Mood Congruent Memory:
Effects on a Lexical Decision Task and a Free Recall Task

by

Catherine Ilaria Gross
Honours Student

A THESIS SUBMITTED IN PARTIAL FULLFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
BACHELOR OF SCIENCE (HONOURS)
IN PSYCHOLOGY

in

The Irving K. Barber School of Arts and Sciences

THE UNIVERSITY OF BRITISH COLUMBIA
OKANAGAN CAMPUS
April 2006
©Catherine Illaria Gross

UBC Okanagan
I.K. Barber School of Arts & Sciences
Psychology

Honours Thesis Title: **Mood Congruent Memory: Effects on Lexical Decision Task and a Free Recall Task**

Submitted by: Catherine Ilaria Gross

Supervisor(s): Barbara Rutherford, PhD

_____
Barbara Rutherford, PhD
Supervisor

_____
Cynthia Mathieson, PhD
Professor & Head, Psychology and Computer Science

April 30, 2006
Date

Abstract

The quality of life of depressed individuals is compromised, as is that of their loved ones. Depression also impacts society in terms of the costs incurred from treatment and from decreases in productivity at work/school. Accordingly, it is important to better understand the mechanisms that may foster depressive episodes. It has been proposed that mood affects conscious and unconscious processing of information in memory and that these processes are involved in the onset, maintenance, and reoccurance of depressive episodes (Beck, 1976). The question addressed in the present research is whether mood affects unconscious and conscious information processing in a non-clinical sample. Music and memories of past events are used to induce a sad or neutral mood. Then participants engage in two tasks: one tests unconscious processing by measuring reaction time on a lexical decision tasks; the other tests conscious processing by measuring correct word recall and false alarms on a free recall task. It is predicted that participants induced into a sad mood will process sad words faster than happy words in the lexical decision task and will remember more sad words than happy ones in the free recall task and that people induced into a neutral mood will recall equivalent numbers of sad and happy words.

The overall efficacy of the mood induction procedure was 59% in a sample of 64 students. Mood congruent effects were not observed on any of the tasks, with the exception of the false alarms produced on the free recall task.

Contents

Abstract / iii

Table of Contents / iv

Introduction / 1

Method: Participants / 7

Method: Materials / 7

Method: Procedure / 11

Method: Design / 13

Results / 14

Discussion / 15

References / 19

Appendixes / 24

Appendix A: Center for Epidemiologic Studies: Depression Scale / 24

Appendix B: Visual Analogue Scales / 26

Appendix C: Word List: Lexical Decision Task / 28

Appendix D: Word List: Free Recall Task / 30

Appendix E: Letter of Informed Consent / 32

Appendix E: Demographic Questionnaire / 36

Mood Congruent Memory: Effects on a Lexical Decision Task and a Free Recall Task

The quality of life experienced by individuals with depression is compromised, as is the quality of life of their loved ones (e.g., Rapaport, Clary, Fayyad, & Endicott, 2005). Not only does depression affect the individual, but also it affects society in terms of an economic burden (Hawthorn, Cheok, Goldney, & Fisher, 2003). This burden is manifest in a decrease in productivity, an increase in health service use, missed workdays, and loss of earnings. According to a study by the World Health Organization, the financial and social burden incurred by depression is predicted increase dramatically by 2020 (Murray & Lopez, 1997). Unipolar depression was ranked fourth globally in 1990 and is projected to rank second by 2020. With these costs and these projections, it is imperative that we further elucidate the mechanisms involved in the etiology, progression, remission and reoccurrence of depressive episodes. By doing so we may better treat the affected individuals and thereby reduce the costs associated with their illness.

It has been proposed that cognitive factors, such as information processing and attention resource allocation, are associated with the mechanisms involved in the progression of a depressive episode (Beck, 1976, as cited in Ellwart, Rinck, & Becker, 2003). By extension, it is believed that emotional states can affect these cognitive factors, both in terms of conscious and unconscious processing of memory information (Sutherland, Newman, & Rachman, 1982; Teasdale, 1983).

Current theories propose that the influence of mood on memory is manifest via a memory bias termed mood-congruent memory (Barry, Naus, & Rehm, 2004; Bower, 1981). Mood-congruent memory (MCM) refers to the tendency for one to remember and/or process

information that matches the individual's mood. In relation to depression, this would mean that sad information is processed differently than neutral or happy information and this difference may foster depression.

Often it is impractical or unethical to study MCM in a clinically depressed population. Individuals suffering from major depression may lack the motivation and/or energy to effectively apply themselves to the tasks used to test MCM (Fehnel, Bann, Hogue, Kwong, & Mahajan, 2004). In response to the problems associated with the study of MCM in a clinically depressed population, researchers have tested non-clinical samples, as will be done in the current research. The use of a non-clinical sample requires the use of a mood induction procedures (MIPs) which is designed to induce a specific mood in a non-clinically depressed participant. There are a variety of MIPs and they differ in stimuli used, efficacy, and demand characteristics (Gerrards-Hesse, Spies, & Hesse, 1994). Examples of MIPs include imagery, Velten statements, music, film, and memories (for overview see Gerrards-Hesse et al., 1994). To ensure that none of the participants in the current research are depressed, they will be screened for depression with the Center for Epidemiologic Studies Depression Scale (CES-D scale; Radloff, 1977; see Appendix A). This is a scale that is quick and easy to administer. It involves a series of 20 statements (e.g., "I had crying spells." "My sleep was restless.") to which the participant responds how frequently he has experienced the each statement using a scale of 0 to 3. Four statements are reverse scored, and the responses are added to result in an overall score. Scores of 16 or higher are indicative of a depressed state, therefore, participants with a CES-D score of 16 or greater will be excluded from participation (e.g., Radloff, 1977).

Currently, the most widely used MIP is the use of Velten statements (1968; Martin, 1990). These phrases are composed of self-referent statements that are either positive or

negative self-evaluations or bodily sensations. The efficacy of this MIP varies by mood that is induced (Gerrards-Hesse et al., 1994). The overall average efficacy is 58% (range 32% to 92%), but the average efficacy for inducing a sad mood is 70% (range 30% to 93%) and the average efficacy for inducing a neutral mood is 54% (range 26% to 79%).

The use of classical music, both alone or in combination with other MIPs, is becoming more frequently used and may soon become as widely used as Velten statements (Martin, 1990). The reason for this is that some studies have directly compared these two popular MIPs and have found that a musical mood induction produced larger changes in mood and perhaps a more sustained response (e.g., Sutherland et al., 1982). However, caution is advised when comparing these and other techniques as the criteria of success varies. The overall average efficacy of music alone is 83% (range 77% to 88%), the average efficacy for inducing a sad mood is 77% (range 43-94%, four studies reported) (Barnes-Holmes, Barnes-Holmes, Smeets, & Luciano, 2004; Gerrards-Hesse et al., 1994).

In order to increase the efficacy of the MIP, researchers have begun to combine different techniques (e.g., Eich & Macaulay, 2000). The present study will employ a combination of classical music and memories, as used in prior research (e.g., Richell & Anderson, 2004; Van der Does, 2002; 2005). Participants will be asked to think of one or more times in their lives during which they felt a specific emotion. This specific MIP is expected to be highly effective, have low demand effects, and produce a sustained change in mood.

It has been suggested that the MCM effects that have been found when comparing happy and sad individuals are confounded (Singer & Salovey, 1988). In this situation it is impossible to determine if the MCM effect is the result of reduced access to happy

information or the result of increased access to sad information. Therefore, the moods that will be induced in the current study are neutral and sad (Knight, Maines, & Robinson, 2002). The sad mood group will be instructed to think of sad memories. The other group will be instructed to think of neutral (unemotional) memories.

Currently there is a debate over the existence of MCM resulting from experimentally induced moods. The debate is not present with regards to a MCM effect resulting from natural variations in the subjects' mood state or in clinical depression (Blaney, 1986; Ucros, 1989). In these natural mood situations it is widely accepted that MCM exists.

In studies of induced moods, the results of explicit memory tasks in relation to MCM are more consistent (and in favor of MCM) than are the results of implicit memory tasks in relation to MCM (Watkins, 2002). Some studies find a significant mood congruent effect while others either find no significant effect or they find a mood incongruent effect (e.g., Ruiz-Caballero, & González, 1994; Rusting & DeHart, 2000). However, there are many possible practical reasons for the inconsistencies that are found in the MCM literature concerning implicit memory biases; the studies differ in terms of the MIP, the criteria used to determine when a mood has been induced, the moods induced, the populations studied, and the tasks used to test mood congruency. Any of these factors could modify the MCM effect.

There are several theoretical reasons to believe that MCM effects are present in not both types memory tasks. Watkins (2002) indicates that much of the early implicit MCM research ignored what we know about levels of processing. In his review of the literature he found that researchers typically had the participant process information perceptually but then tested the impact of the information with a conceptual task or vice versa. For example, the participant processes words in a conceptual manner via elaboration and then is tested for

priming with a word stem completion task which is a perceptual task. He contrasted this with the more valid pairing of the levels processing at input and at output that is seen with explicit tasks. For example, using the same processing strategy as mentioned above and testing the participant's implicit memory with a free association task. Watkins also indicated in his review of the literature that the majority of explicit memory tasks utilized in MCM research were conceptual while the implicit memory tasks utilized in MCM research varied on this dimension. It could be that conceptual memory tasks better address MCM effects than do perceptual memory tasks. An investigation into the impact of this discrepancy indicated that an implicit memory bias may exist if conceptual processing of the information is used but not if perceptual processing of the information is used (Watkins, Martin, & Stern, 2000). To address this problem, both of the tasks that will be used in the present research are conceptual in nature. Theories of depression also suggest that implicit memory may be an important determinant of daily behaviour (e.g., Watkins, Vache, Verney, Muller, & Mathews, 1996). Thus, the reason that an implicit memory effect has not been consistently found may be that the topic has not been correctly studied.

The implicit memory task will be a lexical decision task and it is expected that it will tap into unconscious information processing. In this task participants will compare a letter string to their mental lexicon (storehouse of information about words that an individual knows) to determine if the letter string spells a word (Gazzaniga et al., 2002). A variety of tasks have been used to evaluate the effect of mood on implicit processing tasks and no one task appears to be favored. However, several studies have investigated the effect of mood on a lexical decision task and all have found significant results in favor of mood congruent processing (e.g., Ferraro, King, Ronning, Pekarski, & Risan, 2003; Olafson & Ferraro, 2001).

Consistent with the aforementioned studies, it is predicted that participants in the sad mood induction group will respond faster to sad words and slower to happy words relative to the neutral mood induction group. It is also predicted that participants will have higher average accuracy scores for words that are mood congruent than for words that are mood incongruent.

The explicit memory task will be a free recall task and it is expected that it will tap into conscious information processing. In this task a participant is presented with a list of words to remember and following the presentation writes the words on a piece of paper. Free recall is one of the most common explicit memory tasks used in MCM research (e.g. Ellis, Seibert, & Barner, 1995; Ellwart et al., 2003) and is the second task that will be administered in the present study. It is predicted that participants in the sad mood induction group will recall significantly more sad words than happy or neutral words. It is also predicted that the false alarms produced by participants will show a mood congruent bias. That is, individuals in the sad mood induction group will be more likely to produce sad false alarms than either happy or neutral false alarms.

The present study aims provide evidence in favor of MCM and to replicate the findings from studies finding an MCM effect with a lexical decision task (Ferraro et al., 2003; Olafson & Ferraro, 2001) and with a free recall task (e.g., Ellwart et al., 2003; Knight et al., 2002; Ruiz-Caballero & González) and extend these findings by comparing the two types of tasks.

In summary the following hypotheses will be evaluated:

1. The combination of music and self-referent memories is an effective mood induction procedure.
2. In the LDT, the participants in the sad mood induction group will respond faster to sad

words and slower to happy and neutral words compared to the response times of the participants in the neutral mood induction group.

3. In the LDT, the participants will exhibit higher average accuracy scores for words that are mood congruent than for words that are mood incongruent.
4. In the free recall task, the participants in the sad mood induction group will recall more sad words and fewer happy and neutral words compared to the recall responses of the neutral mood induction group.
5. The false alarms produced in the free recall task will also exhibit a mood congruent bias.

Method

Participants

Sixty-four university students (38 women and 26 men) participated in the study. All participants were not depressed, as determined by a score equal to or greater than 16 on the CES-D scale (M = 5.84, SD = 4.141). The average age of the participants was 21.27 years old (SD = 3.291). Participants were excluded if they had suffered from any mental disorder in their past, as determined by self-disclosure. This criterion was included as it believed that dysfunctional cognitions, which relate to mood congruent thoughts, may result in the relapse of depression in those with a history of depression (Miranda, Gross, Persons, & Hahn, 1998; Van der Does, 2005). All participants had learned English when they were children and had normal or corrected to normal vision and hearing. Volunteers received course credit if they were currently enrolled in an introductory psychology course. All participants were treated in accordance with the Tri-Council Policy Statement: Integrity in Research and Scholarship.

Materials

mood induction. Participants were instructed to think of a memory while listening to music presented on headphones. The music selections were made based upon previous research. The music used in the sad mood induction was “Adagio for strings” by Barber and “Adagio in G minor” by Albinoni (Ferraro et al., 2003; Fox, Knight, & Zelinski, 1998; Knight et al., 2002; Olafson & Ferraro, 2001; Samson & Rachman, 1989). The participants in this condition were instructed “think of a time in your life when you felt very sad or depressed.” The music used in the neutral mood induction was “Neptune the Mystic” by Holst, the “3rd Symphony, second movement” by Brahm, and “English Suite no. 3, Saraband” by Bach (Fox et al., 1998; Richell & Anderson, 2004; Williams et al., 2002). The participants in this condition were instructed to “think of a time in your life when you felt neither overly happy nor overly sad.” Participants listened to the music and thought of the memory for 7 min. Following this the music was turned down to approximately half volume and it was played for the duration of the study, with the exception of the times of instruction, in order to prolong the effects of the mood induction and reduce distraction caused by outside noise (Ferraro et al., 2003; Fox et al., 1998; Olafson & Ferraro, 2001). Although prior studies generally use only one musical piece they also only play the music during the mood induction. The increase in duration of music presentation resulted in the requirement that several musical pieces be combined in order to reduce the number of times each piece was presented. Each combination of music was between 19 and 20 min. The combination of musical pieces is not unprecedented, though uncommon (e.g., Conklin & Perkins, 2005; Olafson & Ferraro, 2001). During debriefing music that has been previously found to induce a happy mood was played. The music used was “Divertimento #136 (adagio)” and “Eine Klein Nachtmusik” by Mozart, “Arrival of the Queen of Sheba” by Handel, “Concerto for 2 Mandolins in G major” and

"Coppelia, Mazurka" by Delibes (Clark & Teasdale, 1985;Conklin & Perkins, 2005; Ferraro et al., 2003; Gayle, 1997; Olafson & Ferraro, 2001; Samsom & Rachman, 1989).

manipulation check. Visual analogue scales (VASs) similar to that developed by Bond and Lader (1974) were constructed to measure subjective ratings of happiness and sadness (see Appendix B). One scale measured sadness, the other measured happiness and they were presented together as a set. Each scale was similar to VAS used in other research, in that it measured a single mood ("How sad do you feel right now?" or "How happy do you feel right now?"), the ends were anchored with an intensity of feeling value (*very little* and *very much*), and each line was 100 mm. Participants mark with a separate line across each the scales how they presently feel. The scales are scored by measuring from the left side of the scale to the mark created by the participant. Repeated administration of the VAS set is possible and the scale has been shown to have both validity and reliability (Folstein & Luria, 1973; Luria, 1975). Five sets of the VAS were administered to each participant over the course of the experiment. A change in mood equal to 15 mm in the appropriate direction (towards very much on the sad scale or very little on the happy scale) was necessary on one of the scales of the second VAS set for inclusion in the sad condition. Maintenance of a 10 mm change was required on all subsequent VAS. A change of less than 15 mm in any direction on either scale was necessary for inclusion in the neutral condition. Two deviations from this criterion were allowed in the neutral condition as some movement was deemed permissible. These criteria resulted in 26 participants being excluded from the statistical analysis (20 in the sad condition, 6 in the neutral condition). The excluded participants did not differ from the included participants with regards to age [$F(1, 62) = 0.056$, $p = .813$], or CES-D score [$F(1, 62) = 0.458$, $p = .501$]. There was also no significant interaction between age or CES-D score.

lexical decision task (LDT). The LDT was administered on a Pentium 1 computer. The Micro Electronic Laboratory, version 2.0 (MEL2) software was used to collect response times and error rates. The LDT was composed of a practice block and a test block. The practice block included 2 happy words, 2 sad words, 2 neutral words, and 6 pseudowords. The test block included 15 happy words, 15 sad words, 15 neutral words, and 60 pseudowords (see Appendix C for a list of all of the words used). These words were largely taken from previous studies (Clark & Teasdale, 1985; Gayle, 1997; Ferraro et al., 2003). The words were equated on length [$F(2, 57) = 0.138$, $p = .872$], and imagery [$F(2, 57) = 0.093$, $p = .912$] (Paivio, Yuille, & Madigan, 1968). Words and pseudowords were equated on length. Each letter string was presented in white, 12-point, Times New Roman font, and was written in all capital letters. The letter strings were presented one at a time, in the center of a black screen. Presentation order was randomized by MEL2 for each participant.

free recall task. The free recall task was administered on the same computer setup as the LDT and was also presented using the MEL2 software. The free recall task was composed of a practice block and a test block. The practice block included 2 happy words, 2 sad words, and 2 neutral words. The test block included 10 happy words, 10 sad words, and 10 neutral words. All words used in the free recall task were previously used in the LDT and were equated on length [$F(2, 27) = 0.010$, $p = .990$], and imagery [$F(2, 27) = 0.013$, $p = .987$]. Each word was presented in white, 12-point, Times New Roman font, and was written in all capital letters. The words were presented one at a time, in the center of a blue screen for 2 s and the word order was randomized by MEL2 for each participant. Following each trial the participant wrote down as many words as she/he could remember in any order on a piece of paper. The time allowed was limited to 3 min in the test trial. Word responses were scored on two

criteria. Under the strict criterion, words that were spelled correctly and were from the presentation of the test list were scored as correct. Under the lenient criterion, words that were spelled incorrectly but could be identified as being from the presentation of the test list were scored as correct.

Procedure

Participants were tested individually and were asked to read and sign the informed consent form (see Appendix D). A demographic questionnaire (information regarding gender, age, and first language learned; see Appendix E), the CES-D Scale, and the first set of VASs was then administered. As the participant was completing the VAS the experimenter scored the CES-D to assess if the participant met the criterion for not being depressed. These measures took approximately 5 min to complete.

Upon completion of these tasks, the participant was told that she/he would now listen to a selection of classical music and was given memory instructions to think of an event in his/her life. In the sad mood induction the instructions were to “think of a time in your life during which you felt very sad or depressed.” In the neutral mood induction the instructions were to “think of a time in your life in which you felt neither overly happy nor overly sad.” It was indicated that the participant would listen to the music and think of the memory for 7 min at which time the experimenter would return to and the computer testing would then begin. At this time the participant was reminded that she/he could withdraw at any time without penalty should any distress or discomfort with the procedure be experienced. No participant withdrew at any time during the testing. At this point the experimenter left the room.

The experimenter returned to the room after 7 min and administered the second set of VASs. While the participant was completing the scale the music volume was decreased. Then

the participant was informed about the LDT. She/he was seated in front of a computer and was told that the computer would display one-at-a-time a list of real words and pseudowords and that the task was to determine which was which. The participant indicated a decision by pressing the “f” key for pseudowords and the “j” key for words. The participant was told that the pseudowords would match English grammatical rules but would not be a word. The participant was also informed that she/he should respond as quickly as possible but not so fast as to make mistakes. Following a response, the participant was instructed to press the space bar to advance to the next word until the list was exhausted. The experimenter remained in the room for the duration of the practice block, asked the participant if she/he had any questions, and then left the room. The participant exited the testing room to retrieve the experimenter once the LDT test trial was completed.

At this point the third set of VASs was completed. The participant was then informed that the next test would be a free recall test. It was explained that this was what is commonly referred to as a memory test and she/he should study the words because they would later be asked to recall them and write the words on a piece of paper in any order that she/he choose. The participant was told how many minutes would be allowed for output at the end of the learning phase and was also told to indicate when they were finished if it was prior to the 3-min cutoff. A practice block preceded the test block and the participant was encouraged to treat the practice block as if it were the test block but that their responses on these words would not be scored. The experimenter remained in the room for this task in order to control the output time allowed.

Following the free recall task the fourth set of VASs was administered. While the participant was completing the VAS, the experimenter removed the headset plug and changed

the music to the happy selection. The participant was debriefed and a final set of VASs was administered. Debriefing included explaining MCM, prior findings, the reasoning behind the present study, and the design of the present study. The participant was encouraged to ask questions and comment on the design of the study. In order to ensure that there was no diffusion of treatment, the participant was asked not to discuss the study with anyone else until the testing phase of the study was finished.

Design

The effectiveness of the MIP will be evaluated by determining the percentage of participants who are induced into the desired mood.

The LDT results will be analyzed in two repeated measures ANOVAs. A 2 X 3 repeated measures ANOVA will evaluate the effects of mood (neutral or sad) on response time (happy words, neutral words, and sad words). A 2 X 4 repeated measures ANOVA will evaluate the effects of mood (sad or neutral) on accuracy (happy words, neutral words, sad words, and pseudowords). All pairwise comparisons will be evaluated with the probabilities adjusted with the Bonferroni adjustment.

The free recall results will be analyzed based on two repeated measures ANOVAs. A 2 X 3 repeated measures ANOVA will evaluate the effects of mood (neutral or sad) on correct recall rate (happy words, neutral words, and sad words). The false alarms recorded will be analyzed with a 2 X 3 repeated measures ANOVA to evaluate the effects of mood (neutral or sad) on incorrect recall (happy false alarms, neutral false alarms, and sad false alarms). The false alarms will also be examined to identify if one group generated more false alarms than the other. All pairwise comparisons will be evaluated with the probabilities adjusted with the Bonferroni adjustment.

Results

Consistent with the first hypothesis, the majority of participants were induced into the desired mood (59%). 50% of participants in the sad mood condition were induced into the desired mood while 75% of the participants in the neutral mood condition were induced into a neutral mood.

The results obtained do not support the second hypothesis. The interaction between mood condition and word type for average response time in the LDT was not significant [$F(2, 35) = 0.339$, $p = .715$]. There was a significant main effect for word type [$F(2, 35) = 15.576$, $p < .001$]. Pairwise comparisons indicate that happy words ($M = 740.0526$, $SD = 217.45642$) were identified as words significantly faster than neutral words ($M = 819.4342$, $SD = 251.60318$) and sad words ($M = 839.6421$, $SD = 301.98338$). All other comparisons failed to reach significance.

Contrary to the third hypothesis, the interaction between mood condition and word type for accuracy of response in the LDT was not significant [$F(3, 34) = 1.207$, $p = .322$]. There was a significant main effect for word type, [$F(2, 35) = 8.905$, $p < .001$]. Pairwise comparisons indicate that words were identified more accurately than pseudowords ($M = .925$, $SD = 0.09702$). Moreover, happy words ($M = .991$, $SD = 0.02283$) were identified significantly more accurately than sad words ($M = .964$, $SD = 0.04302$) but not more accurately than neutral words ($M = .972$, $SD = 0.05287$). All other comparisons failed to reach significance.

Although the free recall data was encoded with a strict and lenient criterion, only the statistics pertaining to the strict criterion will be reported as the two did not differ significantly. Contrary to the fourth hypothesis, the interaction between mood condition and

type of word recalled was not significant though it showed a strong tendency towards being consistent with the MCM hypothesis [$F(2, 35) = 3.206$, $p = .053$] because those in the sad condition recalled more sad ($M = 3.45$, $SD = 1.36$) than happy ($M = 3.50$, $SD = 1.36$) and neutral ($M = 3.40$, $SD = 1.67$) words and participants in the neutral condition recalled more neutral ($M = 3.72$, $SD = 1.60$) and happy words ($M = 2.78$, $SD = 1.80$) words than sad ($M = 4.00$, $SD = 1.14$) words. There was no main effect for word type [$F(2, 35) = 1.978$, $p = .154$].

Consistent with the final hypothesis, there was a significant interaction between mood condition and mood of false alarm produced [$F(2, 35) = 4.567$, $p = .017$]. There was no main effect for mood of false alarm produced [$F(2, 35) = 2.807$, $p = .074$].

Discussion

Perhaps the most important finding of the present study is the efficacy of the mood induction procedure. The procedure utilized in the present study had an efficacy much lower than other studies, and resulted in a large number of unusable participant data. The time course of the induced mood underscores the need for multiple manipulation checks because although many participants were induced into the appropriate mood, many fewer remained in the desired mood. During debriefing, several participants noted that they found the music relaxing rather than neutral or sad. Although anecdotal in nature, these reports are similar to the findings of Momose, Fujisawa, and Uchiyama (2004) whose results indicated that the effect of the musical mood induction procedure was modulated by the participant's impression of the music. A more systematic study of this effect in relation to mood congruent memory would be useful as it may provide important insight as to why some participants do not respond to the mood induction procedure. The benefit of the fleeting nature of the induced mood is that it can be safely stated that the mood induction procedure poses minimal risk to

participants.

The results of the present study partially replicated the results found in prior research that used a lexical decision task to investigate the potential mood congruent effect on an implicit task (Ferraro et al., 2003; Olafson & Ferraro, 2001). In terms of accuracy, words were identified more accurately than pseudowords, as was found in prior research (Ferraro et al., 2003; Olafson & Ferraro, 2001). However, there was no significant interaction between mood and type of word, which is inconsistent with the MCM effect found in previous studies. Furthermore, the results on the main measure of interest, reaction time, were inconsistent with prior research. No mood congruent effect was found in the present research, whereas in prior research a mood congruent effect was found. The inconsistency between the present research and previous studies could be due to several factors. The mood induction procedure utilized in the prior research was very different than the procedure used in the present research. Also, the manipulation check utilized did differ, because previous research did not use multiple manipulation checks. Therefore, it is unclear how many participants were excluded from the analyses performed in the other research. The results of the present research are consistent with other studies that investigate the mood congruent effect with different implicit tasks (Ellwart et al., 2003; Watkins et al., 1996, 2000). Similar to other research, the results of the present research cannot be attributed to an ineffective mood manipulation because only the data produced by participants who were induced into the desired mood were included in the analyses.

The data from the free recall task showed a strong tendency towards mood congruency. Although the explicit memory task utilized in the present research is among the most popular, the results of prior research are equivocal. Of the literature reviewed, two

studies (Knight et al., 2002; Ruiz-Caballero & González, 1994) found a significant mood congruent effect while three did not (Ellis et al., 1995; Ellwart et al., 2003; Gayle, 1997). The failure to find a MCM effect in the current research might have been due to a type II error from the low participant numbers. Indeed, the relatively low participant numbers is a major limitation of the present study.

Although, this is the first study to have conducted an analysis of the false alarms produced in a free recall task during a MCM study, the fact that the finding was significant suggests that future research should examine the effect of mood congruency in relation to false alarms as a significant mood congruent effect was found.

Ultimately, the goal of MCM research is to determine how generalizable the results from a clinical population are to a subclinical or nonclinical population. To this end future research should directly compare the aforesaid groups within a single research protocol. By examining the conscious and unconscious cognitive effects that emotions and mood have on all forms of depression and sad mood, researchers could provide valuable information to clinicians treating the affected groups. For example, if cognitions play a role in the relapse of depression, clinicians should not only inform patients of this but should also monitor the cognitive status of the patients during remission. Early detection of cognitive distortions, as caused by a MCM bias towards sad information, could lessen the severity and/or duration of a depressive episode. This is certainly a worthy goal.

Future research should also investigate whether gender differences exist in relation to the MCM effect. The majority of research to date appears to ignore the potential difference, and a difference between genders could explain why some studies have found a MCM effect and others have not because it is rare for the number of female participants to equal the

number of male participants.

A final recommendation for future research is to include three participant groups where possible (sad, neutral, and happy) to gain a more complete picture of the phenomenon under study. With the suggested protocol amendments, it is possible that the debate over the existence of a MCM effect could be resolved.

References

Barnes-Holmes, Y., Barnes-Holmes, D., Smeets, P. M., & Luciano, C. (2004). A derived transfer of mood functions through equivalence relations. *The Psychological Record, 54,* 95-113.

Barry, E. S., Naus, M. J., & Rehm, L. P. (2004). Depression and implicit memory: understanding mood congruent memory bias. *Cognitive Therapy and Research, 28,* 387-414.

Blaney, P. H. (1986). Affect an memory: A review. *Psychological Bulletin, 99,* 229-246.

Bower, G. H. (1981). Mood and memory. *American Psychologist, 36,* 129-148.

Bond, A., Lader, M. (1974). The use of analogue scales in rating subjective feelings. *British Journal of Medical Psychology, 47,* 211-218.

Clark, D. M., & Teasdale, J. D. (1985). Constraints on the effects of mood on memory. *Journal of Personality and Social Psychology, 48,* 1595-1608.

Conklin, C. A., & Perkins, K. A. (2005). Subjective and reinforcing effects of smoking during negative mood induction. *Journal of Abnormal Psychology, 114,* 153-164.

Eich, E., & Macaulay, D. (2000). Are real moods required to reveal mood-congruent and mood-dependent memory? *Psychological Science, 11,* 244-248.

Ellis, H. C., Seibert, P. S., & Varner, L. J. (1995). Emotion and memory: Effects of mood states on immediate and unexpected delayed recall. *Journal of Social Behavior and Personality, 10,* 349-362.

Ellwart, T., Rinck, M., & Becker, E. S. (2003). Selective memory and memory deficits in depressed inpatients. *Depression and Anxiety, 17,* 197-206.

Fehnel, S. E., Bann, C. M., Hogue, S. L., Kwong, W. J., & Mahajan, S. S. (2004). The

development and psychometric evaluation of the motivation and energy inventory (MEI). *Quality of Life Research, 13,* 1321-1336.

Ferraro, F. R., King, B., Ronning, B., Pekarski, K., & Risan, J. (2003). Effects of induced emotional state on lexical processing in younger and older adults. *The Journal of Psychology, 137,* 262-272.

Folstein, M. F., & Luria, R. (1973). Reliability, validity, and clinical application of the visual analogue mood scale. *Psychological Medicine, 3,* 479-486.

Fox, L. S., Knight, B. G., & Zelinski, E. M. (1998). Mood induction with older adults: A tool for investigating effects of depressed mood. *Psychology and Aging, 13,* 519-523. Retrieved March 23, 2005, from PsycINFO database.

Gayle, M. C. (1997). Mood-congruency in recall: The potential effect of arousal. *Journal of Scoail Behavior and Personality, 12,* 471-481. Retrieved March 9, 2005, from PsycINFO database.

Gerrards-Hesse, A., Spies, K., & Hesse, F. W. (1994). Experimental inductions of emotional states and their effectiveness: A review. *British Journal of Psychology, 85,* 55-78.

Hawthorne, G., Cheok, F., Goldney, R., & Fisher, L. (2003). The excess cost of depression in south Australia: A population-based study. *Australian and New Zealand Journal of Psychiatry, 37,* 362-373.

Knight, B. G., Maines, M. L., & Robinson, G. S. (2002). The effects of sad mood on memory in older adults: A test of the mood congruence effect. *Psychology and Aging, 17,* 653-661. Retrieved March 9, 2005, from PsycINFO database.

Luria, R. E. (1975). The validity and reliability of the visual analogue mood scale. *Journal of Psychiatric Research, 12,* 51-57.

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

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

Momose, K., Fujisawa, Y., & Uchiyama, A. (2004). Effects of music on physiological measurements and mood states, and their correlation with impression of the music. *Journal of the International Society of Life Information Science, 22,* 545-551.

Murray, C. J. L., & Lopez, A. D. (1997). Alternative projections of mortality and disability by cause 1990-2020: Global burden of disease study. *The Lancet, 349,* 1498-1504.

Olafson, K. M., & Ferraro, F. R. (2001). Effects of emotional state on lexical decision performance. *Brain and Cognition, 45,* 15-20.

Paivio, A., Yuille, J. C., & Madigan, S. A. (1968). Concreteness, imagery, and meaningfulness values for 925 nouns. *Journal of Experimental Psychology, 76,* 1-25.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement,1,* 385-401.

Rapaport, M. H., Clary, C., Fayyad, R., & Endicott, J. (2005). Quality-of-life impairment in depressive and anxiety disorders. *American Journal of Psychiatry, 162,* 1171-1178.

Richell, R. A., Anderson, M. (2004). Reproducibility of negative mood induction: A self-referent plus musical mood induction procedure and a controllable/uncontrollable stress paradigm. *Journal of Psychopharmacology, 18,* 94-101.

Ruiz-Caballero, J. A., & González, P. (1994). Implicit and explicit memory bias in depressed and nondepressed subjects. *Cognition and Emotion, 8,* 555-569.

Rusting, C. L., & DeHart, T. (2000). Retrieving positive memories to regulate negative mood:

Consequences for mood-congruent memory. *Journal of Personality and Social Psychology, 78,* 737-752.

Samsom, D., & Rachman, S. (1989). The effect of induced mood on fear reduction. *British Journal of Clinical Psychology, 28,* 227-238.

Singer, J. A., & Salovey, P. (1988). Mood and memory: Evaluating the network theory of affect. *Clinical Psychology Review, 8,* 211-251.

Sutherland, G., Newman, B., & Rachman, S. (1982). Experimental investigations of the relations between mood and intrusive unwanted cognitions. *British Journal of Medical Psychology, 55,* 127-138.

Teasdale, J. D. (1983). Negative thinking in depression: Cause, effect or reciprocal relationship. *Advances in Behaviour Research and Therapy, 5,* 3-25.

Ucros, C. G. (1989). Mood state-dependent memory: A meta-analysis. *Cognition and Emotion, 3,* 139-167.

Van der Does, W. (2002). Different types of experimentally induced sad mood? *Behavior Therapy, 33,* 551-561.

Van der Does, W. (2005). Thought suppression and cognitive vulnerability to depression. *British Journal of Clinical Psychology, 44,* 1-14.

Velten, E. (1968). A laboratory task for the induction of mood states. *Behaviour Research and Therapy, 6,* 473-482.

Watkins, P. C. (2002). Implicit memory bias in depression. *Cognition and Emotion, 16,* 381-402.

Watkins, P. C., Martin, C. K., & Stern, L. D. (2000). Unconscious memory bias in depression: Perceptual and conceptual processes. *Journal of Abnormal Psychology, 109,* 282-289.

Watkins, P. C., Vache, K., Verney, S. P., Muller, S., & Mathews, A. (1996). Unconscious mood-congruent memory bias in depression. *Journal of Abnormal Psychology, 105,* 34-41.

Williams, J. M. G., Healy, H., Eade, J., Windle, G., Cowen, P. J., Green, M. W., et al (2002). Mood, eating behaviour and attention. *Psychological Medicine, 32,* 469-481.

Appendix A

Center for Epidemiologic Studies: Depression Scale

Subject ID: _____ Date: _____

Below is a list of ways that you may have felt or behaved. Please tell me how often you have felt this way during the past week.

Use the following scale:

0 - Rarely or none of the time (less than 1 day)
1 - Some or a little of the time (1 - 2 days)
2 - Occasionally or a moderate amount of the time (3 - 4 days)
3 - Most or all of the time (5 - 7 days)

During the past week:

1. I was bothered by things that usually don't bother me ..... _____
2. I did not feel like eating; my appetite was poor ..... _____
3. I felt that I could not shake off the blues even with help from my family and friends ..... _____
4. I felt that I was just as good as other people ..... _____
5. I had trouble keeping my mind on what I was doing ..... _____
6. I felt depressed ..... _____
7. I felt that everything I did was in vain ..... _____
8. I felt hopeful about the future ..... _____
9. I thought my life had been a failure ..... _____
10. I felt fearful ..... _____
11. My sleep was restless ..... _____
12. I was happy ..... _____
13. I talked less than usual ..... _____
14. I felt lonely ..... _____
15. People were unfriendly ..... _____
16. I enjoyed life ..... _____
17. I had crying spells ..... _____
18. I felt sad ..... _____
19. I felt people dislike me ..... _____
20. I could not get going ..... _____

Appendix B

Visual Analogue Scales

The Effects of Music and Memories on a Lexical Decision Task and a Free Recall Task

Visual Analogue Scale

How sad do you feel?

Very little **Very much**

_____

How happy do you feel?

Very little **Very much**

_____

Appendix C

Word List: Lexical Decision Task

Word List: Lexical Decision Task

Happy Words

pleasure, pleasant, fun, dove, gold, kind, comedy, hope, joy, cheerful, humour, comfort, wise, life, love, justice, helpful, thoughtful, prosperity

Neutral Words

air, ship, hotel, come, lobster, neutral, goblet, fabric, large, thick, binoculars, blink, concept, journal, newspaper, open, profession, question, sauce, similar

Sad Words

poor, gloom, agony, cry, hostile, death, banned, jail, tragedy, blood, rude, defeated, sadness, misery, mournful, fail, slapped, dumb, atrocity, agressive

Pseudowords

tureb, yoastera, tump, mokerel, linberet, hesette, hanbotter, tiw, vort, wape, yeab, zoosterot, gulett, gribe, drated, grend, flirp, golrdreb, palnet, sinmot, brac, brawt, specp, bucte, hopsnot, lieblirp, creteves, univarths, quenthie, tecl, bift, sacger, valuh, bole, feap, ticerem, leamert, thint, chorger, tig, doubh, , blamst, wanbost, stata, deated, squant, bolst, bursed, fusfof, acl, vaskerel, flister, ferait, lebersno, kettenal, vilch, ligelle, sipeter, retrix, risarched

Practice Trials

Happy Words

won, present

Neutral Words

oven, you

Sad Words

weeping, famine

Pseudowords

dattobe, bal, fielhs, watck, gradk, matcd

Appendix D

Word List: Free Recall Task

Word List: Free Recall Task

Happy Words

pleasure, pleasant, fun, dove, gold, kind, comedy, hope, joy

Neutral Words

air, ship, hotel, come, lobster, neutral, goblet, fabric, large, thick

Sad Words

poor, gloom, agony, cry, hostile, death, banned, jail, tragedy, blood

Practice Trials

Happy Words

won, present

Neutral Words

oven, you

Sad Words

weeping, famine

Appendix E

Letter of Informed Consent

THE UNIVERSITY OF BRITISH COLUMBIA | OKANAGAN

Informed Consent Form

The Effects of Music and Memories on a Lexical Decision Task and a Free Recall Task

Principal Investigator: Dr. Barbara Rutherford
Psychology Department
3333 University Way, V1V 1V7
(250) 807-9373
barbara.rutherford@ubc.ca

Co Investigator: Catherine Gross
Student: Psychology Department
catgross@telus.net

Introduction:

The University of British Columbia-Okanagan subscribes to the ethical conduct of research and to the protection at all times of the interests, comfort, and safety of the study of subjects. The information provided in this form is being given to you for your own protection and full understanding of the procedures, risks and benefits associated with this research.

This study is part of Catherine Gross' honours thesis which is required for the completion of her degree.

If you struggle with or suffer from anxiety, depression, or another mental illness, then you should not participate in this study. Furthermore, because of the nature of this study, you must be at least 19 years old to participate.

Purpose of the Study:

This study seeks to better understand how listening to music and thinking of memories affects a persons sensory processes and their memory for words.

Study Procedures:

You will be asked to engage in mood induction procedure and two tasks which will take no longer than 45 minutes of your time.

(1) First you will listen to a selection of music and reflect on a memory from your past. This will take about 7 minutes to complete.

(2) Lexical Decision Task: Real words and fake words will be presented on a computer screen. You will be seated in front of a computer screen with your chin on a chinrest. A letter string will appear on the monitor. Your job is to decide whether the letters spell a word. You will press one or other computer key to indicate the decision. This task will take 3 to 5 minutes to complete.

(3) Free Recall Task: You will be presented with a list of 45 words to learn on a computer monitor. The words will be presented one-at-a-time at a rate of one word every 10 seconds. The learning portion of this task will take 8 minutes. Then you will be given 3 minutes to recall as many of the words as possible. This task will take about 12 minutes.

Potential Risks and Benefits:

This project has been reviewed and granted a certificate of approval by the UBCO Research Ethics Board.

This research is important because it will increase our understanding of how music and memories affect how we think and what new information we remember. The findings of this study will clarify the relationship between these variables.

Through your participation in this study you may have an increased understanding of experimental design and methodology.

Confidentiality:

You understand that all data collected from you will be coded by a number and not your name; therefore, your identity will be kept confidential. The only people who will have access to the data are the principal investigator and the designated co-investigator. The data will be stored in a locked file cabinet and in a password-protected file on a computer in the psychology laboratory complex. All data will be destroyed 5 years after the findings have been published.

Remuneration/Compensation:

Introductory Psychology students at UBCO will receive a 1% course bonus credit/hour of research participation (up to a maximum of 4 credits). Other students are not eligible for compensation.

Contact for Information about the Study:

If you have any questions about the project, you may address them to Dr. Barbara Rutherford, at telephone number (250) 807-9373.

If you have any concerns about your treatment or rights as a research subject, you may contact the Chair of the Research Ethics Board through the Office of Research Services at (250) 807-8150.

The results of the study will be presented at an honours thesis presentation and published in a peer-reviewed journal in psychology. For details on the publication, contact Dr. Barbara Rutherford at telephone number (250) 807-9373 about 2 years following your participation. For other access to the findings, watch for posters on campus that advertise the time and place of a verbal presentation of the results.

Student Services Contact Information:

Access to support services is available for all UBC-O students. Should you find that you need to talk with a counselor you can make an appointment with them at the Student Services Center, Student Services Building Rm 119, telephone number: (250) 807-9100. You may also book an appointment with a counselor by contacting the Health and Wellness Center, Student Services Building Rm 006, telephone number: (250) 807-9270. The

counseling services center has the resources and community contact information that you may require.

Consent:

Your participation in the study is entirely voluntary and you may refuse to participate at any time during the testing session without consequence. Prior to leaving the testing session, you may instruct the researcher to destroy your data and watch while the computer file is deleted and the paper documents are shredded.

Your signature on this form indicates that you understand the information provided regarding this research project including all procedures and the personal risks involved. Your participation in this project is in no way related to your status as a student. You understand that your identity and any identifying information will be kept confidential.

Your signature below indicates that you consent to participate in this study. You will receive a copy of this consent form for your own records.

Your name (Please print): _____

Your signature: _____ Date: _____

Investigator's name: _____

Investigator's signature: _____ Date: _____

Appendix F

Demographic Questionnaire

The Effects of Music and Memories on a Lexical Decision Task and a Free Recall Task

Demographic data sheet

To be completed by the participant:

Age: _____

Gender: _____

First language learned: _____

To be completed by the experimenter:

Participant number: _____