Relation between Music & Human Emotions

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Abstract

We experience what are called emotions in our heart. The heart is nothing but our brain reacting to emotional stimuli. The exploration of new frontiers in the way music affects the brain and elicits physiological and emotional responses has opened up exciting new possibilities for utilizing music. In this paper, we explore the variegated tapestry of emotions that are brought about by music in humans and how this subtle power of music can be used to alter how we feel, react, cope and behave in various circumstances.

Keywords: Human Emotions, Music

I. Introduction:

Music is embedded in society and across cultures as an organic and dynamic entity. As far as evoking emotions and feelings is concerned, music is far more powerful than language [1]. Across cultures, music has been characterized as the "language of emotions". This has spurred a heightened interest in how the brain processes music, thereby creating the consequent emotions. Be it in films, live orchestras, concerts or on a simple home stereo, music can be so evocative and overwhelmingly stirring that it can blur the boundary between a thought in the head and an event in real life. It can make us feel what has not even really occurred. Getting goose bumps on hearing the rustling of leaves at a distance in the woods while sitting in the bedroom of a 30th floor apartment in a metropolitan city, hearing the sputtering flow of a secluded stream past a majestic mountain while being aboard a plane to Seattle, having the heart beat frantically along with the strident pace of music in a thriller movie or automatically tapping the feet to a cheerful folk drum beat - music has a palpable and usually profound effect on our thoughts and actions.

Music can be considered objective in nature as if there is a sad melody, then it would sound sad to the majority of the audience. Similarly, a particular type of music would have same effect on majority of listeners. However, there can be a few people whose perception will differ from the majority. Without going into exceptions, we have tried to explore the intricacies of the sound of music, the effect of the manner of its rendition on the listener and the spectrum of emotions music has the unique ability to single-handedly bring to life or resurrect from the

depths of memory.

A. Music Terminology:

Music is nothing but a combination of sounds that makes sense. To understand music better some of its characteristic terms have been described here; *Note*: A pitched sound itself.There are 7 natural and 5 sharp/flat notes in music. *Octave* is the interval between one musical pitch and another with half or double its frequency. *Scale*: A scale is any set of musical notes ordered by fundamental frequency. *Chord*: A chord is three or more notes that combine harmoniously; it is composed of sounds that go together, or agree with each other.*Rhythm*: The pattern of regular or irregular pulses caused in music by the occurrence of strong and weak melodic and harmonic beats.*Tempo*: The speed of the beat of the composition. *Melody*: The tune of the composition. *Harmony*: The background to the melody. [2]

B. Human Emotions:

Emotions are evolved responses to stimuli. Emotions are controlled by limbic and Paralympic brain, primarily amygdala and are necessary for the survival of a species [3]. Even though humans have become social, still individuality can be seen on many occasions. We tend to feel happy in the situations which will make our survival more comfortable and sad when events do not occur as we expect or had planned. Quantification of emotions has always been an area of interest for researchers. One such example is presented in Fig. 1 where different emotional bands are divided between 2 axes. [4]
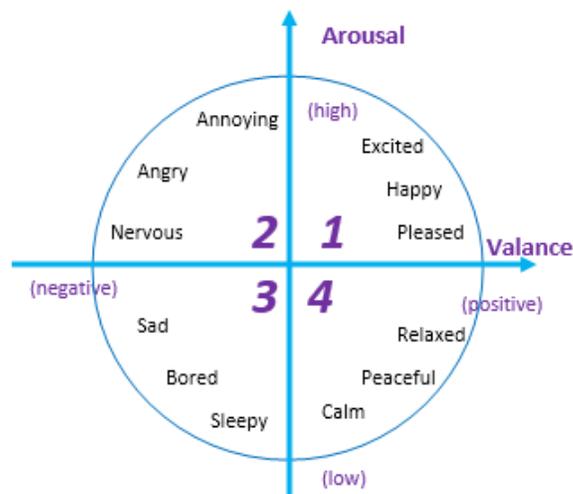

Fig. 1.Thayer's arousal-valence emotion plane. [4]

Definition of Emotion:

Emotion is a complex set of interactions among subjective and objective factors, mediated by neural/hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as perceptually relevant

effects, appraisals, labelling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behaviour that is often, but not always, expressive, goal-oriented, and adaptive.[5]

According to ancient Indian philosophers, there are 9 fundamentalrasasthat encompass all emotions. [6]

TABLE 1

Sanskrit Term	Principle Meaning	Further Meanings & Related Emotions
Shringara	Love	Beauty, Devotion
Hasya	Joy	Humour, Sarcasm
Adbhuta	Wonder	Curiosity, Mystery
Shanta	Peace	Calmness, Relaxation
Raudra	Anger	Irritation, Stress
Veera	Courage	Pride, Confidence
Karuna	Sadness	Compassion, Pity, Sympathy
Bhayanaka	Fear	Anxiety, Worry
Vibhatsa	Disgust	Depression, Self-pity

Mood of Music:
Music shares a very special relation with human emotions. We often choose to listen to that song or music which best fits our mood at that instant. Songs with similar pattern or their similar audio feature range will be grouped together to yield a particular mood as seen in Table 2.[7]

TABLE 2

Mood	Adjective
Happy	cheerful, funny, romantic, playful
Sad	depressed, frustrated, angry
Exciting	dance, celebration, party
Silent	peaceful, calm

For developing better understanding, a thorough cluster classification of musical moods is presented in Table 3. [8]

TABLE 3

Clusters	Mood Adjectives
Cluster 1	passionate, rousing, confident, boisterous,rowdy
Cluster 2	rollicking, cheerful, fun, sweet, amiable/ good natured
Cluster 3	literate, poignant, wistful, bittersweet, autumnal, brooding
Cluster 4	humorous, silly, campy, quirky, whimsical,witty, wry
Cluster 5	aggressive, fiery, tense/anxious, intense, volatile, visceral

Various musical terminologies, which were made famous by numerous music accessories, are commonly associated with human emotions. A general emotion-music characteristics relation has been presented in Table 4. This relation gives a vague idea on how various musical structural features can affect associated moods.

TABLE 4

Structural Feature	Associated Emotions
Tempo	Fast tempo: happiness, excitement, anger. Slow tempo: sadness, serenity.
Mode	Major tonality: happiness, joy, Minor tonality: sadness.
Loudness	Intensity, power, or anger
Melody	Complementing harmonies: happiness, relaxation, serenity. Clashing harmonies: excitement, anger, unpleasantness.

Rhythm	Smooth/consistent rhythm: happiness, peace. Rough/irregular rhythm: amusement, uneasiness. Varied rhythm: joy.

II. EMOTION INDUCTION: THE SCIENCE BEHIND IT

In the following section,reasons for specific emotion generation, on listening to a particular musical piece has been discussed.

A. Scales: Western Music:

In music theory, there are 7 natural notes in music namely; C, D, E, F, G, A & B. Further there are sharps (#) & flats (b). Scale is an ordered set of these notes and is one of the most significant componentsaround which the whole melody revolves. It determines the basic mode of the melody and hence the inclination towards a particular emotion. Various experiments have been done to identify the scale mode effect in the form of happiness or sadness on participants [9].

Major Scales: These scales have a major third (E in the key of C), which makes them feel happy or bright.*Minor Scales:* These scales have a flat third (E-flat in the key of C), which gives them a darker and more tragic feel [11].

Emotional triggers as per different Scales:

Without going into the details the general reasoning for why minor chords sound sad & major happy has been given by the theory of musical equilibration [11]. An overview of the emotional nature of harmonies is described below:

Major tonic: a feeling of sober-minded contentment. As an example it can be seen with staff notations in Fig. 2.

Fig. 2.The major tonic expresses a sense of sober-minded contentment. [11]

Minor tonic: a feeling of grief when played quietly, a feeling of anger when played loudly and also emotions of having a sense of discontentment.
*Natural minor:*a sense of danger, adventure, tension, courage, severity, a provocative situation.
Dominant: a feeling of liberation, aspiration, motion. Minor dominant tonic expresses

equilibrium.

7th chord: feelings of protest, boldness, resistance, tearfulness, weakness, breaking. In the minor tonic character, it expresses stasis.

Secondary dominant chord: portrays anticipation; can express pain, bitter disappointment or a sense of being greatly moved. For major tonic it expresses hope.

Major subdominant: cheerfully optimistic, full of energy, rejoicing, joy, dignified, drunkenness, victory, satisfaction.

Major subdominant with a major 7th: similar to subdominant plus a touch of bitterness: a feeling of intense longing, a wistful goodbye, a final embrace.

Added 6th in a major chord: ease, cosiness, fidelity, kindness, comfort, affection, friendship, togetherness, love.

Added 6th in a minor chord: dissociation, loneliness, despair, heartbreak.

Neapolitan 6th chord: extinction, perishing death, desertion, immutable pain, final good bye.

Diminished 7th chord: fear, anxiety, panic, dismay, terror, horror, melancholy. If the resolving chord is major: simulated despair, flirtatious.

Augmented chord: magic, astonishment, change, amazement, wonder, wizardry.

Whole-tone scale: weightlessness, in space, under water, in a dream.

Minor 6th: threat, nervousness, being afraid, feelings of worry. *[11].*

B. Ragas: The Indian Classical:

A Raga literally means colouring. Raga is a core feature of Indian classical music and is a cornerstone of the Indian music tradition. A raga provides framework to the musicians and it typically consists of at least 5musical notes. Within a raga, certain specific notes can be rearranged and improvised by the musician in ascending or descending order. Each raga has an emotional significance and a number of symbolic associations such as with season, time and mood. [12]. Ragas are considered as meansto evoke certain emotions in the audience in Indian musical heritage. There are hundreds of ragas recognized out of which few are mentioned in Table 4 along with their associated emotions or feelings or Rasas. [13]

TABLE 5

Raga	Rasas
Adana	Veera
Bhairav	Raudra,Shanta,Bhakti, Karuna
Chayanat	Shringara
Darbari Kannada	Shanta
Hindol	Veera, Raudra
Jayjayvanti	Shringara

Jogiya	Karuna, Shringara, Bhakti
Kedar	Shanta
Mian-ki-Malhar	Karuna
Mian-ki-Todi	Bhakti, Shringara, Karuna
Shree	Shanta

One of the unique characteristics of Indian music is the assignment of definite times of the day and night for performing Raga melodies. It is believed that only in this period the Raga appears to be at the height of its melodic beauty and majestic splendour. Fig. 3 describes the ragas and

the corresponding time of day. [14]

Fig. 3.Time for the raga to be performed. [14]

C. Human Genetics:

We evolved to communicate using sound. Music was invented as a form of long-range communication. Our perception of sound is a result of evolution.As on the same lines as our fear, like or dislike had to do with our DNA.

Affection as the soul of human existence has been an obvious centre of a composer's musical expression. Human affection results in all kinds of human social activities, conundrums and cultural inheritance. [15]

D. Nature & Geographical Effects:

Music can also foster greater value of the natural world in our perspectives, especially when nature itself is recognized as being musical [16]. Listening to music composition may overwhelm/irritate someone depending on the surrounding atmosphere of the place.As in music with slow tempo will be more effective in calmer surroundings and listening to music with fast

tempo will be more likely to be effective when you are feeling energetic.

The origin of music depends largely on the location. As the location governs many factors like availability of materials for musical instruments, climate of that location, lifestyle of the civilization etc. Music originated on the locations with peaceful surroundings tends to be calmer, when compared with the music originated in a civilization with busy lifestyle.

E. State of Mind:

Current mind-set of a person affects the choice of music. Ironically, listening to a sad number when one is sad can be pleasurable. The explanation for this contradictory phenomenon is the sensing of empathy for one's own condition in the parallel drawn with that particular sad song. The feeling of being understood makes one comfortable. Lie Chen et.al. [17] have showed that a sad person will prefer a sad song initially. But with time, the mood and musical preferences will change.

F. Relationship with the melody& its Associations:

Music serves as a powerful cue to bring back memories. Because music is such a pervasive part of social life-present at weddings, funerals and religious ceremonies-it brings back emotional memories that are often already associated with it.

As a subjective past connection:

One melody can have different emotional triggers for different people. If one has a memorable incident associated with a particular melody, he/she will perceive it differently from the usual or obvious perceptions by others to the same melody. For instance, someone who lost a loved one in a car accident while a dance number was playing on the radio is more than likely to experience grief and longing every time he/she encounters that melody again in life. Similarly, songs one used to listen to as a young student when played on a programme on TV bring back memories of college and pangs of nostalgia and wistful smiles decades later.

When two melodies are frequently heard in the same order, as with consecutive movements of a symphony or tracks on a rock album, the beginning of the second melody is often anticipated vividly during the silence following the first. This reflexive, often irrepressible, retrieval of the second melody, or "anticipatory imagery", reveals that music consists of cued associations, in this case between entire melodies. [18]

III. MUSIC GENRES COMPARISON & RESULTS

Nearly all the civilizations, kingdoms and nations have been known to enjoy music. Because music originated from different parts of the world undisrupted, it became very diverse. As technology connected the world, we cane to know different music genre, instruments and style.

Different situations also helped to broaden the spectrum of the music. Some of the famous genres around the globe are as Blues, Classical, Country, Disco, Hip-hop, Jazz, Metal, Pop, Reggae, andRock. [19]

Many researchers have started to work on music genre preference, aiming at identifying its structure. Fourteen broad music genres were examined in three US preferences [20]. Convergence in results in all the three studies was seen and results revealed four music preference factors: *Intense and Rebellious(*heavy metal, rock, and alternative*),Reflective and Complex* (jazz, blues, folk and comprising classical), *Energetic and Rhythmic* (rap, soul and electronica), *Upbeat and Conventional* (country, pop, soundtracks and religious). Another study was conducted on 11 music preferences among Dutch adolescents [21]. The results revealed four preference factors: *Elite* (Classical, Gospel and Jazz), *Rock* (rock, hard rock, heavy metal, gothic and punk), *Pop* (trance and top 40 charts) and *Urban*(hip-hop, soul and rap).Ann Colley [22] also investigated preferences for 11 music genres using a small sample space of British university students. She summarized that there are four factors for women and five factors for men. Three factors were common in both: *Heavy* (heavy metal and rock), *Sophisticated* (opera, Jazz, blues and classical) and *Rebellious*(reggae and rap). The fourth factor for women, *Mainstream* genre (folk, country, pop and chart) was split into *Pop* (chart pop) and *Traditional* (country and folk) for men. [23]

IV. MUSIC INSTRUMENTS &THEIR TYPE ANALYSIS

Sounds may be generally characterized by pitch, loudness, and quality. Sound quality or *timber* describes those characteristics of sound which allow the ear to distinguish sounds which have the same pitch and loudness. Timbre is then a general term for the distinguishable characteristics of a tone.

Notion of music has wide context. Numerous kinds of instruments are available. "For purposes of research everything must countas a musical instrument with which sound can be produced intentionally. An Indian sage Bharata, working nearly 2000 years earlier, compiled the knowledge of dance, drama and music forms available in his era in Natyashastra (ca.200 C.E.). He classified musical instruments into 4 different classes [24]. These are; *Sushira*, instruments you blow into; *tata*, instruments with strings to set the air in motion; *avanaddha*, instruments with membranes (i.e. drums), and *ghana*, instruments, usually of metal, that you strike [25]. There are various classifications available, but the most commonly used classification was developed by Erich Mortiz von Hornbostel and Curt Sachs in 1914 [26]. This system classified the instruments on the basis sound producing method.

1. *Idiophones* instrumentsthat produce sound by vibrating themselves
2. *Membranophones* instrumentsthat produce sound by a vibrating membrane
3. *Chordophones* instrumentsthat produce sound by vibrating strings

4. *Aerophones* instrumentsthat produce sound by vibrating columns of air
5. *Electrophones* instrumentsthat produce sound electronically [26]

The above methodology has been improved by Musical Instrument Museums online (MIMO) [24]. Apart from Hornbostel-Sachs classification, its origin, creator, Date of creation, Materials, Clef/Pitch/Range, size of object etc. are also used for classification of the instrument.

All time preferred musical instruments:

Music is a powerful tool that represents a comprehensive role in boosting self-esteem, and total wellness of the person. It gives folks collectively and permits us to experience the same emotions. Nevertheless, have we wondered which tool may create the best music or which instrument go well with melodic mood of the composition. Some instruments are discussed here; *Guitar***:** Rock is the most typical genre of the guitar.*Piano*: The Italian musical terms piano means "soft". In this context referring to the variations in volume produced in response to a pianist's touch or pressure on the keys: the greater the velocity of a key press, the greater the force of the hammer hitting the strings, and the louder the sound of the note produced and the stronger the attack. *Trumpet*: In general trumpet signifies victory but it has also got an element of jazz audio. The design of this wonderful and outdated equipment is like a metal lines tendency into an oblong design. Using the support of three valves positioned in the individual, musicians can certainly alter the message of the appear. *Violin*: This is the hottest audio devices that participate in the larger category of strings. Violins are important instruments in a wide variety of musical genres. They are most prominent in the Western classical tradition and in many varieties of folk music. They are also frequently used in genres of folk including country music and bluegrass music and in jazz.*Saxophone*: Recently, the World Saxophone Quartet has become known as the preeminent jazz saxophone quartet. The saxophone, as a solo instrument or as part of a horn section, can also be heard in blues, soul music, rhythm and blues, reggae, ska, funk, rock and roll, and other forms of popular music.

V. SONG CHARACTERSTIC FEATURES

When melody becomes a song! Basically, a song is a musical composition with lyrics for voice(s) performed by singing while melody is simply a tune, which is a sequence of notes that makes up a musical phrase.

A. Singing Style:

Humans are called as the best musical instruments. This is probably because human voice, through different singing styles, has the potential to effect/generate different types of emotions. No other musical instrument is this versatile. Singers can vocally express their emotional interpretation of a musical piece [27]. Depending on the shape and size of singer's body, vocal tone and resonance characteristics change. These features also depend on the understanding of

vocal techniques. Hence an experienced singer can control airflow through vocal cords and note placement as air passes through resonating chambers.Emotional representation in a song can be improved by using music genre associated with similar mood.A 'catch' in the voice or 'smile' during singing at relevant points can enhance the overall feeling that a singer is trying to portray.

B. Voice Quality:

Texture of a singer's voice contributes a lot to the song. Different singers have different type of voice quality like harsh voice, tense voice, modal voice, breathy voice, whispery voice, creaky voice and lax-creaky voice[28]. The two vocal properties are intensity (loudness) and frequency (pitch). Pitch of a man's voice fall under low frequency, whereas woman's voice is of the high pitch type. Pitch and intensity are proportional to each other. As seen in the spectrograms beneath, we can compare the intensities of male vs female voice. Female's voice has more frequency components compared to men. Women speak at one octave higher than men. Even though in the graphs underneath show that a man's voice (while screaming) has a 1 high frequency component, and then has low intensity after that. Whereas female's voice has a band of median intensity and gradually tapers towards end.Similarly, a Kid's voice has differentcharacteristic features.

C. Lyrics:

Music, like language, can both express and induce emotion. Some experiments have been done to test the emotional effect of lyrics. The purpose of this experiment was to determine whether the presence of

Lyrics affected judgments about music and whether any differences emerged as a function of type of emotion. The experiment systematically examined the effects of music with and without lyrics on a range of emotional responses, spanning all four quadrants of the circumflex theory of emotion, which included 'happy', 'sad', 'calm', and 'angry'. [29]

The lyrics and the music of the song goes hand in hand. The music is decided according to the lyrics. when you are able to understand the lyrics, you should know what's the song about, but on the other side there's a possibility that lyrics doesn't affect our emotions, what do u say about dubstep? Or trap? These genres don't have lyrics but still when the bass is about to drop we feel the excitement, we feel the adrenaline, the dopamine rushing through my body, sometimes we get chills, so in my opinion it's the music that affects our emotions. But if they are accompanied by lyrics then it's a cherry on the cake.

Sometimes people are merely interested in the background music but if we talk about the lyrics then it definitely helps arousing the emotions lying within. And the variations in the songs loved by different people may be a proof to it.Songs feel emotionally different to listeners depending on their lyrical contents, even when melodies are similar. Accordingly, when using features related to melody, like tempo, rhythm, tune, and musical note, it is difficult to classify emotions accurately through the existing music emotion classification methods. [30].

VI. APPLICATION OF MUSIC

A. Musical Therapy:

People described music as a catalyst for achieving mood-change, mood-enhancement and different psychological states of mind. B.L.Wheeler divided music therapy practice into three levels: (1)*Music therapy as an activity therapy;* mostly therapeutic activities are used(2)*insight music therapy with reductive goals;* help in changing the behaviour of the person. (3) *Insight music therapy with reconstruction goals;*helps in reorganising the personalities [31]. All participants reported using their music preferences to reflect/enhance their current mood, or conversely, to alter/diffuse some aspect of their current mood: [32]

Musical therapies are nowadays used for improving psychological and physiological issues. It is mainly used for stroke patients and recent studies have shown that music therapy has delivered results in case of stroke patients [33].During the presentation of pleasant music, increases in blood–oxygen level dependent (BOLD) signals were observed in the ventral striatum(presumably the nucleus accumbens,NAc) and the anterior insula (among other structures) [3]. According to the heuristic working factor model, there are five factors on which the effects of Music therapy depend [34]. The factors are: modulation of attention, emotion, behaviour, cognition and communication.

Healing Power of Music:

The comforting and unified melody is not merely a source of entertainment, but can also be a great stress-buster. Additionally, listening to your favourite music regularly may eliminate soreness, reduce depression and blood pressure together with improve the excellent of the sleeping. In short, it is the most effective healer and acts as a medicine for recovery.

Music can help patients to fight pain. One such demonstration has been done at Cleveland Clinic, where surgery patients who listened to recorded music, mentioned upto 4 times decrease in post-surgical pain. Listening to music also reduced the amount of anaesthesia required during operations. Music is also helpful in lowering stress and anxiety. Decrease in blood pressure, reduction in stress and steadiness in heartbeatis observed when listening to calming music. Research has also shown that listening to music helps in decreasing stress in patients undergoing medical procedures like surgeries, coronary heart diseases and colonoscopies.

Preliminary evidences also indicate a boost in immune system by increasing growth hormones and decreasing stress hormones. Such changes help the body in recovering from illness or resisting it. Unfortunately, research is weak on this topic and topic needs further investigation. Many studies link music to pleasure and happiness in different ways. Although, many individual scholars have different opinions, the scientific consensus is that music provides stimulus to some portions of human brain which are responsible for pleasure.Numerous studies have indicated that

pleasant music triggers mesocorticolimbic system in brain. This is the same centre which provides pleasure during tasty food, humour and even cocaine. [35] [36] [37]

B. Musical Cryptography:

The algorithms applied to musical cryptography use predefined set of notes and rules for the synthesis of musical patterns. The main task in the musical cryptography is to generate musical cryptograms which in turn are good sequence of musical patterns soothing to ear. [38]. Some advantages of musical encoding are that it can used to provide datasecurity like any other cryptography technique and as music is easy to memorize so this helps in remembering complex data easily. As an example mathematical number 'pi' can be memorized upto many decimal places my encrypting into a beautiful musical melody, its musical sheet can be seen in Fig. 4.

Fig. 4.A piece of Pi song. [39]

C. Music Composition using Artificial Intelligence:

Depending on the kind of emotion(s) a musical piece must carry, musical composers write music based on personal experience on music-emotion connection. Computer scientists are working to create programs that can help the composers in writing their musical compositions. This has been possible because of the discovery of Artificial Intelligence. Scientists are performing experiments to understand and explore the relationship of music composition and artificial intelligence [40]. Due to digitization of music industry, most of the composition is done using computer software. Looking at the progress in artificial intelligence and music digitization, creation of computer software which will create musical pieces depending on owner's present mood seems inevitable.

VII. CONCLUSION

In this paper we explored how the sound of music evokes a variety of profound emotions in its listeners. While arts are abstract and removed from our concerns in everyday life, music as an art form is subtly yet firmly embedded in our emotional as well as physiological persona. We delineated the effect of notes and melodies on our mental state and responses.We explored various probable reasons for emotion generation/change on listening to different music.The scope of application of music in therapy, cryptography and the futuristic symbiosis with the powerful artificial intelligence technology was examined. However, it can be safely said that

although music is a vastly traversed path in the field of arts, the emotional prowess and practical applicability of which are being actively pursued, it still remains a potent source of more discoveries, insights and untapped potential.

REFERENCES:

[1] Juslin, P.N. and Västfjäll, D., 2008. Emotional responses to music: The need to consider underlying mechanisms. Behavioral and brain sciences, 31(05), pp.559-575.

[2] Cassidy, J.W. and Speer, D.R., 1990. Music terminology: A transfer from knowledge to practical use. Bulletin of the Council for Research in Music Education, pp.11-21.

[3] Koelsch, S., 2010. Towards a neural basis of music-evoked emotions. Trends in cognitive sciences, 14(3), pp.131-137.

[4] Yang, Y.H., Lin, Y.C., Su, Y.F. and Chen, H.H., 2008. A regression approach to music emotion recognition. IEEE Transactions on audio, speech, and language processing, 16(2), pp.448-457.

[5] Meyers, O.C., 2007. A mood-based music classification and exploration system (Doctoral dissertation, Massachusetts institute of technology).

[6] Marchand, P. and Johari, H., 2006. The Yoga of the Nine Emotions: The Tantric Practice of Rasa Sadhana. Inner Traditions/Bear & Co.

[7] Ujlambkar, A., Upadhye, O., Deshpande, A. and Suryawanshi, G., 2014. Mood based music categorization system for bollywood music.International Journal of Advanced Computer Research, 4(1), p.223.

[8] Kim, Y.E., Schmidt, E.M., Migneco, R., Morton, B.G., Richardson, P., Scott, J., Speck, J.A. and Turnbull, D., 2010, August. Music emotion recognition: A state of the art review. In Proc. ISMIR (pp. 255-266).

[9] Collier, W.G. and Hubbard, T.L., 2001. Musical scales and evaluations of happiness and awkwardness: Effects of pitch, direction, and scale mode. The American journal of psychology, 114(3), p.355

[10] Hevner, K., 1936. Experimental studies of the elements of expression in music. The American Journal of Psychology, 48(2), pp.246-268.

[11] Willimek, B., 2013. Music and Emotions-Research on the Theory of Musical Equilibration (die Strebetendenz-Theorie).

[12] Lochtefeld, J.G., 2002. The Illustrated Encyclopedia of Hinduism: AM (Vol. 1). The Rosen Publishing Group.

[13] Wieczorkowska, A.A., Datta, A.K., Sengupta, R., Dey, N. and Mukherjee, B., 2010. On search for emotion in Hindusthani vocal music. In Advances in music information retrieval (pp. 285-304). Springer Berlin Heidelberg

[14] Sharma, A.K., Panwar, A. and Chakrabarti, P., 2014. Analytical Approach on Indian Classical Raga Measures by Feature Extraction with EM and Naive Bayes. International Journal of Computer Applications, 107(6).

[15] Wang, A., 2014, May. The Expression of Emotion and Feeling in Music Composition. In International Conference on Education, Language, Art and Intercultural Communication (ICELAIC-14). Atlantis Press.

[16] Turner, K. and Freedman, B., 2004. Music and environmental studies. The Journal of Environmental Education, 36(1), pp.45-52.

[17] Chen, L., Zhou, S. and Bryant, J., 2007. Temporal changes in mood repair through music consumption: Effects of mood, mood salience, and individual differences. Media Psychology, 9(3), pp.695-713.

[18] Leaver, A.M., Van Lare, J., Zielinski, B., Halpern, A.R. and Rauschecker, J.P., 2009. Brain activation during anticipation of sound sequences. Journal of Neuroscience, 29(8), pp.2477-2485.

[19] Li, T. and Ogihara, M., 2005, March. Music genre classification with taxonomy. In Acoustics, Speech, and Signal Processing, 2005. Proceedings. (ICASSP'05). IEEE International Conference on (Vol. 5, pp. v-197). IEEE.

[20] Rentfrow P.J. and Gosling S.D., 2003. The Do Re Mi's of Everyday life: The Structure and Personality Co relates of Music Preferences. Journal od Personalities and Social Psychology, Vol. 84, No.6, 1236-1256.

[21] Delsing Marc J.M.H. et. al., 2008. Adolescent's Music Preference and Personality Characteristics. European Journal of Peronality, 22, 109-130.

[22] Colley, A., 2008. Young People's Musical Taste: Relationship With Gender and Gender-Related Traits1. Journal of applied social psychology, 38(8), pp.2039-2055.

[23] Rentfrow, P.J., Goldberg, L.R. and Levitin, D.J., 2011. The structure of musical preferences: a five-factor model. Journal of personality and social psychology, 100(6), p.1139.

[24] Von Hornbostel, E.M. and Sachs, C., 1961. Classification of musical instruments: Translated from the original german by anthonybaines and klaus p. wachsmann. The Galpin Society Journal, pp.3-29.

[25] Juslin, P.N. and Västfjäll, D., 2008. Emotional responses to music: The need to consider underlying mechanisms. Behavioral and brain sciences, 31(05), pp.559-575.

[26] Von Hornbostel, E.M., 1933. The ethnology of African sound-instruments. Comments on Geist und Werden der Musikinstrumente by C. Sachs. Africa, 6(02), pp.129-157.

[27] Langeheinecke, E.J., Schnitzler, H.U., Hischer-Buhrmester, M. and Behne, K.E., 1999. Emotions in the singing voice: Acoustic cues for joy, fear, anger, and sadness. The Journal of the Acoustical Society of America, 105(2), pp.1331-1331.

[28] Gobl, C. and Ní, A., 2003. The role of voice quality in communicating emotion, mood and attitude. Speech communication, 40(1), pp.189-212.

[29] Ali, S.O. and Peynircioğlu, Z.F., 2006. Songs and emotions: are lyrics and melodies equal partners?. Psychology of Music, 34(4), pp.511-534.

[30] Kim, M. and Kwon, H.C., 2011, November. Lyrics-based emotion classification using feature selection by partial syntactic analysis. In Tools with Artificial Intelligence (ICTAI), 2011 23rd IEEE International Conference on (pp. 960-964). IEEE.

[31] Wheeler B.L.,1983, A Psychotherapeutic classification of music therapy practices: A continuum of procedures. In Music Therapy Perspectives (1983) 1(2):8-12.

[32] Greasley, A.E. and Lamont, A.M., 2006, August. Music preference in adulthood: Why do we like the music we do. In Proceedings of the 9th international conference on music perception and cognition (pp. 960-966).

[33] Altenmüller, E., Marco-Pallares, J., Münte, T.F. and Schneider, S., 2009. Neural Reorganization Underlies Improvement in Stroke-induced Motor Dysfunction by Music-supported Therapy. Annals of the New York Academy of Sciences, 1169(1), pp.395-405.

[34] Hillecke, T., Nickel, A. and Bolay, H.V., 2005. Scientific perspectives on music therapy. Annals of the New York Academy of Sciences, 1060(1), pp.271-282.

[35] Nilsson, U., 2008. The anxiety-and pain-reducing effects of music interventions: a systematic review. AORN journal, 87(4), pp.780-807.

[36] Dileo, C. and Bradt, J., 2007. Music therapy: applications to stress management. Principles and Practice of Stress Management, 3rd ed. New York: Guilford.

[37] Bradt, J. and Dileo, C., 2009. Music for stress and anxiety reduction in coronary heart disease patients. The Cochrane Library.

[38] Kumar, C., Dutta, S. and Chakborty, S., 2014, March. Musical cryptography using genetic algorithm. In Circuit, Power and Computing Technologies (ICCPCT), 2014 International Conference on (pp. 1742-1747). IEEE.

[39] David Macdonald "Song from Pi", www.youtube.com.

[40] Tran, V., Music Composition using Artificial Intelligence.