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Affective response to a set of new musical stimuli[1]

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Summary.—Recently, a novel set of musical stimuli was developed in an attempt to bring more rigor to a paradigm which often falls under scientific scrutiny. Although these musical clips were validated in terms of recognition for emotion, valence, and arousal, the clips were not specifically tested for their ability to elicit certain affective responses. The present study examined self-reported "elation" among 82 participants after listening to one of two types of the musical clips; 47 listened to happy music and 35 listened to sad music. Individuals who listened to happy music reported significantly higher "elation" than individuals who listened to the sad music. These results support the idea that music can elicit certain affective state responses.

Infants as young as 6 months of age have shown the ability to distinguish happy music from sad music (Flom, Gentile, & Pick, 2008), as well as develop a preference for consonant over dissonant music (Zentner & Kagan, 1998). Rhythm and melody are used in every human culture, and music has been considered to be addicting much like other pleasures such as prescription drugs and sex (Huron, 2001). Several researchers agree that humans are inclined to musical behavior (e.g., Miller, 2000; Wallin, Merker, & Brown, 2000; Mithen, 2006). The premise of this research is that the prevalence of music in all cultures must have a psychological basis.

Research on the psychology of music has been the subject of several criticisms as well. Specifically, claims that listening to music can alter mood states have been undermined by three possible problems: (1) the cognitivist view that music merely *expresses*, but does not induce, mood; (2) lack of evidence or explanation for *how* music elicits emotional reactions; and (3) the use of subjective methodologies (self-report) to measure the supposed induced mood.

The first problem may be a problem of misattribution (e.g., Meyer, 1956; Kivy, 1989); the cognitivist view proposes that participants misattribute the recognized emotional expression of the music for their own feelings. This problem is often addressed methodologically by specifying to participants that they should report how they feel and not how the music sounds. Scherer and Zentner (2001) observed a difference in self-reported affect when the participants were told to report how they felt as opposed to how the music sounded.

The second problem suggests that up to six cognitive processes (e.g., episodic memory, visual imagery, expectation) may occur during the act of listening to music, any combination of which could induce feelings of emotion in individuals. Juslin and Västfjäll (2008) proposed that

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these processes are not exclusive to music, and therefore emotional reactions to music may possibly be related to ordinary emotional reactions to the extent they employ the same processes.

The focus of the present research is the third problem facing research on music and emotions, which has to do with the gathering of affect data via self-report. This method is the norm for typical research on affect, and as such has often been applied to music-based emotion research. Problems with self-report methodology (e.g., the possibility of demand characteristics) must be suspected in any such research including music and affect, although Kenealy (1988) found that experimentally manipulated demand characteristics had no effect on participants' self-reported moods in music-based research.

Various researchers have conducted isolated studies related to music that may not be generalizable or even comparable to each other. This difficulty in comparison between studies has primarily been due to variations in methods and in stimuli, both of which can have severe implications on theory development and verification. To address this lack of consistent methodology and provide a set of standard stimuli, Vieillard, Peretz, Gosselin, and Khalfa (2008) developed 56 musical clips to be used in music-based emotion research. These 56 clips were composed of four groups of 14 clips, with each group being a different intended emotion. Vieillard, et al. developed clips intended to sound "happy," "sad," "peaceful," and "scary." The items were both categorical (e.g., Ekman, 1982) and dimensional (e.g., Russell, 1980), e.g., they can be treated as bipolar elements on an affective dimension. Thus, although "peaceful" is generally not considered a basic emotion, it was added by Vieillard, *et al*. to provide the dimensional opposite of the "scary" music clips. Similarly (but here conforming to two basic emotions), the "happy" and "sad" music clips were created as dimensional opposites.

The Vieillard, et al. (2008) musical clips were digitally constructed in piano timbre on computer software. Construction of the musical clips was based on the rules of the Western tonal system. The "happy" clips were in a major mode with fast tempo; "sad" clips were in a minor mode with slow tempo; "scary" clips were in a minor mode with intermediate tempo; and "peaceful" clips were in a major mode with slow tempo. Also, although most of the "scary" clips were composed for regular rhythm and consonance, a few were irregular and dissonant (similar to the piano music from older horror films). These descriptions are generalizations, of course. Readers who are musicians can refer to the appendixes of Vieillard, et al. (2008) for musical scores.

Vieillard, et al. (2008) tested participants' abilities to correctly recognize the intended emotion in the music. A detail important to the proposed study is that Vieillard, et al. also used two sets of instructions before their experiment: one set of instructions told participants to merely attempt to recognize the intended emotion, whereas another group was told to focus on their emotional experience while listening to the music. Participants more often correctly recognized the intended emotion when they were instructed to focus on their emotional experience. Although not the purpose of the study, Vieillard, et al. suggested that this is supportive of the notion that emotional recognition and emotional experience differ only in strength. Further, they suggested that the musical clips may have induced a congruent affective state in some of the participants. Evaluating this claim is the topic of the present research.

For the present research, only the "happy" and "sad" musical clips were used (28 total clips). Since "happy" and "sad" are often considered basic emotions and are also often considered dimensional opposites, these two were judged most useful for evaluation. Using a between-groups design comparing "happy" and "sad" musical clips, the hypothesis of this study was that "happy" sounding musical clips would elicit higher scores on the Elated–Depressed

subscale of the Semantic Differential Feeling and Mood Scale than would "sad" sounding musical clips.

Method

Participants

Participants were 82 undergraduates enrolled in a regional university in the Southern United States. The mean age was 22.8 yr. (*SD* = 6.9) with a mix of ethnicities and sexes: 67% Caucasian, 23 (28%) African American, 3 (4%) Asian, 1 (1%) Hispanic; 18 (22%) men, 64 (78%) women. Participants were recruited from introductory psychology courses and given extra credit in their course for participating in the study. Those who did not wish to participate were given an alternative option for extra credit.

Materials

Mood scale. The Semantic Differential Feeling and Mood Scale (SDFMS; Lorr & Wunderlich, 1988) was used in this study. The SDFMS is a measure of feeling and mood states along five bipolar dimensions (see below). Past research has suggested that affective states, including emotions, moods, attitudes, etc. (Scherer, 2000), are bipolar in nature (Russell, 1979).

The SDFMS consists of 35 items, each rated on a 5-point scale labeled 1: Quite, 2: Slightly, 3: Neutral, 4: Slightly, and 5: Quite; to the left of each item's rating scale was one bipolar adjective (e.g., Dejected) and to the right of the boxes was the dimensionally opposite adjective (e.g., Cheerful). Participants were given specific instructions to place a check in the box indicative of how they *feel right now.* The scale can be subdivided into five different bipolar dimensions of general affect or feeling with the subscales having adjective-based labels and also a letter assigned to them. This allows scoring as a Total questionnaire or by subscales which can be analyzed separately. The subscales have general adjective-based labels and also a letter assigned to them. The first subscale is defined by the dimension *Elated—Depressed* (hereafter called the Elation scale), with higher scores indicating higher general cheerfulness. The remaining subscales and their names are as follows: Relaxed–Anxious (Relaxed), with higher scores denoting greater relaxation; Confident–Unsure (Unsure), with higher scores signifying higher uncertainty; Energetic–Fatigued (Fatigue), with higher scores denoting higher fatigue; Good Natured–Grouchy (Grouchy), with higher scores indicating more grouchiness or hostility.

Scherer and Zentner (2001) argue that the common adjective-based measures used in most research may not be appropriate for research on musical emotions. Thus, for the present study a different approach (i.e., the SDFMS) was taken regarding the listeners' general affective experiences. There is some debate as to whether the emotional experiences of music mirror normal emotions (see Peretz, 2001; Scherer & Zentner, 2001). Although the SDFMS is an adjective-based measure, it was not designed to measure emotional states specifically, so it can be used to gain additional knowledge on affective responses in general (i.e., outside the traditional boundaries of "basic" emotions).

Musical stimuli. The "happy" and "sad" musical clips developed by Vieillard, et al. (2008) were used in this experiment. In the remainder of this paper, Vieillard, et al.'s "happy"

musical clips are referred to collectively as happy music and the "sad" musical clips as sad music. Clips were downloaded from the Peretz Lab website at the University of Montreal[2]. Although free for academic use, permission to use the clips was first obtained from an author of the publication (i.e., Vieillard, et al., 2008). Each set of clips, when played through once, was approximately 150 sec. long. Thus in the between-groups design, during the 5-min. listening session, participants would twice hear one complete set of either the happy clips or sad clips.

Procedures

The experiment was implemented in introductory psychology classrooms of approximately 40 students. Prior to the study, permission from professors was obtained to perform the experiment on two separate classes. The classes were randomly assigned to the different music groups—a Happy music group (n = 47; 10 men, 37 women) and Sad music group (n = 35; 8 men, 27 women)—using the flip of a coin. Because the participants were obtained via convenience sampling, there were unequal numbers of men and women in both conditions, a limitation of the study. The two classes were tested on the same day in the same classroom. One class was tested prior to the other but both were tested in the morning. Prior to the beginning of class, the musical clips were loaded onto the playlist of Windows Media Player and set to "loop" (i.e., continuously play without stopping). For each class, participants listened to the music clips in a group via the classroom's external audio system; one class listened to happy music and one class listened to sad music.

When all students had arrived for class, the general nature of the experiment was explained, participants were given informed consent sheets, and any questions were answered. Participants who wished to discontinue their participation or had chosen to not participate were given alternate opportunities for extra credit at the end of class.

Participants' demographic information (ethnicity, age, sex, and year in school) was requested. For each class, the researcher then began playing either the happy or sad musical clips. The musical clips were allowed to play for a total of 5 min., during which participants were instructed to sit and listen to the music. After 5 min. of listening, while music continued to play, participants were given copies of the Semantic Differential Feeling and Mood Scale (Lorr & Wunderlich, 1988) and were asked to answer the questions pertaining to how they *feel right now* and not how the music *sounded.* The musical clips continued to play as they completed the SDFMS (approximately another 15 min.). Volume was held constant for participants in both classes.

Following the completion of the Semantic Differential Feeling and Mood Scale, participants were debriefed as to the purpose of the study. Questions were answered pertaining to the hypothesis and contact information was provided if the participants wished to follow up on the results of the study. Although not controlled for, intergroup discussion about the experiment was unlikely; only the class professors but not potential participants knew of the experiment before the beginning of class.

Analysis

The data were first analyzed using a one-way between-subjects multivariate analysis of variance (MANOVA) to examine possible sex differences on the SDFMS. An additional one-

[2] http://www.brams.umontreal.ca/plab/publications/article/96#downloads

way between-subjects MANOVA was used to analyze possible group differences between Happy and Sad music groups on the SDFMS. Further univariate analyses were used to test for group differences on specific SDFMS subscales; however, because there were no significant sex differences (see Results), sex was excluded from any further analysis.

Results and Discussion

Results of the one-way MANOVA for Sex were not significant (Wilks' $\lambda = 0.87$, $F5,76 = 2.26$, $p = .06$; partial $\eta2 = .13$), suggesting that overall, men and women did not differ significantly in their self-reported affect. Lack of sex differences in this study justified excluding sex from further analyses. Results of the one-way MANOVA for Music Group were statistically significant (Wilks' $\lambda = 0.73$, $F5,76 = 5.55$, $p < .001$; partial $\eta2 = .27$), warranting further testing of the omnibus effect of music group on the SDFMS. To this end, univariate ANOVAs were used to examine the effect of music group on each SDFMS subscale. Statistically significant differences were found between Happy and Sad music groups for Elation ($F1,80 = 21.06$, $p < .001$; partial $\eta2 = .21$), and for Unsure ($F1,80 = 6.64$, $p = .01$; partial $\eta2 = .08$). No other significant differences were found (see Table 1).

Table 1

ANOVA results and descriptive statistics for music group and SDFMS subcategory

SDFMS Subcategory	Music Group	*M*	*SD*	*F*	*p*	partial η^2
Elation				21.1	.001	.21
	Happy music	3.8	0.7			
	Sad music	3.0	0.8			
Relaxed				0.5	.479	.01
	Happy music	2.7	0.7			
	Sad music	2.8	0.6			
Unsure				6.6	.012	.08
	Happy music	2.7	0.9			
	Sad music	3.2	0.8			
Fatigue				2.1	.153	.03
	Happy music	3.4	0.8			
	Sad music	3.2	0.7			
Grouchy				3.1	.081	.04
	Happy music	2.4	0.7			
	Sad music	2.7	0.8			

The present research assessed the changes in affect associated with listening to the new musical stimuli developed by Vieillard, et al. (2008), at the same time striving to minimize general concerns common within music and emotion research regarding possible misattributions of affective states and other self-report biases. The results of the present study documented a difference in self-report state affect between individuals listening to happy versus sad music. Confidence in the statement that these musical clips elicit some type of affective response certainly depends in part on one's confidence in the present method of measuring state affect. The participants were instructed to distinguish between how the music sounded and how they felt. In further research, the extent to which individuals can differentiate their feelings from their cognitive responses to the music could be explored. The results extend the possible uses of the Vieillard, et al. (2008) musical clips and lend some support to the notion that listening to music

can elicit affective responses in individuals. Although this phenomenon has been regularly noted by the general public, it has much less frequently been subject to scientific scrutiny. It is hoped that the development of the Vieillard, et al. musical clips, along with an added rigor in the field of music-based psychological research, will help further this particular line of investigation.

Further research should utilize the other two musical types developed by Vieillard, et al. (2008): "peaceful" sounding music and "scary" sounding music. Other measures of affective responses could be tested and used as validity checks, perhaps also to control for trait emotional tendencies. Scherer and Zentner (2001) suggested that several varying measures of emotion should be used in emotion research, especially when dealing with music. This could perhaps help in the identification of the variables which seem to make the affective response to music such a unique experience.

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