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Research Article

A Method of Personal Music Psychological Recognition Based on Psychological and Physiological Signals

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We can hear sweet and touching music in our daily life. We like listening to music because music can affect our emotions. Dynamic music makes us very excited. When we are sad, hearing beautiful music can make us happy. In physiology, music affects many physiological processes. It can inhibit fatigue and affect pulse, respiratory rate, and blood pressure level. "Listening music helps improve mood." Although the pursuit of personal happiness is likely to be considered a self-centered adventure, research shows that happiness is positively correlated with socially beneficial behavior, better health, higher income, and better interpersonal relationships. Another reason why we like music and music can be used very effectively for various therapeutic goals is that music is used in many ways in our society. When a group of people come together to sing a chorus or engage in musical activities, concerts establish new ties between people and make them closer. People grow up listening to lullabies from birth. When they die, they end their lives with funeral music (songs). It may be said that one's life begins with music and ends with music. Through music, we sing about social phenomena, express ourselves, and communicate with others. The themes and hidden contents that the music production society is unwilling to express publicly are not limited by any judgment. It should be noted that the functions of the above music are flexibly applied according to personal conditions, rather than being classified and limited by functions.

1. Introduction

Music is a wonderful sound composed of tone, timbre, and rhythm, which gives people unique aesthetic experience [1]. Therefore, if we need to know more about these experiences, we need more empirical research from outside the laboratory. At present, exploratory research has measured the aesthetic experience (emotion and absorption caused by music) of 95 participants, as well as the research on the response of fast-paced and slow-paced music to people's physiology [2]. These participants played romantic, classical, rock, and modern music in four concerts. One of the musical movements of modern works is deduced from the recording. So, the first result emphasizes the influence of two key parts of the framework on aesthetic emotion: (1) unfamiliar contemporary works lead to higher negative emotion, which is caused by the rising and falling trajectory of emotion by the programming sequence. Nevertheless, this experience is printed into a highly praised concert as a whole. (2) Compared with the low participation of live recorded music, the vitality factor becomes obvious. Secondly, the participants' reactions made them observe how more musical works were perceived [3]. The opening and closing movements caused more positive responses, compared the characteristics of the internal parts, and caused lower arousal and complex emotions. However, will the speed of music rhythm affect people's emotional and physiological indicators? Edworthy and Waring found in previous studies and their own that fast-paced music can cause positive performance of participants better than slow-paced music. In the study by Brownley McMurray and Hackney, fast-paced music can improve the physiological response of participants better than slow music [4]. And, some scholars (Nethery, Harmer, Taaffe, etc.) have discussed the impact of inserting music during sports on athletes and how different music affects them, which has also produced many different

arguments and opinions, so 26 athletes were invited to do experiments. The results showed that the heart rate of athletes with music was higher, and the exercise time with music insertion was longer than that without music insertion. Therefore, they believe that music can affect athletes' psychological and physiological reactions during sports because music can stimulate athletes' blood flow [5].

1.1. Aesthetic Experience of Live Concert. Although there are still emotional frameworks and aesthetic experience in music at present, there are still problems of ecological effectiveness in listening and stimulation. Up to now, research is usually carried out in a highly controlled laboratory environment, using relatively short music works or single movements and short films. Classical laboratories usually neither include works of whole or multiple movements nor do they choose the so-called key influence of the framework of auditory generation. Although in theory, the background and scene are considered to be the combination of artistic visual aesthetic experience. The main purpose of this study is to explore the aesthetic experience of listening music in the current real environment, that is, performing music live in the concert hall, including the string quintet of contemporary composers Brett Dean, Ludwig van Beethoven, and Brahms. These writers are very representative in contemporary times. For example, Ludwig van Beethoven's concert has been widely spread until now, and they are very famous pianists. This study takes their works as an experiment, which is very representative. In a fixed course, dedicated listening is the framework of the concert. We chose a term introduced by a sociologist Irving Goffman, namely, framework Goffman [6] in order to understand the relationship between music-related behavior and situational factors. According to Goffman, these frameworks will also affect aesthetic experience and appreciation, and the impact of the contemporary realistic environment, situation, framework, or background is also recognized by the institute. for example, cinemas [7], theatres (Cardizzi et al., 2020) [8], and so on. In fact, research shows that some concerts enhance the experience of music listening, and live music performance provides people stronger (positive) response [9]. Compared with the same performance, the live performance of the video in the Church can arouse the emotional input and feelings of the participants [10] and can be appreciated with more concentration. A series of works performed in the concert are presented in the expected order. Emotions fluctuate during the performance of different musical works [11]. During the performance of classical works, complex and positive emotional fluctuations rise, contemporary works decline, and romantic works rise again. Tension and excitement fluctuate greatly in contemporary works and are significantly higher than classical and romantic works [12]. It can be seen that the emotional range of the less familiar works is different from that of the other two familiar works. Classical concerts put it in famous classical works through different arrangement ideas, including new works, so as to increase people's love for it.

2. Measurement of Aesthetic Experience

In the measurement of aesthetic experience, we use the mixed test experimental model because the conclusions obtained from different model experiments are more comprehensive and illustrative. We select models from different latitudes and test the physiological and psychological data to get a high aesthetic experience. Aesthetic experience has many dimensions, but the most critical is the emotion and absorption induced by music. Other scholars' research data show that people can get more emotional experience beyond music itself from music through physiological response [11], for example, perception of beauty, pleasure, excitement, and so on. Studies have shown that people can witness faster heart rate and respiration when listening music, resulting in an increase in the frequency of skin conductive response—shivering [13]. The key of absorption in the aesthetic discourse of classical music has been discussed by music history literature. This is related to the perception of participants and is different from the "daily" psychological state [14]. The valuable measure of music aesthetic experience at the concert is the performance of absorption state and the difference between the feeling emotion we need and the feeling emotion [17]. In addition, the measurement of experienced emotions through continuous, nonintrusive methods is the use of cardiovascular, electromechanical, and skin conductive responses such as heart and respiratory rate and sweat gland secretion increases (measured by skin conductive response), which is activated by sympathetic nervous division of the autonomic nervous system to stimulate events and, from this reaction, to increase sensory participation. And, facial muscle activity is also known as a measure of behavior, and it can feed back the imitation of several discrete emotions and induce emotions to a certain extent [16]. The emotion of music is generated within the audience. Using the concept of latitude (valence arousal) or classification (such as sadness and happiness) emotion, studies have shown that "happy" music can evoke higher skin conductive induction amplitude than "sad," and thus faster heart rate and breathing. Through the combination of sound and lyrics, many different types of information can be conveyed [17]. For example, music can depict and create a self or group image, and music can also be used to exchange political information. Research shows that music can convey emotional information. And, the speed of the rhythm will affect people's vitality. Speeding up the rhythm will lead to a greater possibility of sympathetic arousal. Using the measurement of skin conductive response, in the following experiments, we compare slow-paced and fast-paced classical music with rock music excerpts and silence [5]. As expected, the frequency of skin conductance response (SCR) during music processing was higher than that during silence. Skin conductive response level (SCL) data show that fast-paced music can "enhance information or emotional content" more than slow-paced music. Using people's psychological response to music to improve sympathetic nerve and finding higher skin conductive response in fast-paced music, people can expect

various emotions induced by music, so as to get a better aesthetic experience.

2.1. Aesthetic Experience of Vision and Hearing. In the aesthetic experience of vision and hearing, we use the principle of the mixed test experimental model. By comparing live concerts with recorded concerts, we draw a conclusion in these experimental model assumptions that there is not much difference. At the same time, the research theory believes that the combination of visual and auditory information may be more easily aroused in music aesthetic experience [16, 17] and enhance the experience by enhancing the uniqueness and creativity in the current performance, We expect that live concerts will cause a stronger positive aesthetic experience than recorded concerts. According to the current research, compared with 256 movements, the participation of live performance will be greater, the degree of liking will be higher, and the attention will be more focused. This is due to the lack of a major factor, namely, vitality [20]. This is true even if you are watching the same performance of the same musician. However, compared with other studies, namely, visual recording [10] and live performance, recorded visual and live performance did not show other differences in self-report and physiological reactions. This leads to the assumption that the situation regulates the aesthetic experience and points out that the framework [6] is a key component of modeling the aesthetic experience. In other words, the emotional difference is related to the framework of the concert site, and it is not necessarily due to the recording. The aesthetic experience of vision and hearing cannot be judged because of whether it is also on the spot. According to experimental research, it is not on the spot that the aesthetic experience is better than that of recording screen. On the contrary, it is more important whether it can attract people's attention and be more energetic. The higher the degree of liking, the stronger the aesthetic experience of vision and hearing.

3. The Adjustment of Music to Emotion

Different music has different effects on emotion. Some studies have shown that, under various emotional conditions, the relaxation degree of self-report of participants who are silent and self-selected is the highest, while the relaxation degree of self-report of rock listeners is the lowest, and there is no obvious physiological difference between groups. Rickard combined self-report of enjoyment, familiarity, and emotional impact with psychophysiological tests to evaluate the effect of music on emotional regulation. Physiological and psychological measurements include shivering, muscle tone, skin temperature, and skin conductance. Although the plot of the film is a song with strong emotional power and strong emotional power of self-selection and although easy and exciting music does not have emotional power, it can regulate emotions. Rickard found that 95 people who attended the concert thought they were in a good mood, and their self-reported measurement scores would be higher, resulting in the largest increase in skin conductance and shivering [21]. However, no correlation was found between these effects and participants' music training or gender. Krumhansl [22] discussed how college students' emotions are stimulated by the peripheral nervous system of the brain. When listening, half of the participants made dynamic emotional judgments from their feelings of music and collected their physiological data from the other half of the participants. All participants' feelings in the work will be filled in a questionnaire for evaluation. From this, we can know that, in all music, no matter what discrete emotions you show, your respiratory rate and blood pressure will increase, and your heart rate will decrease. In addition, all extracts will lead to sympathetic nervous system measurements (i.e., finger temperature and skin conductivity). In Krumhansl's research data, discrete emotions also have a major impact. What can lead to greater sympathetic activation is the excerpt of happiness, followed by fear and sadness. The dynamic characteristic of this effect over time is a statistical analysis of the Pearson r value between the calculation time and the skin conductivity level. As we expected, given the deceleration nature of autonomic nerve activation during the experiment, the results showed that the negative correlation was greater with the development of music over time. Research on mood in testing mode (major or minor) and rhythm shows that increasing rhythm will affect mood more than mode. Kent [23] and Kellaris and Kent [24] asked the participants to listen to original works, marking these works as tonal (atonal, minor, and major), textural (popular and classical), and rhythmic. Participants reported their excitement and pleasure from these original works. The results showed that the greater self-report pleasure was the increase of rhythm from classical music, but in pop music, it was more able to mobilize participants' emotions, and the tone had nothing to do with the awakening of self-report. But there is no doubt that music can "transmit" emotions and regulate emotions [25]. However, there are still differences in the literature of music psychologists on how to better empirically and theoretically solve this problem 26–30. The first is that the cognitive calculus that prompts the need for recognition in the score is excluded by emotionalists, and this kind of musical emotional response is described as another emotion, which is different. The other is the cognitive approach, which describes the emotional response of music as the cognitive recognition of the clues of the music audience to the music itself. There are two ways to interpret music: social influence and cultural influence. However, there are still many differences in music's emotional expression and quotation [31].

4. The Influence of Music on Sports

Scholars have long pointed out that the insertion of music can improve the performance of athletes. If inserting music can improve the performance of athletes, the use of music in competition or training is very important. But there is still no way to clearly say the impact of music on people's psychology and physiology. However, there are traces of music use in many sports fields. Many studies have shown that music has an impact on sports performance and can

improve sports performance 32, 33. In terms of discussing whether music has an impact on people's exercise, Eliakim et al. conducted experiments on 26 athletes, inserted music in their warm-up stage, and tested the temperature and heart rate after the warm-up. The results showed that the group with music insertion has higher temperature and heart rate, and the peak value of anaerobic exercise is also higher than other groups with music insertion [34]. It was also found that those with music insertion lasted longer than those without music insertion. In sports, people often affect sports performance because of physiological and psychological factors inside the human body, such as pain and anxiety. Nethery [35] showed that the level of wakefulness measured during exercise in the inserted music group was lower than that in the distracted and undisturbed group. In Nethery's study, it was verified that the degree of arousal in the music group was lower than that in the nonmusic group and the video group. The fact proved that if the athletes had a small amount of attention, they could be stimulated by some attention diversion, such as music insertion, and the stimulation was received by the sensory receiver to form some short-term memories caused by music stimulation [36]. If the impact of this short-term memory was large enough, it can cover the working memory formed by pain or anxiety caused by exercise, so that the brain can preferentially check the stimulation given by music so as to forget the pain and anxiety caused by exercise. Therefore, music can effectively reduce the level of wakefulness and distract athletes to a large extent [32]. Figure 1 is a general model of the theory that music stimulates the brain. But in the future, we need to further understand the impact of music on sports, such as whether the same music has the same impact on male athletes and female athletes and whether male and female athletes are more sensitive to aesthetic music, which is worthy of our experimental research.

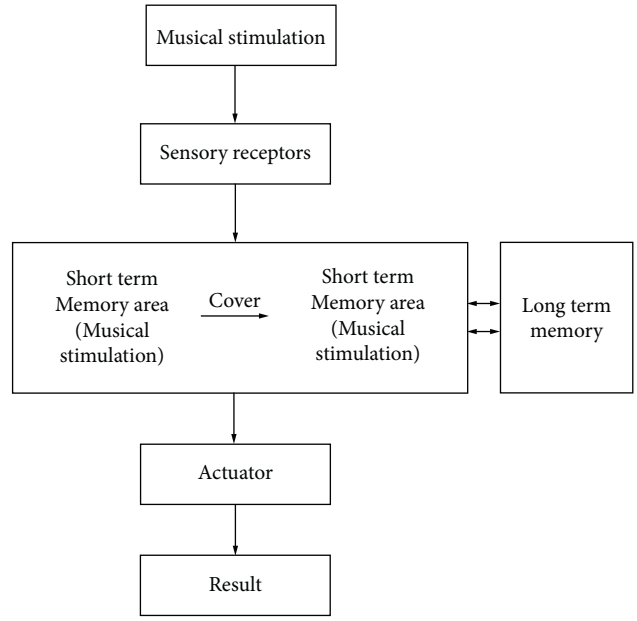

Figure 1: Theoretical model of how music stimulates the brain.

5. Experiment

Different music choices are selected among rock music, swing music, and classical music types, and the following assumptions are tested according to similar experimental designs [37]:

H1: in the selection process of different music, participants showed less deceleration in SCL when listening to fast-paced music than slow-paced music.

H2: there will be genre × rhythm interaction, which is activated on the sympathetic nervous system. Increasing rhythm will lead to greater SCR activity in classical music than rock and swing music types we are more familiar with.

5.1. Method. To better solve these assumptions, we designed and implemented a 2 (type) × 3 (rhythm) × 6 (presentation order) hybrid test experiment. The two main internal factors are music rhythm (fast rhythm and slow rhythm) and genre (rock, swing, and classical).

5.2. Experimental Process. In the experiment, six participants were randomly assigned, and the theme factor was the order of presentation. Twenty-seven graduate students agreed to participate in the experiment in exchange for graduate course credits. However, due to equipment failure, the skin conductance data of 7 students could not be used, and these 7 students also received the same credit reward. During the experiment, these participants heard the following six music clips, including slow classical, slow rock, fast classical, fast rock, and two silent clips. The slow-paced (75 BPM) classic clip features Pachelbel"s "Canon in D major." The slow tempo (74 BPM) swing clip features the Squirrel Nut Zippers' Mean to Be. The fast-paced (140 BPM) classical editing features the ending of Rossini's "William Tell Overture." The fast-paced (138 BPM) rock clips are taken from the cut's "She Sellers Sanity." In the video, these sounds divide the system into six unique sequences. After each auditory choice, the movie clips of pop music will follow closely, and the time will be maintained between 90 seconds and 115 seconds. These six movie clips are sorted by the system according to different types, so that there is not only any music choice next to each movie clip. As far as the current test is concerned, what is more relevant is that the research results are applied to the speed of music rhythm, which is consistent with the more subjective arousal level of interest during programming, rest, and programming sequence [38]. The SCR frequency data presented in these six movie clips is 2 (rhythm) × 3 (genre) repeated test MANOVA. Although the figures of these SCR frequencies are similar to those we predicted, the only surprising result is the main influence of genre (f (2, 40) = 6.947, P = 003, $\varepsilon 2$ = .2207). Regardless of the rhythm, classic genres can more arouse the activation of participants. In order to solve hypothesis 1, participants' SCL in fast-paced music was compared with slow-paced music, the change value was

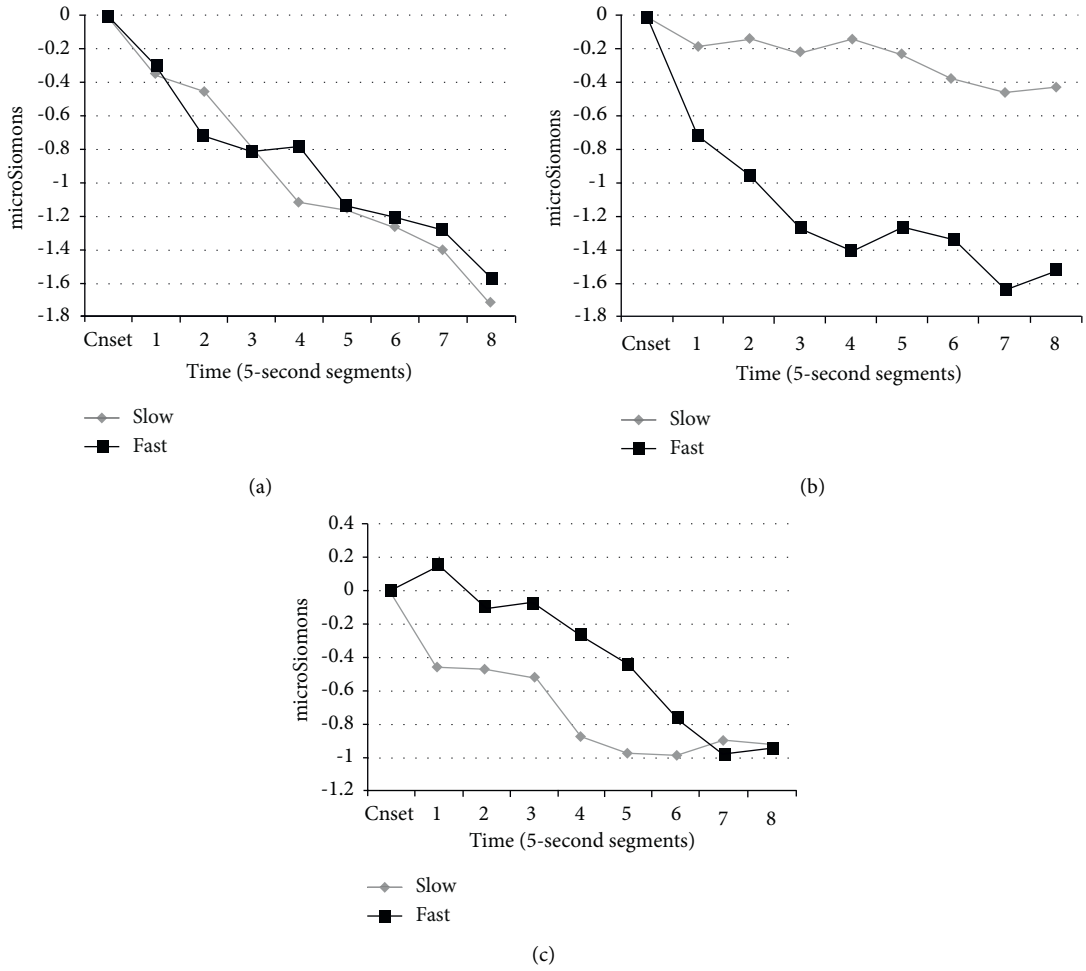

Figure 2: Tempo × genre × time on SCL. (a) Rock genre. (b) Classical genre. (c) Swing genre.

submitted to 2 (rhythm) × 3 (genre) × 8 (time) repeated test MANOVA, and the result was close to significance (f (16256) = 1.502, P = 099, ε 2 = . 0287).

5.3. Results and Experimental Analysis. This group of experiments attempts to test two broad hypotheses. First, when participants hear fast-paced music, they show less deceleration in SCL than slow-paced music. Second, the increase of rhythm will lead to greater SCR activity of classical music than rock and swing music types we are more familiar with [38]. According to the collected participant data, these two hypotheses have been confirmed. The data show that, as time goes on, rock music is not affected by rhythm. However, rhythm has obvious influence on the other two types. However, faster rhythms increase sympathetic activation in the swing type and decrease activation in the less familiar classical type, as shown in Figure 2, which is contrary to our expectations. In the selection of classical music that may be less familiar, the activation response of slow rhythm (even if the change score is initially higher than the baseline level) is greater in fast rhythm than in relatively familiar swing music. Therefore, by analyzing the experimental data, it is proved that the familiarity assumption around classical and rock proposed by hypothesis 2 is not tenable in accurately predicting the direction of this interaction. The experiment uses psychological and physiological factors to verify the existence of any music, whether slow or fast-paced, classical music or rock music, which will increase the excitement of people's sympathetic nervous system. Over time, the genre of music may alleviate the impact of any rhythm on skin conductance. Through data analysis, when using SCL as attribute measurement to confirm the dynamic characteristics of music processing, it is predicted that music with a slower beat will cause less sympathetic activation than music with a faster beat. People are using all the spontaneous SCR frequency counts, so the whole listening period is summarized across time, and no major impact is found. On the contrary, in the interaction with genres, the increase of rhythm in the processing of rock music leads to a significant increase in SCR, while the increase of rhythm in the processing of classical music leads to a significant increase in SCR. In slow-paced classical music, participants can adapt to the expected genre and the rapid start of a single note in the rhythm pairing [39]. Through the analysis of the two hypotheses, we can better confirm that the speed of rhythm and

genre are related to the presentation of SCL, but it is untenable to propose that it is related to familiarity, and in the interaction of genres, classical music is higher than rock music SCL.

6. Conclusion

The extraction of key words in this paper is a relatively extensive field. The psychological construction of music combines psychological and physiological signals. That is, the collection of aesthetic experience and physiological experience created by emotion and absorption caused by music. The type of music and the speed of rhythm can convey many different types of signals through different combinations [40]. Based on the scenes of classic classical concerts, this paper discusses the aesthetic experience of music works with different musical styles and fast and slow rhythms, as well as the adjustment of music to our emotions and sports performance. According to the research data, the speed of rhythm can increase the excitability of the sympathetic nervous system, and if in the same type of music, fast-paced music is easier to activate the sympathetic nerve than slow-paced music. Emotional reactions and some physiological reactions reflect the changes in the form of sonata represented by motor function in familiar classical music works. Of course, it does not follow such a trajectory in unfamiliar contemporary works [40]. Use music to reduce athletes' arousal and divert attention, reduce sports pain, and improve sports performance. Moreover, music can improve our psychological feelings, promote the motivation of activities, and increase their attachment. In addition, some scholars Zhou [41] believe that not the same kind of music has the same impact on everyone. Some scholars have also proposed that a type of music has an impact on one person, but not necessarily on others. So far, many scholars' research on the impact of music intervention on the human body is still growing. André Previn said, "there are a million things in music that I do not know. I just want to narrow this number [42]." In addition to the speed of the music rhythm, we should also evaluate the type. Perhaps, as our understanding of the awakening caused by music increases, our ability to predict the effect of music will be improved. Then, we can start to study the impact of music on human psychology and physiology, so as to make our research more in depth and breadth [41].

Data Availability

The dataset can be accessed upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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