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The Effect of a Musical Mood Induction Procedure on Mood State-Dependent Word Retrieval

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The purpose of this experiment was to replicate and expand upon an earlier study by Thaut and de l'Etoile (1993) by examining the effect of a musical mood induction procedure on mood state-dependent word retrieval. Participants (N= 45) completed a 2-day testing procedure. On day one, participants read a list of adjectives and wrote down an antonym for each one. On day two, participants recalled as many of the antonyms as possible. During the testing procedure, participants were placed in 1 of 4 conditions: (a) mood induction at encoding, (b) mood induction at recall, (c) no mood induction, and (d) mood induction at both encoding and recall. The mood induction procedure included 3 steps. Participants first assessed their current mood state using a visual analog scale. They then listened to music for 5 minutes, determined the mood of the piece while listening, and tried to match their mood to the music. Finally, participants again used the visual analog scale to indicate their mood. Results indicated that participants who received mood induction prior to both encoding and recall were able to retrieve significantly more words than participants who did not undergo any mood induction. The results are discussed in light of the associative network theory of memory and emotions and the treatment of mood disorders.

In the mid-1970s, psychologists began to recognize the profound effect of emotional states on cognitive processes, especially memory performance (Ellis & Hunt, 1988; Searleman & Herrmann, 1994). Research findings in this area contributed to the identifica-

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tion of a cognitive phenomenon known as mood state-dependent recall. Within this experience, "state" may refer to an individual's prevailing mood. A mood state can affect storage of information to memory, known as encoding, as well as later retrieval from memory, known as recall (Roediger & Guynn, 1996). Retrieval is optimized when mood state at encoding matches mood state during recall (Ellis & Hunt, 1988; Searleman & Herrmann, 1994; Smith, 1994).

Numerous researchers have since demonstrated the effect of mood state on memory particularly in regard to negative emotions, such as depression (Searleman & Herrmann, 1994). In testing situations, individuals who are depressed or in a sad mood tend to demonstrate a memory bias for negative information, such as greater recall of derogatory personality trait words, negative adjectives or sad memories (Clark & Teasdale, 1985; Josephson, Singer, & Salovey, 1996; Ruiz-Caballero & Gonzalez, 1994). Additionally, individuals with depression require considerably more time to retrieve positive information, such as memories of pleasant events or past successes (Bower, 1981; Teasdale & Fogarty, 1979).

Researchers further report that during depression, participants may experience more intrusive and irrelevant thoughts that are difficult to remove and may interfere with memory processes (Ellis, Moore, Varner, Ottaway, & Becker, 1997; Gunther, Ferraro, & Kirchner, 1996; Sutherland, Newman, & Rachman, 1982). Depressed mood may also influence how an individual approaches learning by impairing the ability to discriminate between different aspects of a task (Hettena & Ballif, 1981). In essence, individuals with depression may engage in less efficient learning, and consequently may recall less information, regardless of content (Kelley, 1986).

The effect of a negative mood state on recall appears to be self-perpetuating; that is, depressed mood results in negatively distorted recall, thus maintaining mood at a depressed level (Wright & Salmon, 1990). Depression represents a vicious cycle of events in which mood negatively biases information recall, which further enhances the emotional and physiological perceptions of depression (Beck, Rush, Shaw, & Emery, 1979; Teasdale, 1983; Wright & Beck, 1983). Mood state-dependent effects observed in the onset and maintenance of depression may best be explained by a cognitive model, known as the associative network theory of memory and emotion (Bower, 1981).

The dominant theory in the area of affect and memory, the associative network theory is based upon three main assumptions (Eysenck & Mogg, 1991; Gotlib & MacLeod, 1997; Teasdale and Barnard, 1993). First, information is organized in memory as specific 'nodes' that are joined together via associative links to form a semantic network. Second, information retrieval involves activation of the network. When node activation exceeds a particular threshold, the desired information can then be recalled or recognized. The third assumption of the theory explains the role of emotions in the memory network. Distinct emotions, such as joy, depression or fear, are also represented by specific nodes. Emotion nodes are connected to cognitive nodes that have been encoded in association with each other, thus forming a cohesive network. Activation of either type of node can stimulate the entire network, resulting in emotional perception, information recall, and expression of associated behaviors.

Depressed individuals are most likely "stuck" in negative networks of emotional and cognitive nodes. People who are depressed think mostly negative thoughts, which in turn, serve to activate negative memories that are connected to emotion nodes of sadness, despair and hopelessness. Due to the reciprocal nature of thoughts and emotions, the task of accessing more positive memory networks and relieving the depression becomes increasingly difficult.

In combination, mood state-dependent recall and Bower's theory provide logical explanations for the influence of mood on memory and for the maintenance of specific mood states, such as depression. Recent research, however, has not always provided consistent validation of these effects (Roediger & Guynn, 1996; Teasdale & Barnard, 1993). These empirical deficits have encouraged some theorists to develop alternative explanations, while other researchers have instead opted to refine the methodology utilized in mood state-dependent studies. These investigators suggest that improved control of experimental conditions will result in a more precise understanding of mood state-dependent effects (Beck & McBee, 1995; Ellis & Hunt, 1988).

In a classic series of four experiments, Eich and Metcalfe (1989) identified three conditions necessary for laboratory situations to facilitate mood state-dependent recall. First, testing procedures should require participants to encode and retrieve internally-generated types of information, such as words or ideas that partici-

pants have created through the mental processes of reasoning, imagination and thought. Internally-generated information may have a stronger connection to mood state at encoding than information gleaned from external sources, such as words read from a list or photographs presented to participants. Subsequent research has justified the use of internally-generated information by proving its success in mood state-dependent studies (Beck & McBee, 1995).

Second, of the various memory tests available, researchers have found that free recall produces the most reliable results. In their research, Eich and Metcalfe (1989) found that only free recall of encoded information provided consistent evidence of mood state-dependence. In a free recall situation, the investigator provides few external cues to assist participants in information retrieval. This technique encourages participants to use internal cues, such as mood state.

The third component of successful mood state-dependent research involves mood strength and stability during encoding and retrieval (Eich & Metcalfe, 1989). A mood state considered mild, neutral, or transitory may fail to establish a strong association with cognitive information during encoding. Reinstatement of such a mood, therefore, will not facilitate information recall.

With regard to depression, researchers typically examine the effects of negative mood on memory in one of two ways: (a) by studying patients with clinical diagnoses of depression, or (b) by using a temporary mood induction procedure (Roediger & Guynn, 1996; Searleman & Herrmann, 1994). Of the two options, temporary mood induction clearly provides an advantage as it allows for precise mood manipulation as an independent variable and serves to eliminate the effects of certain confounding variables associated with clinical populations, such as medication side-effects (Ellis & Hunt, 1988; Martin, 1990).

In order to reliably demonstrate mood state-dependence, researchers must therefore develop, implement, and replicate effective mood induction procedures. Mood induction effectiveness may be defined as a resulting change in mood that is both substantial and long-lasting. Eich & Metcalfe (1989) demonstrated that a shift from a "very happy" state to a "very sad" state resulted in reduced recall of internally-generated events; a response typical of depression. In addition, mood effects that exist at the start of an

encoding or retrieval task must continue throughout the procedure. If the mood shift is transient, participants do not have an adequate opportunity to form meaningful and strong connections between the encoded information and their current mood state.

In an attempt to induce both substantial and long-lasting mood changes for experimental purposes, researchers have employed a wide variety of techniques. The most commonly-used methods include hypnosis, memory elicitation, success/failure procedures (i.e., winning and losing at computer games), music listening, mood posturing (i.e., making facial expressions or body postures consistent with particular moods), and the Velten Mood Induction Procedure (VMIP) (Gerrards-Hesse, Spies, & Hesse, 1994; Martin, 1990; Searleman & Herrmann, 1994).

Of these procedures, the VMIP (Velten, 1968) may be considered the most controversial and widely used. In this technique, participants read a series of self-referent statements that gradually progress from a mild emotional state to one that is related but more intense (Finegan & Seligman, 1995). The investigator also encourages participants to try to feel the mood described in the statements. Despite its widespread usage, the VMIP has received significant criticism. Some researchers argue that this technique is flawed, since the intended mood change is obvious from the self-referent statements.

In addition, a recent meta-analysis of mood induction techniques determined that the VMIP is only effective in approximately 60% of all participants (Gerrards-Hesse, Spies, & Hesse, 1994). Individual studies indicate that the VMIP may demonstrate gender differences, with only females responding appropriately (Pignatiello, Camp, & Rasar, 1986), and that the mood effects may be relatively short-lived (Eich & Metcalfe, 1989). Last, due to the nature of the technique, the VMIP relies heavily on linguistic processing and the ability to read, which may limit its application with certain populations.

Many of the weaknesses observed with the VMIP can be avoided by using a musical mood induction procedure (Sutherland et al., 1981). Men and women respond equally well to musical mood induction (Clark & Teasdale, 1985) and the technique enjoys a higher success rate with all participants in comparison with the VMIP (Clark, 1983; Rachman, 1981). Furthermore, in musical

mood induction techniques, the suggested mood is not as obvious as in verbal statements; thus, the procedure is not as susceptible to demand characteristics (Pignatiello et al., 1986). Participants are free to interpret the mood of the music, possibly resulting in a more authentic mood change. For these reasons, musical mood induction may be used with individuals who either cannot read or who have lower intellectual functioning, thus enhancing its use in both laboratory and clinical settings.

Numerous researchers have successfully implemented musical mood induction procedures to create positive and negative moods (Clark, 1983; Clark & Teasdale, 1985; Eich & Metcalfe, 1989; Gerrards-Hesse et al., 1994; Martin, 1990, 1994; Pignatiello et al., 1986; Sutherland et al., 1982; Terezis, 1993; Thaut & de l'Etoile, 1993). These studies demonstrate that musical mood induction not only results in substantial and lasting mood changes, but also influences various cognitive processes, including memory retrieval. Musical mood induction, therefore, may be a key factor in developing reliable methodology for the facilitation of mood state-dependent effects.

The one weakness evident within studies using musical mood induction is inconsistent methodology. Procedures vary in terms of whether or not participants are informed about the intended use of the music, the musical genre used and listening duration (Gerrards-Hesse et al., 1994; Martin, 1990). Improved control of such experimental conditions will provide more reliable results; therefore, future research should strive to develop consistent and effective mood induction methods.

Developing effective mood induction procedures will not only strengthen the research base on mood state-dependent effects, but may also enhance understanding of the effects of depression on cognition. Such information may eventually contribute to the treatment of affective disorders (Martin, 1990). The purpose of this study was to replicate and expand upon previous research conducted by Thaut and de l'Etoile (1993) in which the effect of background music on encoding and recall was compared with the effect of musical mood induction on the same processes. This study was designed to: (a) provide additional evidence for the effectiveness of a musical mood induction procedure and (b) further explore mood state-dependent effects on the encoding and free recall of internally-generated words.

Method

Participants

All 45 participants, including 13 males and 32 females, were students at a mid-Western university, and none were music majors. Participants were told that the purpose of the study was to measure the influence of music on cognitive skills. The specific concepts of memory and recall were not mentioned prior to testing.

Testing Procedure

Participants individually completed a 2-day testing procedure. On day one, participants engaged in encoding which included reading a list of 40 adjectives and writing down an antonym for each adjective. Participants were given 10 minutes to complete this task and were not informed that they would be asked to recall this information at a later time. On the second day of testing, participants underwent a free recall procedure. They were given a sheet of paper containing 40 blank lines and asked to write down as many of the antonyms as they could remember from the previous day. This task was also conducted within 10 minutes.

To assess the effect of the musical mood induction procedure on mood-state dependent word retrieval, participants were randomly assigned to one of the following four conditions: (a) musical mood induction prior to encoding only, (b) musical mood induction prior to recall only, (c) no musical mood induction prior to encoding or recall, and (d) musical mood induction prior to both encoding and recall.

Musical Mood Induction Procedure

The musical mood induction procedure used in this study was identical to one used in a previous study which compared the effects of musical mood induction with background music on word recall (Thaut & de l'Etoile, 1993). The mood induction procedure included three steps. First, participants indicated their current mood using a visual analog scale. This instrument consisted of a single straight line 15 centimeters in length on a piece of paper. One end of the line was labeled with the feeling words "sad, anxious, or tense," thus representing a negative mood. The other end of the line represented a positive mood by including the feeling words "happy, uplifted, or relaxed." Participants indicated their

mood by making a single vertical mark at the appropriate place on the line.

Following mood assessment, participants listened via headphones to the first 5 minutes of a compact disc recording of W. A. Mozart's *Clarinet Concerto in A,* Opus 107. This musical selection was the same as the one used in the Thaut and de l'Etoile study (1993). Prior to listening, participants were instructed to "determine the mood of the piece," then to "move yourself into that mood." The experimenter did not indicate the intended mood of the piece (positive) for the participants. After listening, participants again indicated their current mood using the visual analog scale. Mood change was then assessed by measuring the distance between pre and postmusic listening markings on the visual analog scale. Prior to data collection, the criterion for adequate mood change was set at a difference of at least 10 millimeters in the desired direction between pre and postmusic listening (Thaut & de l'Etoile, 1993).

Results

Two forms of data were collected in this study. First, for participants in the mood induction conditions, data included mood change as reported on the visual analog scale. Mood change was determined by measuring the distance between participants' pre and postmusic listening markings on the scale. The second type of data included the number of antonyms participants correctly recalled on day two of testing. One participant was eliminated due to not completing the testing procedures. Data analyses, therefore, refer to the remaining 44 participants.

Of the 34 participants who underwent the musical mood induction procedure, 29 met the preset criterion for adequate mood change, resulting in an overall success rate of 85%. Examining these results by gender revealed that 22 out of 26 female participants (84.6%) met mood change criterion, and 7 out of 8 male participants also met mood change criterion (87.5%).

Group 1 participants, who received mood induction prior to encoding only, reported an average mood change of 29.3 millimeters in the positive direction. For Group 2, participants completed mood induction prior to recall only. This group reported the largest mood change; averaging 33 millimeters in the positive direction. Group 3 participants did not undergo mood induction.

For Group 4, mood induction was applied prior to both encoding and recall. Before encoding, this group averaged 23.4 millime-

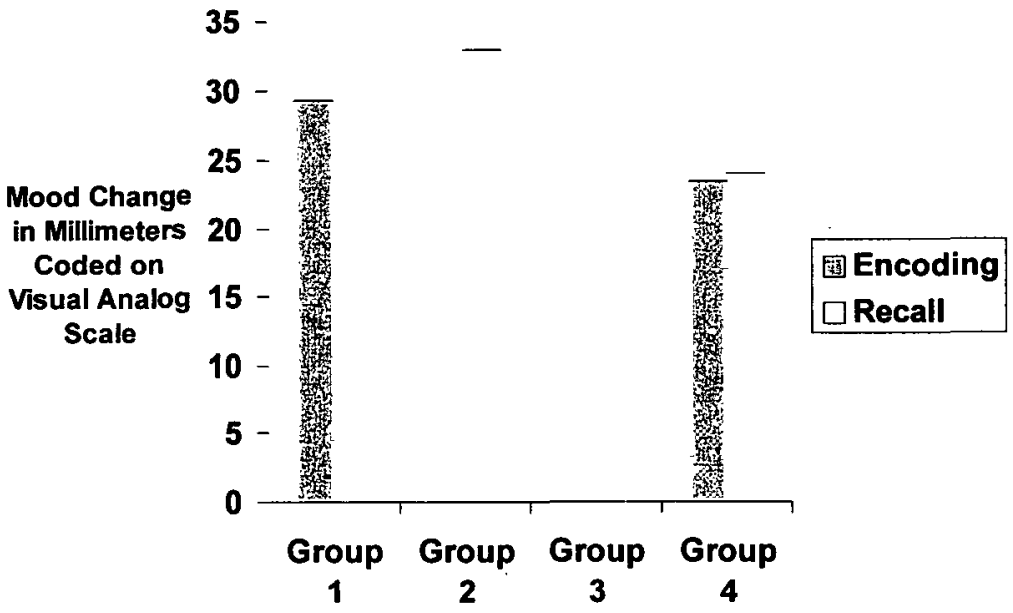

FIGURE 1.
Mean mood change in each group.

ters of mood change in the positive direction. Prior to recall, group four averaged 24 millimeters of mood change in the positive direction. Overall, the fourth group averaged 23.7 millimeters of mood change in the positive direction. The results of the mood induction procedure are visually represented in Figure 1.

In the second data category, the number of antonyms correctly recalled was analyzed by computing group means and standard deviations. Participants who did not meet the predetermined criterion for mood change were considered not to have experienced sufficient mood change to test for its effects on word recall. Five participants did not meet the preset criterion and were therefore not included in this portion of the data analysis.

Group 4 participants, who received mood induction prior to both encoding and recall, retrieved the greatest mean number of words (M = 15.33, SD = 3.12). Group 1, with mood induction prior to encoding only, recalled the second greatest mean number of antonyms (M = 12.20, SD = 4.98). In Group 2, participants had mood induction at recall only and remembered an average of 10.20 words (SD = 6.12). Group 3 participants, who received no musical mood induction, retrieved the fewest antonyms as a group with an average of 8.40 words (SD = 4.24). Group means of recalled words are visually represented in Figure 2.

A one-way ANOVA was computed to compare the four group

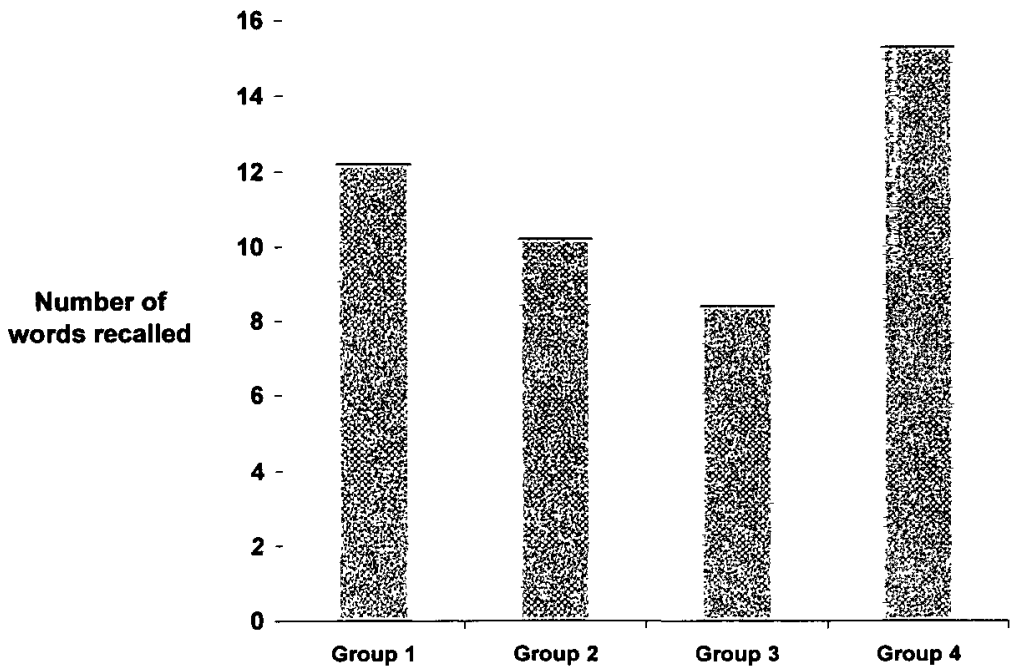

FIGURE 2.
Mean number of words recalled in each group.

means. Results indicated that significant differences existed between groups ($F(3) = 3.64$, and $p = .0220$). Post hoc analysis using the Scheffe test at the .05 level of significance revealed that the mean number of words recalled by Group 4 (mood induction prior to both encoding and recall) was significantly higher than in Group 3 (no mood induction). No other significant differences were found between groups. Results of the ANOVA are summarized in Table 1.

Discussion

The results of this study are discussed in reference to the original purpose statements: (a) to examine the effectiveness of a musical mood induction procedure and (b) to explore mood state-dependent effects on the encoding and free recall of internally-generated words. First, the musical mood induction procedure was effective in the majority of cases, for both male and female participants. The high success rate (85%) for this technique concurs with results obtained previously by Thaut and de l'Etoile (1993), and the absence of gender effects corresponds with previous research by Clark (1983). The failure to meet mood change criterion for the remain-

TABLE 1
Analysis of Variance: Mean Differences in Word Recall between Groups

Source	*df*	*SS*	*MS*	*F*	*p*
Between groups	3	249.99	83.33	3.64*	.0220
Within groups	35	801.60	22.90		
Total	38	1051.59			

*$p < .05$.

ing 15% of participants may indicate that they considered their current mood to match the perceived mood of the music. Consequently, these participants would not have experienced nor reported a substantial mood shift after music listening.

Mood change within groups is also worthy of mention. In Group 4, 9 out of 12 participants met mood change criterion on both procedure days. These participants also exhibited a slight mood improvement on Day 2, thus indicating the absence of testing effects. These results support the effectiveness of music as a reliable medium for mood induction.

Additionally, Group 2 participants, who received musical mood induction prior to recall only, indicated the largest mood change of all groups. These participants, however, recalled fewer words than Groups 1 and 4. In light of earlier research on mood state-dependent effects and the associative network of memory, results from Group 2 may indicate that mood induction caused a mood shift strong enough to interfere with recall ability. Since these participants experienced such a large mood change, their overall mood state at recall was possibly quite different from their encoding mood.

On Day 1, Group 2 participants may have encoded the words into either neutral or negative memory networks. Induction of a positive mood on the second day then created access to positive networks, interfering with retrieval abilities. These participants may have been operating within very different associative networks from Day 1 to Day 2, limiting their access to the words stored in memory. The performance of Group 2 validates the effectiveness of a musical mood induction procedure in producing a substantial change in mood.

The results of this study also provide additional evidence for mood state-dependent effects on memory. Group 4 participants received mood induction prior to both encoding and recall and

demonstrated significantly greater word retrieval than participants in Group 3, who received no mood induction. These results agree with earlier research on mood state-dependent recall using the same mood induction procedure (Thaut & de l'Etoile, 1993). Additionally, the recall performance of Group 4 was consistently high across participants as indicated by a relatively low standard deviation ($SD = 3.12$).

For Groups 1 and 4, the mood induction procedure most likely helped participants make an initially positive association with the words, allowing for storage into positive memory networks. If participants also experienced a positive mood at recall via mood induction, the positive network could then be accessed, leading to optimal retrieval. For participants not receiving mood induction at recall, access to the positive network may have been blocked or inhibited resulting in impaired recall. As stated in the mood state-dependent recall theory, retrieval is greatest when mood at encoding matches mood at recall.

The retrieval ability of all groups may also have been influenced by specific elements of the testing procedure. Following the suggestions of Eich and Metcalfe (1989) regarding laboratory conditions necessary for demonstration of mood state-dependent effects, participants in this study recalled words they had created, or that were internally generated. Additionally, the investigator provided few retrieval cues for participants at recall (a page with 40 blank lines), thus establishing a free recall testing situation. Using free recall of internally-generated information may have enhanced retrieval abilities for all participants.

While these findings appear to provide a clear example of mood state-dependent recall via musical mood induction, further examination of the results reveals a different perspective. For example, the same piece of music was used for all mood induction procedures throughout the study. The piece was chosen for its ability to portray and elicit a positive mood state, which it apparently did judging from participants' mood ratings. However, using different 'positive' musical selections for mood induction prior to encoding and recall would have allowed for better isolation of mood state-dependent effects. In the current study, participants may have simply used the musical piece as a cue for word recall, irrespective of current mood. This interpretation may provide an alternate explana-

tion for the great disparity in recall between Group 4 (mood induction at both encoding and recall) and Group 3 (no mood induction), and certainly necessitates further investigation.

Cautiously assuming that the high recall demonstrated by participants in Group 4 was the result of mood state-dependence, this study may contribute to the treatment of mood disorders, such as clinical depression. Research has demonstrated that clients with depression tend to think negative thoughts and to retrieve negative memories, thus exacerbating the depressed affect and creating a negative cycle of cognitions and emotions (Teasdale, 1983). Essentially, clients with depression appear to be trapped in an associative network of negative thoughts and feelings. One way depressed clients can break out of the negative network is by experiencing a positive mood, at least temporarily. Activation of a positive emotion node stored in memory could then stimulate an entire network of positive thoughts and memories, thereby weakening the negative cycle of depression.

By utilizing musical mood induction, therapists may assist clients in experiencing these critical positive mood states. When clients experience positive emotions, they gain access to positive cognitive networks, such as memories of past success. In addition, clients may establish new associative networks in memory as a result of their participation in effective therapeutic experiences.

Using cognitive approaches to treatment, therapists can then assist clients in developing more realistic cognitive perceptions of themselves, their immediate environment and their future. This type of cognitive reorientation provides the foundation needed for desired emotional and behavioral changes (Wright & Beck, 1983). Current literature supports this line of thinking by demonstrating the reciprocal nature of emotions and cognitions in regard to mood alteration.

In a recent study, investigators discovered that when participants in a sad mood were asked to retrieve a memory, they initially recalled a mood-congruent memory (sad), followed by retrieval of a positive memory (Josephson et al., 1996). In response to open-ended questions following testing, participants explicitly stated that their conscious intention was to alter their mood by recalling a happier event from their past. These results suggest that participants attempted to alter their negative mood by accessing more

positive cognitive-emotional networks and provide evidence that such a process may be a natural tendency toward self-restoration. This natural tendency, however, appears to be diminished or absent in clients with depression. Therapists can set the process in motion by using musical mood induction to elicit positive emotions and then verbally directing clients' attention to more positive thoughts.

The results of this study provide preliminary support for the use of musical mood induction procedures in the laboratory, which may generalize to clinical settings. Future research may utilize a variety of musical selections intended to induce a specific mood, or provide musical selections with contrasting moods at encoding and recall, such as positive music at encoding and negative music at recall. In essence, the results of this study help to demonstrate the effects of mood state-dependency on word retrieval and may invite additional investigation. Such exploration may enhance understanding of the relationship between emotions and cognitions, leading to improved treatment of mood disorders.

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