in the latter group. In other words, the main prediction of modern cognitive theory of depression—mood-state dependency of dysfunctional cognitions in vulnerable individuals only—was supported by the results of both procedures.

There were also some interesting differences. First, the music condition had somewhat bigger effects than the film procedure on all outcome measures (moods, cognitions); the differences were statistically significant for sadness and irritability. Second, the effects of the music condition were more strongly in accordance with cognitive theory. Although recovered depressed participants had higher cognitive reactivity scores in both conditions, the correlation between change in mood and cognitive change was significant in the

TABLE 3
PREDICTION OF COGNITIVE REACTIVITY

	Stepwise Multiple Regression Analysis						
Step, Variables	*R*	R^2	*F* Change	*p*	Beta	*t*	*p*
Music condition[a]							
1. NSE	.52	.27	16.9	<.001	.42	3.2	.002
2. Δ Mood	.59	.34	5.1	.03	.25	2.2	.036
3. A/C	.63	.40	4.2	<.05	−.27	−2.3	.025
4. HA	.68	.46	4.3	.04	.27	2.1	.043
Film condition[b]							
1. NSE	.44	.19	10.9	.002	.47	3.3	.002
2. IND	.51	.23	4.4	.04	−.36	−3.0	.005
3. DAS Pre	.58	.33	4.5	.04	−.35	−2.7	.011
4. HA	.65	.42	6.9	.01	.36	2.6	.012

Note. 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; Δ Mood = Change of sadness before and after mood induction; Mood ind = Mood induction; HADS = Hospital Anxiety and Depression Scale.

[a] *Not in the equation:* DAS Pre; IND; History of Depression; HADS Depression; Anxiety Sensitivity.

[b] *Not in the equation:* Δ Mood; MFN; Anxiety Sensitivity; History of Depression; HADS Depression.

music condition only. Furthermore, participants who had experienced a subthreshold depressive episode in the past appeared to react more strongly to the music induction. In other words, the music induction seems to be the more sensitive measure of cognitive reactivity. LEIDS scores also had somewhat different relationships with the two mood inductions: Indifference had a protective effect in the film condition, whereas acceptance/coping had a protective effect in the music condition.

One motive for the present study was the inconsistency between the findings by Brosse et al. (1999) and previous studies using mood inductions in formerly and never-depressed individuals. Although the present study indicates that the music induction is a more sensitive procedure, the Brosse et al. findings remain anomalous. In the present study, cognitive reactivity during the film procedure was also substantially bigger for previously depressed participants. Brosse et al. suggested a procedural explanation of their findings: Administering a diagnostic interview before the film induction may have acted as an additional cognitive prime, resulting in a stronger effect in the never-depressed group. The present study suggests that this may indeed be the case: There was evidence for a carryover effect from the musical to the film induction, despite the fact that both procedures were separated by a neutral

distraction task and a short break. In contrast, no evidence was found for carry-over effects from the film to the music induction.

An important limitation of the present study is the small number of participants with a history of depression. Furthermore, it should be noted that there are many differences in content and procedure between the two mood inductions that were used in this study. For instance, the music induction lasts 7 minutes, whereas the duration of the film fragment is less than 3 minutes. The present study does not indicate which characteristic of the mood induction procedure (self-reference nature, duration, other?) is responsible for the differences, nor was it designed to do so. The purpose of the study was to compare two widely used mood induction procedures that had led to inconsistent findings in previous studies.

In conclusion, the music and film mood-induction procedures have largely similar effects, but there are also subtle differences. The music induction is the more sensitive procedure to study the role of cognitive dysfunction in depression.

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