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First Notes – Pass 4

Primary Sources

1. ***Measuring Cardiac and Electrodermal Responses of Emotional States and their Persistence***
   Participants rated their emotional state on the valence dimension selecting one out of nine adjectives (adapted from Plutchik, 2001). There were three adjectives related to positive mood (happy, excited, and euphoric), three to negative mood (sad, melancholic, and distressed), each one corresponding to a low, medium, or high-intensity level, respectively. We also selected three adjectives to rate neutral mood (neutral, indifferent, and unresponsive) . Although the valenced adjectives were rated as low, medium, and high intensities, participants were not informed about these intensities. The arousal dimension was measured immediately after valence, in which participants were requested to rate the arousal of the previously selected adjective on a 7-point analog scale about how they felt at that moment. One corresponded to "I feel very little aroused" and 7 to "I feel very much aroused." Moreover, to assess ratings of musical pleasantness, a 7-point scale was also included, with 1 meaning unpleasant and 7 meaning very pleasant. (**p.4**)

2. ***Embodied Cognition is not what you think it is***
   How can these resources be assembled so as to solve the task? Solving a specific task means creating a smart, task-specific device that can do the job (Bingham, 1988). To be more specific, it means assembling the required resources into a dynamical system that solves the task at hand as its behavior unfolds over time. Remember, these resources can be distributed over brain, body, and environment. Since we only have access to information about our bodies and the environment via perception, an embodied analysis must include a detailed account of the perceptual information used to connect the various resources (Golonka and Wilson, 2012). (**p.3**).

3. ***Event-related skin conductance responses to musical emotions in humans***
   In the validation of our material, arousal and valence of each stimulus was evaluated on a 10-point scale, from 1 to 10 (with 1 meaning 'very calming' and 10 'very stimulating' on the arousal scale; and with 1 meaning 'very unpleasant and 10 'very pleasant' on the valence scale…A significant effect of the emotion category was observed on the ratings of arousal

($F(3,36) = 139.6$, $P < 0.001$) and valence ($F(3,36) = 58.4$, P<, 0.0001). Both Fearful and happy melodies were rated more stimulating than those peaceful or sad melodies (Tuckey test, $P < 0.05$). In contrast, melodies associated with peacefulness and happiness were judged as more pleasant than melodies associated with sadness and fear (Tuckey test, $P < 0.05$). (**p. 146**)

4. ***Role of tempo entrainment in psychophysiological differentiation of happy and sad music?***
The happy excerpts were written in a major mode at a fast tempo (average Metronome Marking = 136 beats/min) (range: 110–154). In contrast, the sad excerpts were written in minor mode at an average slow tempo of 52.3 beats/min (Metronome Marking) (range: 40–69). Two other versions of the original excerpts were created with the Encore 3.0 software, by successively removing the pitch variations (rhythmic version), and pitch plus temporal variations (tempo version) in each melody (see sad and happy stimuli respectively in Appendix 1a and 1b). Six musical conditions, each comprising three excerpts, were presented to the participants: 1) 3 happy— original melodies (happy), 2) 3 sad—original melodies (sad), 3) 3 happy—rhythm (happy R), 4) 3 sad—rhythm (sad R), 5) 3 happy—tempo (happy T), 6) 3 sad-tempo (sad T). (**p. 19**)

5. ***Emotion elicitation during music listening: Subjective self-reports, facial expression, and autonomic reactivity.***
Pairwise correlations showed a high correspondence between subjective evaluations for shortened (obtained in this experiment) and longer original excerpts (Spanish normative values), in hedonic valence, energy arousal, and tension arousal ratings, $r(1) = .96$, .95, and .94, all $ps < .0001$, respectively. Similarly, strong correlations were found in all the ratings assigned to discrete emotions for shortened and longer excerpts. Specifically, significant associations were found for happiness, anger, fear, tenderness, and sadness, $r(3) = .98$, .97, .98, .89, and .93, all $ps < .0001$, respectively. (**Results**)

6. ***The Role of Peripheral Feedback in Emotional Experience With Music***
It was found that two groups of participants with different levels of induced arousal reported different emotional experiences: an exercise group, with elevated pulse rates, reported feeling a greater intensity of emotions congruent with the valence of the music than did a relaxation group. This result suggests that physiological arousal can influence listeners' experience of emotion in relation to music, as hypothesized. The association of elevated arousal levels with increased ratings of emotions congruent with the valence of the piece suggests that physiological arousal intensifies the dominant valence of the response and confirms the pattern found in nonmusical studies. These findings are consistent with

undifferentiated arousal models, which suggest that arousal facilitates performance of the dominant response. Failure to find any influence of physiological arousal on the energy (arousal) dimension of emotional response suggests that listeners do not use their body state as information about the emotional energy of the music. (**p. 94**)

7. ***Cardiovascular and respiratory responses during musical mood induction***
   Subjects reported experiencing the targeted mood at a stronger intensity than the other emotions following each induction. The mean rating given by the subjects on each clip to each question appears in Fig. 1, with bars indicating standard error of the mean. The ratings were lower on the sad clips than the fear or happy ones, representing a more mixed reaction to the sad and fear clips than the happy ones. Nevertheless, the questionnaire results indicate that the music clips were effective at eliciting the targeted mood. Analysis of the dial and questionnaire data is presented elsewhere (Johnsen, 2004); this study did not attempt to relate the dial and physiological responses. Few subjects reported familiarity with the music and no subject was able to correctly identify the source of any clip. (**p. 61-62**).

Secondary Sources

1. ***Music and Embodied Cognition: Listening, Moving, Feeling, and Thinking***
   Bodily representation refers to the bodily states and changes of state that occur in response to an external stimulus. These representations involve both nonmimetic and mimetic processes. Via MMI and MMA we represent an observed action in the musculoskeletal system and correlated portions of the brain, as well as in systems that control respiration, heart rate, and blood chemistry. To understand the role of MMI and MMA, we have to relate these representations to established meanings of five terms: perception, comprehension, conceptualization, recognition, and inhibition. (**p.40**).

2. ***Cross-Cultural Comparisons of Affect and Electrodermal Measures While Listening to Music***
   With regards to further investigation, our results suggest that there may have been differences between groups that did and did not present the HE response for familiarity with the stimulus, musical preference, age, and felt arousal. Specifically, we suggest that studies that incorporate other stimuli available in the EiM database and target these relationships specifically. In this and our other published work, musical preference has repeatedly demonstrated an effect on both self-reported and psychophysiological response. Studies that delineate the characteristics of this relationship would have important implications for the field of affective computing. (**p.7**).

3. ***Origin of Music and Embodied Cognition***
   Masataka and Perlovsky (2013) demonstrated that consonant music helps "everyday" decision-making in the presence of cognitive interfering evidence, whereas dissonant music increases interference effects. Is music limited to a few emotions, or does every musical phrase evoke a different shade of emotion? Researchers take opposite sides of this issue (Scherer, 2004; Cross and Morley, 2008; Juslin and Västfjäll, 2008; Zentner et al., 2008; Koelsch, 2011; Juslin, 2013). As reviewed in Perlovsky (2012a,b), this does not affect the main argument of this paper for embodiment of abstract concepts through music. (**p.2**)

4. ***Musical Interaction reveals music as embodied language***
   Secondly, movement can also disambiguate a metric structure. In a couple of experiments Phillips-Silver and Trainor (2005) let infants be passively bounced or adults bend their knees to an ambiguous rhythmic pattern. These subjects' oscillations were set to stress either the second or the third beat, thus rendering either a binary or a ternary meter, as was manifest by their answers afterward, when asked to recognize which of two different patterns they moved on (while the adults answered verbally, the infants were observed attending to their preferred pattern between those two). (**p.5**).

5. ***The Routledge Handbook of Embodied Cognition (pp. 81 – 89)***
   To sum up, the above examples show that some of the core cognitive phenomena associated with music perception require a foundation based on environmental constraints and particularities of the human body. Music perception, at levels that involve cognition, is not detached from the body or from the environment with which it interacts. At this point, it is important to state that there is little discussion about the fact that music perception involves the anticipation of emerging patterns. The question is more about the origins and the resources of anticipation, and to what degree that should be understood in relation to body and environment. Further arguments in favor of embodiment are based on recent findings that show dependencies of music perception on movement and emotions. (**p.83-84**).