

Music's Influence on Short-Term Emotional States and Perception of Faces

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Abstract— Music is believed to be able to elicit specific mood states. The current study examined the impact of different emotionally-toned musical pieces on participants' short-term mood states. In addition, the impact of differing musical forms on participants' perceptions of depictions of facial expression was also examined. Specifically, we sought to determine whether happy music would increase positive emotion while sad music was associated with more negative mood states. In addition, it was hypothesized that facial expressions would be rated happier with happy music, and conversely, sad music would result in sadder ratings. Participants were 52 male and female students from a midwestern U.S. university who were randomly assigned to listen to either happy or sad music. Prior to listening to the music, they completed the Multiple Affect Adjective Checklist-Revised (MAACL-R). While listening to approximately 9 ½ minutes of music, participants rated four facial expressions at predetermined intervals. The MAACL-R was then re-administered. Results indicated that sad music was associated with a significant reduction in positive moods. However, happier music was not associated with an increase in positive mood nor was sad music related to increases in negative mood. In addition, there were no significant effects of musical type on facial expression ratings. The current findings are discussed in the context of previous studies in this area.

Index Terms—Music and Psychology; Emotion; Music and Perception

I. INTRODUCTION

Music has been widely viewed as influencing human emotion. Musical scores for films are deliberately organized to be consistent with the emotional effects conveyed by the visual narrative. For example, music believed to escalate emotional tension and apprehensiveness is commonly employed for horror movies. Films with themes of loss and separation are often accompanied by music with a lower tonality and slower tempo. Despite the widely assumed impact of music on emotional functioning, this issue has not been investigated in detail. The purpose of this study is to explore

whether music can influence affective state as well as influence the perception of facial expressions. Specifically, this study examined whether happy music would increase positive moods, and sad music would increase negative moods, as well as decrease positive moods. In addition, the study examined how music influenced individuals' ratings of facial expressions, with happy music hypothesized to lead to happier ratings and sad music inducing sadder ratings. Emotional state was assessed immediately before and after participants heard a sad or happy musical selection. In addition, while listening to these musical selections, standardized pictures of faces were rated according to their level of perceived affect. These changes were assessed with self-report measures.

1.1 Music and Mood

Controlled studies evaluating the impact of music on mood have not always yielded consistent findings. Zentner and Scherer [1] distributed surveys to groups of concert goers and asked them to rate a song, or part of the concert that had either a positive or negative impact on their mood. The investigators generated a nine factor model of emotions associated with listening to music. The positive emotions commonly reported often had a cognitive or attitudinal component with terms such as "feeling moved," "enchanted," "filled with wonder," or psychophysiological dimensions such as "relaxed." Positive emotions were the most commonly reported with negative emotional states such as "depressed," "angry," or "anxious," reported by only a small minority.

McCarty, Barrios-Choplin, Atkinson and Tomasino [2] investigated the impact of four specific musical genres (grunge rock, classical, New Age, and designer) on tension, mood, and mental clarity. The "designer" music was developed to elicit specific emotional reactions—typically states of well-being that included alert relaxation and creativity as well as reduced autonomic arousal. Participants rated their emotional state immediately before and after a listening to a 15 minute selection of one of these four musical types. There were distinct differences in emotional reaction to the music selections. Grunge rock was found to be associated with increased hostility, sadness, tension, and fatigue, and reductions in caring, relaxation, mental clarity, and vigor. While the effects of New Age and classical music were mixed, designer music was most effective in increasing positive feelings and decreasing negative feelings. Specifically, listening to designer music was associated with significant increases in caring, relaxation, mental clarity, and vigor; with

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significant decreases in hostility, fatigue, sadness, and tension. Among adults, classical music was associated with significant reductions in fatigue, sadness and tension in the adult group. However, these reactions were not found for adolescents exposed to classical music [2].

Juslin [3] conducted a study using the Experience Sampling Method (ESM) in which university students carried an electronic device that signaled multiple times per day. When signaled, participants were to log their activity and accompanying emotional states. Of interest, 37% of the over 2,000 episodes included music. Happiness-elation and nostalgia-longing were more common when music was present. In contrast, in non-musical settings, anger-irritation, boredom-indifference, and anxiety-fear, were more common. The investigators noted that overall, musical emotions involved a larger proportion of positive emotions than did nonmusical emotions.

1.2 Psychophysiological and Neurological Aspects of the Music-Emotion Relationship

A current debate in the mood-music relationship is whether music genuinely induces a mood state or whether the listener confuses their affective experience with the emotion the music is expressing [4]. Some investigators believe that electrophysiological and neurological patterns exhibited in the presence of a particular musical genre may address this question. Lundqvist et al. [5] had participants listen to happy or sad music while several physiological responses were monitored including heart rate, skin conductance, finger temperature, and facial muscles. In addition, participants provided ratings of their mood. The pattern of findings suggested that there were consistent patterns of physiological responses associated with musical genre that paralleled self-reports. When compared with sad music, happy music was associated with more zygomatic facial muscle activity, greater skin conductance, lower finger temperature, and greater self-reported happiness [5].

An earlier study by Krumhansl [6] examined the effects of three types of classical music (happy, sad and fearful) on multiple physiological measures as well as ratings of mood. There was a fairly distinct physiological pattern associated with each musical type. Sad music was associated with a larger difference in the heart's interbeat interval (slower heart rate), systolic and diastolic blood pressure, skin conductance, and finger temperature. By comparison, the music chosen to represent fear was associated with changes in pulse transmission time, pulse amplitude, respiration rate and finger temperature. The happy musical selection produced an increase in rate and depth of respiration [6].

Several studies have examined neurological correlates of specific musical genres. Using transcranial magnetic stimulation, Baumgartner, Willi and Jancke [7] found that motor evoked potentials of similar magnitude were associated with music designed to evoke fear, sadness and happiness. However, these effects were greater when the music was accompanied by a mood-congruent picture. Of interest, these neurally mediated responses were less pronounced when either the picture alone or the music alone was presented as

compared with the combination of both [7].

MRI images of the brain suggest that music elicits significant neural activity typically associated with strong emotional reactions. These emotional responses occur in the regions of the brain associated with arousal, emotion, and reward/motivation. Research conducted in the past decade on neural activation has found that music is associated with a range of brain regions including the anterior fusiform gyrus, the medial temporal gyrus as well as the insula and the amygdala [8]. Functional MRI findings indicated that there were distinct patterns of activation associated with happy and sad music. Happy music elicited activation in the left ventral and dorsal striatum while sad music was associated with right sided activation in the hippocampus and amygdala [9].

1.3 Self-report Approach to the Music-Emotion Relationship

Consequently, the results that were obtained by researchers utilizing physiological and neurological methods led to further examination of the phenomenon utilizing self-report methods.

In a study by Lundqvist et al. [5] participants first listened to four musical excerpts of either a happy or sad nature. After each musical passage was played participants' rated their emotions utilizing a Differential Emotions Scale (DES). Results revealed significant main effects on the emotional ratings. Sad music resulted in sadder ratings and happy music led to happier ratings. McCraty, Barrios-Choplin, Atkinson and Tomasino [2] examined the effects of four different types of music (classical, grunge, new age, and designer) utilizing the Personal Feelings Survey (PFS). Participants completed the PFS twice, once prior to listening to the musical selections and once after listening to the selections. Significant findings were found for every musical genre. The adult group demonstrated significant reductions in sadness, tension and fatigue after listening to the classical selection. Grunge music affected the teenage group negatively. This genre resulted in significant decreases in mental clarity, energy, empathy, and relaxation and increased levels of hostility and tension.

1.4 Music, Mood and Visual Stimuli

As suggested above, the combination of a picture which reflects a mood state similar to a musical piece appears to have a greater central nervous system impact than either the picture or music, alone [8]. Listening to emotionally evocative music appears to influence appraisal of visual stimuli. Bouhuys, Bloem, and Groothuis [10] found that when participants listened to either happy or depressing music, it influenced their appraisal of faces. One substantial finding was that more sadness and rejection was associated with the neutral faces after experiencing the depressing musical stimuli. Among a subgroup of participants who reported a substantial increase in depressed mood after listening to sad music, there was a pronounced negative bias effect in the appraisal of faces. Specifically, neutral faces were more likely to be evaluated as sad and rejecting while those faces expressing more distinct negative or positive affect were more likely to be seen as fearful and less likely to be viewed as happy. Gender differences were present with women reporting more negative

emotions in response to neutral facial expressions than men [10].

Logeswaran and Bhattacharya [11] studied the relationship between music and facial appraisal with a more complex design. Researchers played 60 happy and 60 sad musical excerpts for 15 seconds followed by the presentation of 40 photos of faces-- each demonstrating happy, sad or neutral expressions. Participants were evenly split into 6 conditions (2 musical emotions x 3 facial emotions). First, participants were exposed to either 15 seconds of happy or sad music. Next the facial expression stimuli were presented for one second. Finally, the facial expression stimuli were rated using a 7-point scale after both stimuli had been presented. It was found that sad faces, when paired with sad music, were rated as sadder than when paired with happy music. Happy, as compared with sad, music demonstrated a greater impact on ratings of neutral faces.

1.5 Current Study

As noted above, the relationship between mood, music and appraisal has not been studied in great depth and findings have, in some instances, been inconsistent. This has also been the case when utilizing self-report methods. The purpose of the current study is to further examine the effects of music on both moods, as well as on perceptions of facial expressions utilizing strictly self-report measures. This study attempted to demonstrate that happy music would increase positive mood, and sad music would increase negative moods, as well as decrease positive moods. In addition, music would influence how individuals rated facial expressions. Emotional state was assessed immediately before and after participants heard the sad or happy musical selection. In addition, while listening to these musical selections, standardized pictures of faces were rated according to their level of perceived affect.

II. METHOD

2.1 Participants

Participants for this study were 52 undergraduate students (15 males and 37 females), recruited voluntarily from various psychology classes and one art class at small public university in the midwestern United States. Each participant was randomly assigned to one of two conditions ($n = 26$). The happy music group was comprised of 19 females and 7 males. The sad music group consisted of 18 females and 8 males.

2.2 Stimuli

Two laptop computers were utilized to play the musical selections used in this study.

Four musical excerpts were used for each musical selection (happy and sad). The musical selections for the happy group were comprised of Mozart Concerto 5 in A, K. 219 -1. Allegro Aperto, Beethoven Symphony 6 in F Major, Op. 68 "Pastoral", Copelia Act 1, and Dancing Limes. The initial three excerpts were selected based upon their use in other studies [8,10,12]. The musical selections for the sad group consisted of Swan of Tuonela, Theme from Schindler's List, Adagio for Strings, and

Leaving Hope [8,10,12]. The final song in each selection was a contemporary excerpt similar in tone and genre to each type of music based upon personal choice.

2.3 Scales

The Multiple Affect Adjective Checklist-Revised (MAACL-R) was completed twice by each participant to measure changes in mood. This MAACL-R consists of 132 adjectives describing moods and feelings. Participants indicated their responses directly on the multiple choice style form by marking all descriptors that applied to them. The MAACL-R scales that were utilized for this study, were the overall scores for positive affect and sensation seeking (PASS) and anxiety, depression and hostility (Dys); internal reliabilities for these scales are .89 and .93 respectively.

The facial stimuli consisted of color photographs of three men and one woman with four facial expressions; one sad, two neutral, and one happy) from the CMU PIE Database [13]. A seven point Likert scale was used to rate the facial stimuli. The adjectives used to rate these facial expressions were; 1 - very sad, 2 - somewhat sad, 3 - sad, 4 - neutral, 5 - happy, 6 - somewhat happy, 7 - very happy. Participants indicated their selected by circling only one of these items.

2.4 Procedure

The participants were randomly assigned to either the happy or sad musical group. Testing occurred in groups whenever applicable. In the instance that both of the groups were tested simultaneously, they were taken to separate, empty classrooms. The laptop computer playing the music was placed on the desk at the front of the classroom with the screen facing the researcher for timing purposes

The MAACL-R was administered before the musical selections were played. Participants were instructed to "Listen to the music quietly and without disturbing anyone around you. Please remove your picture packet at this time and open to the first image." The same set of instructions was used for each picture. The facial stimuli in the picture packets were rated at pre-selected time intervals, which occurred approximately every two and a half minutes. Participants were instructed to rate their pictures by circling only one descriptor from the list. Immediately upon the conclusion of the music, participants were asked to fill out the MAACL-R once more.

III. RESULTS

The first analysis focused on the effect of the type of music (happy, sad) on participants' pre and post mood happy (PASS) mood scores as indicated by the MAACL-R using a 2 x 2 (Music [happy, sad] x Time [pre, post] analysis of variance (ANOVA). This ANOVA yielded significant results for time $F(1,50) = 4.33, p < .05$. Post hoc analysis using a paired samples *t*-test indicated that the significant difference occurred in the sad music group from pre test ($M = 13.54, SD = 7.45$) to post test ($M = 10.00, SD = 5.56$) $t(25) = 3.18, p = .004$.

Table 1 Mean Ratings and Standard Deviations for MAACL-R scores before and after Happy and Sad Music

Music Type	PRE PASS	POST PASS	PRE DYS	POST DYS
HAPPY	11.12 (6.67)	10.73 (9.21)	1.19 (1.79)	0.58 (0.95)
SAD	13.54 (7.45)	10.00 (5.56)	1.54 (2.20)	1.73 (2.01)

PASS=MAACL POSITIVE AFFECT AND SENSATION SEEKING
 DYS=MAACL ANXIETY, DEPRESSION, AND HOSTILITY

The sad mood scores (Dys) were analyzed using a 2 x 2 (Music [happy, sad] x Time [pre, post] ANOVA. This ANOVA did not reveal any significant results and there was no interaction. The sad music treatment did increase Dys scores slightly, while happy music decreased them slightly. Table 1 illustrates the changes in participants' mood scores for both happy and sad musical groups for both PASS and Dys scores.

The final analysis focused on the mean rating of facial expressions (sad, neutral 1, neutral 2 and happy) after listening to either happy or sad musical excerpts. Using a 2 x 4 (Music [happy, sad] x Facial expressions [sad, neutral 1, neutral 2, and happy] analysis of variance (ANOVA). The results approached, but did not reach statistical significance for music type, *p* =.084. There was no interaction. Participants in the happy music group rated all facial expressions happier when compared to the sad musical group except for the actual happy facial expression. Participants in the sad group rated the happy facial expression as higher (happier) than the happy group. Table 2 presents participants' ratings of facial expressions during the musical intervention.

Table 2 Mean Ratings and Standard Deviations for Facial Expression

Music Type	Sad	Neutral 1	Neutral 2	Happy
Happy	3.08 (1.02)	4.04 (.72)	4.04 (.60)	6.00 (.89)
Sad	2.58 (.86)	3.73 (.96)	3.77 (.98)	6.15 (.78)

IV. DISCUSSION

In the current study, the effect of emotionally themed music on participants' mood was somewhat limited. The only significant effect was for sad music which reduced positive mood. However, happy music did not significantly increase positive mood nor did sad music significantly increase negative mood. Music did not significantly influence participants' ratings of facial emotional expressions.

It is noted that this is a relatively new area for rigorous investigation and methods are somewhat variable. Compared with the visual stimuli used in other reported studies, our pictures were relatively subdued. In finding an additive effect

for emotionally-themed music and pictures, Baumgartner and colleagues [8] employed a large number of distinctly emotionally evocative pictures. For example, the fear inducing pictures included a man pointing a gun at the viewer while sad scenes featured "...a crying little boy standing in front of a destroyed house" and "... a couple standing at a gravestone" [8; p. 35]. By contrast, our pictures were head shots of men and one woman exhibiting various facial expressions. These photos may not have been "strong" enough stimuli to evoke significant affect. There were also suggestions that there are additional factors influencing the mood-music association. For many people, specific musical pieces are associated with personally significant emotionally-laden memories. Experimenter selected music may not have the same level of emotional impact as these personally significant musical works. There are suggestions that participant selected music may be more effective in inducing specific emotional states than standardized selections chosen by the investigator [13]. Participant-selected music is likely to trigger personally meaningful autobiographical memories. Vuskoski and Eerole [4] found that 47% of participants who self-selected sad music reported experiencing personally significant sad memories associated with the music.

Specific personality characteristics, such as capacity for empathy or fantasy may also influence the impact of music on mood. In their study comparing self-selected with experimenter selected sad music, Vuskoski & Eerole [4] found that experimenter chosen sad pieces induced sadness only in participants who were high in trait empathy. However, experimenter selected music induced sadness regardless of levels of trait empathy. There is also evidence that individuals who are fantasy prone and demonstrate the ability to identify with the emotions of fictitious characters react with greater sadness to sad music [4,14].

A possible limitation of the current study may have been the abbreviated amount of time that participants listened to the musical selections. In their study on the effects of music on mood, McCraty and colleagues [2] played 15 minutes of each musical selection whereas the current study utilized just 9 ½ minutes of music. Furthermore, the length of the MAACL-R may have been too extensive for the condensed testing period, perhaps leading to ambiguous results. Previous studies [2, 5] employed self-report surveys that contained significantly fewer emotional descriptors and which were administered for longer time periods..

Finally, most studies to date have used instrumental musical selections—typically, classical pieces. However, when participants were able to self-select sad music as in Vukoski and Eerole's [4] study, nearly all participants chose pieces with lyrics. Because of their personal significance, lyrics are likely to intensify music's impact.

In sum, the research interest on music and mood is increasing. At present, there is fairly good evidence that sad music can induce sad mood and is accompanied by transient physiology reactions consistent with self-reported emotion. However, the ability of music to influence mood appears to be influenced by

the personality of the listener and whether the music elicits meaningful autobiographical memories.

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