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Inconsistent Mood Congruent Effects in Lexical Decision Experiments

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During a lexical decision task, the mood congruent effect occurs when a participant responds more quickly and accurately to word items that are congruent with their current mood. The present study investigates the inconsistencies found for mood congruent effects in the lexical decision task literature. Previous studies that have successfully produced the mood congruent effect used a pseudohomophone nonword context while studies that have not successfully produced the effect used a scrambled nonword context. The purpose of this study was to assess if manipulating the nonword context would interact with the mood congruent effect in a similar manner as other semantic effects. A significant effect for nonword context was found. However, a significant mood congruent effect was not found.

According to Bower (1981) memory consists of clusters of nodes that represent words, concepts, and events. Items in memory that are related to each other are connected. When a new event occurs, it is not stored in a secluded manner but forms connections with other related concepts and events. When an item in memory is accessed and becomes activated, energy travels along these connections and increase the activation of the related items. This increase in activation facilitates processing for these related items.

Bower (1981) proposed that memory contains emotion nodes that are part of the same associative network as words, concepts and events. These emotion nodes have connections to items that are related to specific moods. He suggested that two phenomena occur because of these connections. The first is known as the mood-congruent effect where people would tend to remember more about things that are related to the mood that was being experienced when the event occurred. The second is known as mood-state-dependent memory where people tend to recall more information about an event if their mood during recall is congruent with the mood that was experienced when the event occurred.

Bower's associative network model of memory has led to a number of investigations into how mood can influence lexical recognition. Based on Bower's model, it is assumed that when a person is in a particular mood, activation will spread to lexical items that are congruent with their mood. Therefore, responses to mood congruent items will be facilitated. Results from these experiments appear to be somewhat inconsistent. For example, Clark, Teasdale, Broadbent, & Martin (1983) performed a study where music was used to induce either a happy or sad mood prior to a lexical decision experiment. During the lexical decision experiment, the participant's task was to categorize strings of letters as being either words or nonwords (e.g. shoug). The word stimuli consisted of positive, neutral, or negative personality traits. Their results revealed no difference in response times for mood-congruent and mood-incongruent words and these response times did not differ from neutral word response times.

In a similar study, Challis and Krane (1988) performed a lexical decision experiment where participants were give positive and negative statements to read prior to a lexical decision experiment. Positive, negative or neutral trait adjectives were used during the lexical decision task. Their experiments produced a mood congruent effect for participants in the happy mood condition where happy adjectives were responded to more quickly than sad adjectives. However, they were not able to produce this effect for the sad mood induction condition.

Neidenthal and Setterlund (1994) also investigated the effects of mood on lexical access. Again, mood induction was performed using either happy or sad music prior to a lexical decision experiment. Words used during the lexical decision experiment included happy, positive, sad, negative, and neutral items. A mood congruent effect was found for both the happy and sad mood participants.

Finally, a study by Olafson and Ferraro (2001) and a second study by Ferraro, King, Ronning, Pekarski, and Risan (2003) are consistent with these findings. Using methods similar to Neidenthal and Setterlund (1994) both studies produced results where a mood congruent effect was produced in both the happy and sad mood induction conditions.

The findings from these studies appear to be somewhat inconsistent. However, a closer look at these studies reveals differences in methodologies that may be the cause of the inconsistencies. Previous studies that did not produce the mood congruent effect (Challis & Krane, 1988; Clark et al., 1983) used scrambled nonwords during the lexical

decision experiment while the studies that produced the mood congruent effect (Neidenthal & Setterlund, 1994; Olafson & Ferraro, 2001; Ferraro et al, 2003) used pseudohomophone nonwords. Scrambled nonwords are strings of letters that are not pronounceable (e.g. SHTYE). Pseudohomophones are strings of letters that are pronounceable and sound like real words (e.g. BRANE). Previous research has shown that when the nonword context that is being used during a lexical decision task switches from scrambled nonwords to a pseudohomophone nonword context, reaction times to words increase and the size of semantic effects become larger (James, 1975; Antos, 1979; Smith, Theodor, & Franklin, 1983; Briand, den Hyer, & Dannenbring, 1988; Kellas, Ferraro, & Simpson, 1988; Stone & Van Orden, 1993; Borowsky & Masson, 1996; Piercey & Joordens, 2000). When a scrambled nonword context is used, lexical decisions can be made based on early orthographic processing. Scrambled nonwords consist of strings of letters that do not follow normal rules of orthography. When a pseudohomophone context is used, participants can no longer distinguish between words and nonwords based on early orthographic processing. Both real words and pseudohomophones follow normal orthographic rules. Pseudohomophones are also pronounceable so it is difficult to distinguish then from real words based on phonology. Also, when pseudohomophones are pronounced they sound like a real word. Therefore, to be able to correctly distinguish between words and pseudohomophones deeper semantic processing must occur.

This pseudohomophone effect has been seen for semantic effects like frequency (Stone & Van Orden, 1993), ambiguity (Kellas, Ferraro, & Simpson, 1988; Borowsky & Masson, 1996; Piercey & Joordens, 2000), priming (Briand, den Hyer, & Dannenbring, 1988; Antos, 1979; Smith, Theodor, & Franklin, 1983), and concreteness (James, 1975) etc. For each of the studies listed above, the size of the semantic effects become larger as the nonwords become more wordlike and the task becomes more difficult. This increase in task difficulty increases reaction times, decreases accuracy and results in deeper semantic processing. If Bower's (1989) associate network model is accurate, perhaps the mood effects would be sensitive to the nonword context manipulation which would explain the inconsistent effects that have been previously reported.

The purpose of this study was to examine the influence of nonword context on the mood congruent effect. Participants were randomly assigned to one of four between participant conditions: 1) happy mood induction with scrambled nonwords, 2) happy mood induction with pseudohomophones, 3) sad mood induction with scrambled nonwords or 4) sad mood induction with pseudohomophones. Participants in each condition performed a lexical decision task to happy and sad words. If Bower's theory is correct, participants in the pseudohomophone condition should produce the largest mood congruent effect. The pseudohomophone context will force deeper processing which should allow for a greater amount of spreading activation to occur. Therefore an interaction between Congruence (Congruent vs. Incongruent) and Nonword Context (Scrambled vs. Pseudohomophone) should occur. Mood congruent items should be responded to faster than mood incongruent items and the size of this effect should be largest when pseudohomophones are used.

Method

The questionnaires, mood induction, and lexical decision components of the experiment follow the procedures described by Olafson and Ferraro (2001) and Ferraro et al. (2003),

where a mood congruent effect was found in both the happy and sad conditions. The main difference between this experiment and Olafson and Ferraro (2001) and Ferraro et al. (2003) is the inclusion of two scrambled nonword conditions.

Participants

Fifty-eight undergraduate students from the University of New Brunswick participated in one session lasting approximately 35 minutes. All participants reported being proficient in English and had normal or corrected-to-normal vision. All participants received one bonus credit towards their grade in Introductory Psychology. Participants were randomly assigned to one of the four conditions. New Brunswick is a bilingual province (English and French) and four participants were removed from the data analysis because their accuracy for nonword decisions was below 80% leaving a total of fifty-four participants (42 female). Therefore, the happy mood/scrambled nonword condition contained thirteen participants, the happy mood/pseudohomophone condition contained twelve participants, the sad mood/scrambled nonword condition contained fourteen participants and the sad mood/pseudohomophone condition contained fifteen participants.

Questionnaires

Participants completed the State-Trait Inventory (STI) (Spielberger, Gorsuch, Luschene, Vagg, & Jacobs, 1971) which was used to assess their 'state' level of anxiety, which is the level of anxiety at that time, but also factored in the 'trait' level of anxiety, or their normal level of anxiety. This questionnaire included 20 questions for which participants had to choose one of four options to best describe their personal experience in relation to each provided statement. The possible responses consist of: not at all, somewhat, moderately so, and very much so. Participants then completed the Geriatric Depression Scale-Short Form (GDS-SF) (Ferraro & Chelminski, 1996) which consisted of 15 yes or no questions pertaining to their life and their mood over the past week. The purpose of the STI and the GDS-SF was to insure that the mood of participants at the beginning of the experiment did not differ between groups.

Participants also completed the Depression Adjective Check List (DACL) forms A and B (Lubin, 1965). A list of 32 adjectives is presented to the participants and they are instructed to checkmark all of the adjectives that describe they way they are feel at that time. A point is given each time a negative adjective is chosen and each time a positive adjective is not chosen. Participants completed the DACL-A immediately after the mood induction occurred, prior to the lexical decision experiment and the DACL-B immediately following the lexical decision experiment. The DACL-A scores represented the induced mood of the participants and the DACL-B scores insure that participants remained in the induced mood for the duration of the lexical decision experiment.

Mood Induction

Mood induction was performed using the same methods as utilized in previous research (Halberstadt, et al., 1995; Niedenthal & Setterlund, 1994; and Olafson & Ferraro, 2001). Participants in the happy mood condition listened to Mozart's "Eine Kleine Nacht Musik," "Divertimento No. 136," and "Ein Musikalischer Spass," and Vivaldi's "Concerto

for Two Mandolins and Strings" (in G Major) for 8 minutes. Participants in the sad mood condition listened to Mahler's "Adagietto" (from Symphony No. 5 in C# Minor) and Barber's "Adagio for Strings" for 8 minutes.

Lexical Decision Task

The lexical decision task took place on an IBM Personal Computer with a 17" IBM E74M monitor. The task consisted of ten practice trials followed by 100 experimental trials consisting of 50 nonwords (scrambled or pseudohomophones) and 50 words (25 happy words and 25 sad words). The happy and sad word lists were taken from the Olafson and Ferraro (2001) study. The targets were white letters presented on black background. The single list of pseudohomophones was used in the happy/pseudohomophone and sad/pseudohomophone conditions and a single list of scrambled nonwords was used in the happy/scrambled and sad/scrambled conditions. A single list of words was used in all four conditions. For each participant, the items were randomized prior to presentation with no more than 3 consecutive word or 3 consecutive nonword trials occurring. Participants began the experiment by pressing the space bar on the computer keyboard. Each trial consisted of (1) a 250-msec. blank field, (2) a 250-msec. presentation of a fixation cross "+", (3) a second 250-msec. blank field, and (4) either a word or nonword was presented until the participant responded. Participants categorized the lexical status of each item by pressing the z key for word responses and the / key for nonword responses. This procedure continued for all 110 trials and the experiment took approximately ten minutes to complete.

Procedure

Procedures were the same for all participants in the four conditions. Upon arriving, the participants read and signed the informed consent form. They were then led into the testing room where they then completed the STI (Speilberger et al., 1971) and the GDS-SF (Ferraro & Chelminski, 1996). They were then left alone to listen to 8 minutes of music at a comfortable level. Participants were then given the DACL-A (Lubin, 1965) before being instructed on how to perform the lexical decision task. The participants then performed the lexical decision task. Upon completion of the lexical decision task, the DACL-B (Lubin, 1981) was administered followed by a debriefing. During the debriefing, participants in all four conditions listened to happy music. Participants were then given their bonus credit slip before leaving.

Results

Mean scores with standard deviations for the questionnaire measures are presented in Table 1. A one-way ANOVA performed on the GDSF-SF data across the four conditions did not reveal any significant differences (F 1,50 = 2.12, p = 0.11, MSe = 11). A one-way ANOVA performed on the STI data across the four conditions also did not reveal any significant differences (F 1,50 = 0.35, p = 0.79, MSe = 16). These tests revealed no significant difference between the happy and sad mood groups upon entering the lab for the experiment.

To determine the effectiveness of the mood induction, a 2 (Mood: Happy vs.

Table 1. *Means Scores and Standard Deviations for Questionnaires*

Condition	GDS-SF M (SD)	S.-T. Inventory M (SD)	DACL-A Mean (SD)	DACL-B Mean (SD)
Happy / Scram.	1.54 (1.76)	31.77 (4.78)	3.38 (2.18)	3.0 (3.03)
Happy / Pseudo.	1.5 (1.46)	33.25 (5.91)	4.0 (3.62)	3.58 (3.73)
Sad / Scram.	1.29 (1.9)	31.5 (6.0)	12.71 (3.41)	10.86 (6.75)
Sad / Pseudo.	3.29 (3.52)	33.43 (9.35)	14.29 (5.12)	12.86 (7.04)

Sad) X 2 (DACL: First vs. Second) analysis of variance revealed a main effect for Mood (F 1, 51 = 65.9, $p < .001$, MSe = 2235) which indicates that the two DACL means for the happy mood group (M = 3.68 and M = 3.28) differed from the two DACL mean of the sad group (M = 13.5 and M = 11.86). There was no main effect for DACL (F 1, 51= 2.75, ns, MSe = 27) which indicates that the mood induction lasted the duration of the lexical decision task. The interaction between Mood and DACL was also non significant (F 1, 51 = 1.02, ns, MSe = 10).

Mean reaction times and percentage correct for words in each of the conditions are presented in Table 2. A 2 (Mood: Happy vs. Sad) X 2 (Item: Happy vs. Sad) X 2 (Nonword Context: Scrambled vs. Pseudohomophone) analysis of variance on reaction time revealed a significant main effect for Nonword Context (F 1, 50 = 17.76, $p < .001$, MSe = 194861) which indicated that words presented in the context of scrambled nonwords were responded to more quickly than words presented in the context of pseudohomophones. The main effect of Mood was not significant (F 1, 50 = 3.319, ns, MSe = 36406). The main effect of Item was significant (F 1, 50 = 5.95, p = .02, MSe = 4215) which indicated that happy words were responded to more quickly than sad words. Neither of the remaining interactions in the analysis was significant (all $p > .2$).

Table 2. *Mean (and Standard Deviation) Reaction Times (in Milliseconds) and Percent Correct as a Function of Condition and Word Type*

Condition	Word Type	RT	% Correct
Happy / Scram.	Happy	509 (65)	93 (4.7)
	Sad	527 (74)	96 (4.5)
Happy / Pseudo.	Happy	569 (66)	95 (4.6)
	Sad	581 (74)	95 (3.3)
Sad / Scram.	Happy	520 (55)	95 (4.2)
	Sad	533 (57)	95 (6.2)
Sad / Pseudo.	Happy	637 (84)	96 (4.4)
	Sad	643 (112)	96 (4.3)

A 2 (Mood: Happy vs. Sad) X 2 (Item: Happy vs. Sad) X 2 (Nonword Context: Scrambled vs. Pseudohomophone) analysis of variance on accuracy did not reveal any significant effects (all $p > .2$)

A further analysis was performed to determine if mood congruent items were responded to more quickly or more accurately than mood incongruent items. Mean reaction times for congruent versus incongruent items and Cohen's d (i.e. effect size) in each condition are presented in Table 3 (Cohen, 1969, 1988).

Table 3. *Means Reaction Time (and Standard Deviation) for Mood Congruent and Incongruent Words and Cohen's d for Each Condition*

Condition	Congruent M (SD)	Incongruent M (SD)	Cohen's d
Happy / Scram.	510 (65)	527 (74)	.24
Happy / Pseudo.	569 (66)	581 (74)	.17
Sad / Scram.	533 (57)	520 (55)	.23
Sad / Pseudo.	644 (113)	637 (84)	.07

A 2 (Congruence: Congruent vs.

Incongruent) X 2 (Nonword Context: Scrambled vs. Pseudohomophone) analysis of variance on reaction time revealed a significant main effect for Nonword Context (F 1, 52 = 18.22, $p < .001$, MSe = 212680). The remaining effects were not significant (all $p > .70$). All effect sizes are considered to be small (Cohen, 1969, 1988) and, in fact, two of the four mood congruent effects are in the wrong direction. A similar analysis of variance was conducted on item accuracy with no significant effects (all $p > .2$).

Discussion

The study presented in this manuscript investigated the inconsistent findings in the literature related to mood congruent effects in a lexical decision task. Previous studies have either failed to produce the mood congruent effect (Clark, Teasdale, Broadbent, & Martin, 1983), produced the mood congruent effect in only one of two mood induction conditions (Challis and Krane, 1988), or have successfully produced the mood congruent effect (Ferraro et al., 2003; Neidenthal and Setterlund, 1994; Olafson and Ferraro, 2001). These studies differed in the nonword context that was used. Studies that did not produce the mood congruent effect or produced the mood congruent effect in only one of two mood induction conditions used a scrambled nonword context. Whereas studies that produced a significant mood congruent effect in both mood induction conditions used a pseudohomophone nonword context. The purpose of this study was to determine if the different nonword contexts were the cause of these inconsistent findings. In the current study, the mood induction process was successful which is evident from the higher DACL scores that were obtained in the sad mood induction condition when compared to the happy mood induction condition. A significant nonword context effect and a significant item effect were produced. However, the current study failed to produce a mood congruent effect. The results of this study are similar to the results of Clark et al. (1983) where they failed to produce a mood congruent effect. This leaves us wondering why inconsistencies in the lexical decision literature exist. The current study used methodological procedures that were the same as those used by Olafson and Ferraro (2001) and Ferraro et al. (2003). Also, the number of participants in the current study (N = 53) was similar to the number of participants that took part in the study performed by Olafson and Ferro (2001) (N = 55) and Niedenthal and Setterlund (Experiment 1 N = 43, Experiment 2 N = 38).

Inconsistent findings in mood induction studies are not limited to lexical decision experiments. In fact, similar inconsistent findings have been found in memory task studies involving controlled processing of episodic information (see Isen, 1985 for a review), and the Stroop color-naming task (Gotlib & McCann, 1984). These studies produced asymmetric results where a mood congruent effect was found only in the happy mood condition.

The current study attempted to rule out nonword context as the cause for the inconsistent findings in the lexical decision literature. However, since the mood congruent effect was not produced, it leaves us still wondering why these inconsistent findings exist. Perhaps the inconsistencies are related to the mood induction procedure. In future research it may be necessary to investigate various methods of mood induction. Although listening to either happy or sad music was found to be an effective method of inducing mood, other methods may produce greater levels of happiness and sadness. Perhaps instructions, which are not reported in the methods sections of previous research, were provided to participants before listening to either the happy or sad music. If this is the case, these instructions may be necessary to produce the mood congruent effect.

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