The International Conference on Interdisciplinary Humanities and Communication Studies
DOI: 10.54254/2753-7048/6/20220230

Tone Language's Effect on Emotional Detective Music

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Abstract: We already know tone language has different tones, but non-tone language does not. Music can cause our emotions to change. According to the relationship between languages and music, music and emotions, we want to design a study that uses the reaction of Autonomic Nervous System(ANS), especially the part of Heart rate (HR), heart rate variability (HRV), and electrometal activity (EDA) to detect the emotional arousal caused by joyful pleasant music, isochronous tones, and unpleasant control stimuli. The main purpose of the test is that to see if there are some differences from the sensitivity of music caused emotional changes between tone language speakers and non-tone language speakers. Also, further aim is to determine whether music therapy for different language speakers should be detailed to different frequency pitches changed music.

Keywords: Autonomic Nervous System(ANS), music therapy, language, emotion

1. Introduction

Music is related to languages. Studies have provided evidence that music and language are using a crossing process in mind [1-3]. For example, Patel et al. found that music and language share neural resources in structure processing [2]. An out-of-key tone eliciting the same ERP pattern in language. especially in tone languages.

Because tone language speakers use precise and stable pitch patterns when producing words compared to non–tone language speakers, tone languages are more related to music [4]. For example, Mandarin speakers use 4 tones: tone 1 is flat, tone 2 is rising, tone 3 is falling-rising, and tone 4 is falling. And the relationship between Mandarin tones and the pitches is widely used in teaching Mandarin in Primary schools (see figure 1).

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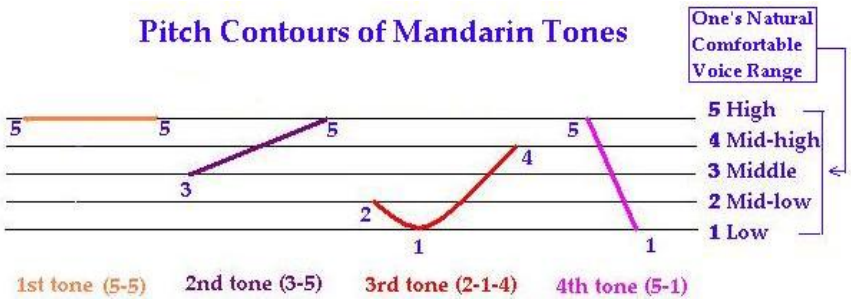

Figure 1: The figure that is posted in schools that help native English speakers to learn Mandarin.

Mandarin speakers were also better than English speakers at a melody tone discrimination task and a melody tone identification task [5-6].

People can detect different emotions in music. Research from Fritz et al. already proved that even from different cultures and backgrounds, people can still detect the three basic emotions(happy, sad, and fear) in music [7]. Fritz et al. let African natives (that is, people who have never been exposed to Western music) listen to Western classical music, and those African natives detected the three emotions(happy, sad and fear) successfully [7]. That is to say, the music itself has emotions attached to it when emotion changes without cultural crossing problems.

In the previous study, we already found out whether people can feel emotions because the musical tones mimic the tonal characteristics of vocalizations in different emotional states, which means the music has some cross-cultural effects depending on different languages [8]. Other studies also showed that compared with non-tonal language cultures, tonal music has more frequent changes in pitch direction and greater pitch spacing; More frequent changes in pitch direction and greater pitch spacing were also evident in tone languages compared to non-tonal language cultures [9].

Language is a way to convey our feelings; Music is the product of blowing up human emotions. In music, a major key can express happiness, while a minor key can express sadness; In language, high pitches can express anger or happiness, while low pitches can express fear, sadness, and tenderness [10]. A sudden increase in the intensity of a musical tone translates into an emotional response of surprise in the emotional pattern in the hypothalamus; a slower increase in intensity translates into a nervous emotional response in the hypothalamus; a steady increase in the intensity of the musical tone results in a heightened and elevated emotional response; the weakening of the musical intensity will cause a pleasant or calming emotional response [11]. When the number of action potentials changes regularly in a disparate proportion, the emotional fluctuations generated by the hypothalamus will spread to the periphery and internal organs of the body along the descending conductive nerve fibers, causing the behavioral motivation of the skeletal muscles of the body [11]. Nerve fibers carrying sound signals of different frequencies terminate in different parts of the auditory center of the cerebral cortex [11]. That's how music processes feelings in our mind. Whether it is songs and dances used to fear ghosts and gods since ancient times, or music created in the later stage to match various scenes and stories, it is all to express emotions.

Based on Patel's, Han et al.'s and Bowling & Purves's studies, we are interested in whether tone language speakers are more sensitive to the emotion changes [8-10]. Because major key can express happiness, a minor key can express sadness; because more changes is found in tone language music; because music is a mimic of emotional language talking, we proposed that tone language speakers have a sensitivity to music emotion changes [8-10].

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2. Background

Young proposed that emotion is a disturbance and destruction of normal physiological and psychological balance: “When a person is so excited by the surrounding situation that his brain control weakens or loses control, the person has an emotion.” [12]. The incongruous theory of emotions is scientifically appropriate for those intense emotions such as anger, excitement, fear, and happiness, but is not sufficient to explain those emotions with lower levels of physiological arousals, such as comfort, melancholy, confusion, and contentment. For example, unexpected successes lead to euphoria, and unexpected setbacks lead to anger, both of which are disruptive to the original internal pattern, both of which are intense emotions.

Music activates the parasympathetic nervous system, it prompts the body to relax from tension or high levels of physiological arousal and into a state of relaxation. Music decompression and relaxation in music therapy uses this feature of music. Although the emotional response to music is ever-changing, its basic mechanism is very simple: a low physiological level of tension-relaxation movement changes. This simple model, in different forms, incorporates the person's senses, attention, and awareness into its trajectory, thereby relieving tension.

So what is for this study, we want to find out if there’s a difference between tone language speakers to non-tone language speaker to process the music emotion. If tone language speakers are more sensitive than non-tone language speakers, in music therapy, we should choose a more gentle music for the tone language patients to improve the therapy efficiency.

2.1. Proposed Study: Do Mandarin Speakers More Sensitive to Music Cause Emotional Changes than English Speakers?

Background Music can evoke strong emotions and thus elicit significant autonomic nervous system (ANS) responses [13]. Krabs et al. already tested that both pleasant music, isochronous tones, and music-like noise elicited a similar pattern of autonomic effects: heart rate (HR) and electrodermal activity (EDA) increased, whereas heart rate variability (HRV) decreased [13].

So what we want to know is that, if different language cause different effect to our autonomic nervous system (ANS)? We try to figure out whether it has difference between mother tone language speakers and mother non-tone language speakers. On the one hand, we proposed that mother tone language speakers will have a higher heart rate (HR) and electrodermal activity (EDA) together with a lower heart rate variability (HRV). On the other hand, mother non-tone language speakers will have a lower heart rate (HR) and electrodermal activity (EDA) together with a higher heart rate variability (HRV).

2.2. Method

2.2.1. Participants

We will recruit 120 volunteers (60 women) aged between 20-25 from a random university. 120 volunteers included 60 (30 women) healthy Mandarin speakers without a second language and 60 (30 women) English speakers without a second language. Mandarin group and English group were divided into 3 groups again: 20 students (10 women) for each group. Mandarin group and English group are randomly given for each small group pleasant music, isochronous tones, and unpleasant control stimuli.

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2.2.2. Stimuli

The participants will maintain a comparatively stable mental and emotional state before the experiment begins. The humidity and temperature of the rooms where the subjects stay will be about the same using an air conditioner. The participants will be sitting in a comfortable situation throughout the experiment. Each person is instructed to listen to the kind of stimuli they are asked to. The sound will be played for at least 60 seconds under any situation in order to keep the ANS reaction effective.

2.2.3. Records

We will especially record graphs of heart rate (HR), heart rate variability (HRV), and electrodermal activity (EDA) and compare the frequency of the graphs between the Mandarin group and the English group.

2.2.4. Predictions

If the experiment supports our study, then Mandarin speakers should show a higher frequency than the English group of heart rate (HR), heart rate variability (HRV) and electrodermal activity (EDA) whatever the stimuli is. And the frequency between different sounds is that isochronous tones is the lowest one, the Mandarin group showed a stronger frequency than English speakers.

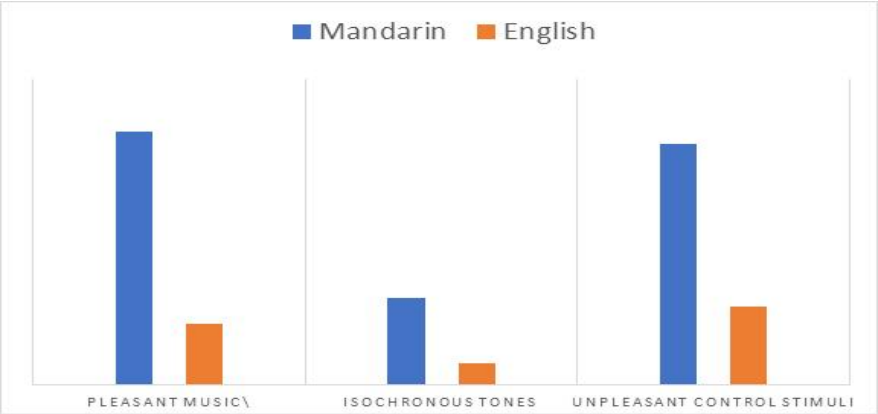

Figure 2: If the study supports our hypothesis.

If the experiment does not support our study, then Mandarin speakers should show a nearly the same frequency as the English group of heart rate (HR), heart rate variability (HRV) and electrodermal activity (EDA) whatever the stimuli are. And the frequency between different sounds is that isochronous tones are the lowest one, and the frequency between the Mandarin group and English group are nearly the same.

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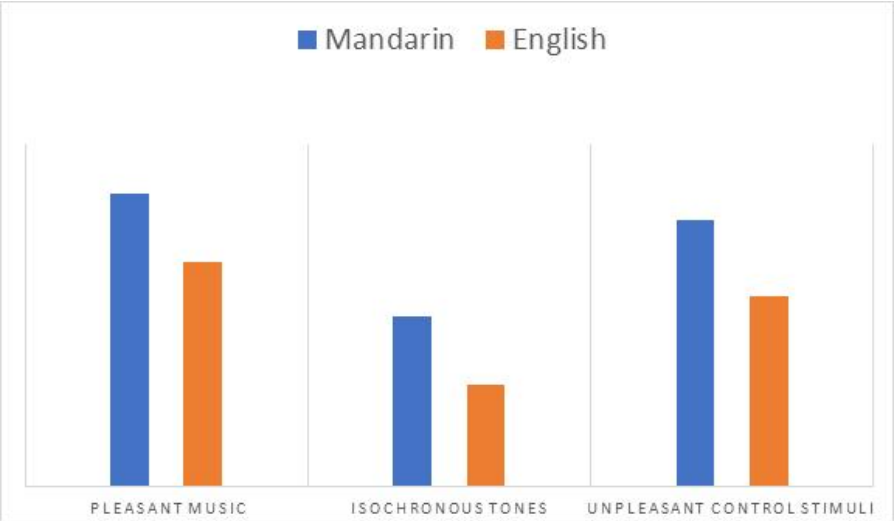

Figure 3 Predictions that if the study does not support our hypothesis.

3. Conclusion

If the study supports the first model (figure 2), this result will give us a possible concern: using a stronger emotion driven music will not approve therapy process, otherwise leading to a worse condition. However, if we use the correct type of music, that will help music therapist improved their therapy progress. For instance, for mother tone speakers, use gentler music to calm them down; for mother non-tone speakers, especially those with depression disorders, use more intense music to live them up. All music therapy must to treat disorders differently and tailored to the specifics of individuals' language type: tone or non-tone languages.

If the study supports the second model (figure 3), that means the therapist will not take too much time to worry their choice of background music. However, the therapy progress will stay in still, which is not our hope.

If the results of the proposed study support our hypotheses, there are more things for us to improve in the future. First, because we only do one kind of language for the tone language group and non-tone language group, we want to see if for other languages, the hypothesis still works. Second, we want to see if the hypothesis still works in other countries and in other cultures. Third, we want to see if the hypothesis still works in other age groups. Forth, if it is possible in the future, we need to do more research on two languages or more language speakers. Fifth, maybe we can do more research on if these people learning a new language (tone or non-tone) affect their detection for emotional changes.

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