Bridging Neuroscience and Music to create sound processes to probe human emotions

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Introduction: Emotions are a psychophysiological process triggered by conscious and/or unconscious perception of an object or situation and are often associated with mood, personality, and motivation [1]. We have applied the technique called Mandalas of Emotions (ME) to study human emotions. ME defines nine steps to welcome emotions and develop abilities for reflection, as follows: to identify, receive, accept, access, revisit, understand, resignify, reflect and release emotions [2]. This technique uses five colored, walnut-sized stones that are placed around the patient or on the person's abdomen for periods of 10 to 15 minutes, creating mandalas that correspond to five colors (green, red, yellow, white, black) and five emotions with its positive and negative correspondents (anger/comprehension, euphoria/compassion, concern/gratitude, joy/sadness, fear/courage) [2]. Variations in sounds may evoke what Huron [3] described as the expectation-related emotion response system, which arouse corresponding limbic activations and contrasts, and may enhance access to emotions. This project proposes the creation of 'sound processes', a term for systematized variations of sound, as an add-on tool to provide immersive experiences and enhance reflection during ME application.

Materials and Methods: This project establishes a bridge between composition of sound processes and emotions. This study designed a correspondence between the circumplex model of Russel (Western) [4] and the classification proposed by the Mandalas Emotions technique (Eastern), in order to create a heuristic for composition of sound processes for each mandala. The circumplex model of affection proposes that all affective states result from two fundamental neurophysiological systems, one related to valence (a continuum of pleasure-dislike) and another to arousal or alertness [4]. As described by Huron, in order to amplify the magnitude of emotional response, we created a sound composition with large contrasts between predicted and actual outcome [3].

Results: This is a theory-based creation of sound processes considering Russell's circumplex model [4] for each of the five Mandalas of Emotions. GSS and JM created five sequences of five minutes, varying the following sound parameters: scale material (minor, semitone, major, augmented), timbre (harsh, distorted, bright, mellow), tempo (very slow, slow, fast, very fast), sound level (low, moderate, loud), articulation (legato, non-legato, staccato) and time deviations (none, moderate) according to definitions of each mandala and its expected valence and arousal.

Discussion: According to the circumplex model, specific emotions arise from activation patterns within two neurophysiological systems associated with valence and excitation, along with cognitive interpretations and labeling of these central physiological experiences. Music composition applies the expectation-related emotion response system as described by Huron [3], which comprises imagination, tension response, prediction response, reaction response, appraisal response, in order to create absorbing sounds, as applied in this project.

Conclusion: Musical theories on creation of sound processes can be applied for study of emotions, through establishment of an add-on tool for therapeutic purposes based on a neuroscientific understanding of emotions. Further testing will be required to validate the tool.

References: [1] Russell JA, Psychological Review110:145–172, 2003. [2] Ling LH. Curitiba: Insight, 2013. [3] Huron, D. Sweet anticipation: music and the psychology of expectation. 2006. [4] Russell JA. Journal of Personality and Social Psychology 39:1161– 1178, 1980. [5] Wassermann et al, IEEE Computer Society 2003. 1070-986X/03.