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First Notes – Pass 2

Primary Sources

1. ***Measuring Cardiac and Electrodermal Responses of Emotional States and their Persistence***
   The literature on the persistence of the emotional effects after musical exposure on HR and SCL signals are scarce, yet critical. If an induced emotion persists after its induction, one may also expect to observe a variation in physiological responses of the subjects induced by music. One of the few studies investigating the persistence of emotions used four different valence–arousal film clips with its original soundtracks to induce positive high-arousal, positive low-arousal, negative high-arousal, and negative low-arousal. These mood inductions lasted 10 min; they were followed by a computer task (online shopping) aiming to observe whether induced emotions would last throughout the cognitive task. The authors reported lower SCL for the negative videos during the accomplishment of the task. In contrast, the HR results for those participants who watched the two positive videos did not present significant differences. Also, after approximately 9 min of the computer task, no self-reported arousal effects were observed (Gomez et al., 2009). (**p.3**)

2. ***Embodied Cognition is not what you think it is***
   What is the task to be solved? Embodied cognition solutions solve specific tasks, not general problems, so identifying how an organism produces a given behavior means accurately identifying the task it is trying to solve at the time. Taking things one task at a time opens up the possibility of smart solutions (Runeson,1977). Organisms using smart solutions solve particular problems using heuristics made possible by stable features of the task at hand, rather than general purpose rote devices which apply algorithms to solve the task. For common tasks, smart solutions are typically more efficient, more stable, and more economical than rote solutions (e.g., Zhu and Bingham, 2008, 2010). (**p.3**).

3. ***Event-related skin conductance responses to musical emotions in humans***
   The study of emotions induced by music has already benefited from the use of electrodermal indices. However, studies have typically monitored tonic levels of electrodermal activity over long-duration periods of music listening (30-s–6-min) [1,7], rather than the phasic, more transient changes occurring in response to brief stimulations (i.e. a few seconds). Tonic

changes in skin conductance level, such as those recorded over a few minutes during long-duration stimuli, and phasic changes in the form of SCRs occurring 1–4 s after discrete stimuli, may not reflect the same underlying physiological and psychological processes (**p. 145**)

4. ***Role of tempo entrainment in psychophysiological differentiation of happy and sad music?***

   Nevertheless, several experiments have demonstrated clear physiological differentiations between happy and sad music. In general, happy excerpts elicit larger skin conductance responses (Khalfa et al., 2002), faster heart and respiration rates relative to sad excerpts. In a study where participants listened to 3 min of sad, fearful and happy music, happiness and sadness were differentiated by the electrodermal conductance level (reflecting activation of the sympathetic nervous system), and by cardio-respiratory responses (Krumhansl, 1997). The heart rate was slower during sad music than when listening to happy music, the diastolic blood pressure increased more for sad than happy excerpts, and the breathing rate increased less for sad than happy music. (**p. 18**)

5. ***Emotion elicitation during music listening: Subjective self-reports, facial expression, and autonomic reactivity.***

   Regarding the methodological diversity among studies, one important caveat influencing the comparability of results is the duration of music excerpts, which have been ranging between 15 and 30 s (Brushan & Asai, 2018; Gomez & Danuser, 2004) and even more than 60 s (Baumgartner et al., 2006; Bullack et al., 2018; Etzel et al., 2006; Guhn et al., 2007; Lundqvist et al., 2009; Roy et al., 2009; Sammler et al., 2007). Interestingly, only a few studies have used music stimuli with durations shorter than 15 s (Dellacherie et al., 2011; Gringas et al., 2015; Khalfa et al., 2002; Vieillard et al., 2012), despite being the standard procedure in other stimuli modalities such as affective pictures (IAPS: Bradley et al., 2001) or emotional sounds (IADS: Bradley & Lang, 2000). (**middle of introduction**).

6. ***The Role of Peripheral Feedback in Emotional Experience With Music***

   What, then, is the process by which body state can influence emotional experience? Philippot et al. (2002, pp. 606–607) provide a useful conceptualization of emotion and body states in terms of three strands of thinking. *The first conception* of emotion and body state, the "undifferentiated arousal model," argues that arousal feedback can intensify emotional states and that the arousal-emotion relationship is mediated by causal attributions regarding the source of the arousal (Reisenzein, 1983, p. 258; Schachter, 1964) but does not differentiate between different emotions. *The second conceptualization*, the "cognitive appraisal model," suggests that body changes are the result of cognitive appraisal or action

readiness (Frijda, 1986). This suggests that the body changes that accompany emotion feeling states are differentiated according to the kind of appraisal or the kind of response readiness required to deal with the environment (Frijda, 1986, p. 165). *The third conception*, which Philippot et al. term the "central network model," argues that the different components that make up emotion are connected by a neural or cognitive network. This group of theories suggests that body changes are differentiated according to the emotion experienced. (**p. 83-84**)

7. ***Cardiovascular and respiratory responses during musical mood induction***
   The present study expands the literature of psychophysiological measurements of musically induced emotions by examining individual changes in physiological activity during the stimuli and coordination of respiration with the music. The goal of the present study was to determine whether consistent cardiovascular and respiratory changes occur while subjects experience emotions induced by music. We chose our music stimuli in a pilot study based on its ability to reliably induce reports of strong happiness, sadness, and fear in the listeners. We hypothesized that (a) the induction of emotion would be associated with reliable changes in heart rate and respiration, and that (b) these changes in heart rate and respiration would differ systematically between the different induced moods. It was expected that changes would be consistent with those reported in previous studies: decreased respiration and heart rate during sadness compared to fear or happiness inductions, with the measures highest on the happiness inductions and intermediate during fear. (**p. 59**).

Secondary Sources

1. ***Music and Embodied Cognition: Listening, Moving, Feeling, and Thinking***
   I will refer to overt mimetic behavior as mimetic motor action (MMA), and for the relevant muscle-related brain processes that do not manifest in overt actions I will use the term mimetic motor imagery (MMI): mimetic for imitative, motor for muscle related, and imagery for "thought," "imagination," or "mental representation." I intend imagery to include not only voluntary and conscious forms, but especially those forms that occur automatically and with or without our awareness. The involuntary and nonconscious forms of MMI are in some respects the most significant in the construction of musical meaning. (**p.12**).

2. ***Cross-Cultural Comparisons of Affect and Electrodermal Measures While Listening to Music***

In 2007, Grewe et al. [11] utilized EDA from 38 participants (the majority of whom were musicians), to study pieces that could evoke chills. EDRs were compared against self-report measures (participants pressed a button when experiencing a chill), and segments in which both were not observed were discarded. Pieces were selected by the researchers and participants, with no emotion classifications. They found that chills coupled with EDRs are relatively rare events, supporting previous findings from [12], [13], and that the musical event that triggered most chills was the entrance of a singing voice. (**p.3**).

3. ***Origin of Music and Embodied Cognition***

Does music help in overcoming CD? Masataka and Perlovsky (2012a,b) have reproduced the above experiment with music in the background and observed that the toy is not devalued. Another experiment demonstrated that academic test performance may improve while listening to music. Perlovsky et al. (2013) demonstrated (1) that students allocate less time to more difficult and stressful tests (as expected from CD theory), and (2) with music in the background students can tolerate stress, allocate more time to stressful tests, and improve grades. These experiments confirmed the hypothesis that music helps in overcoming CD. It is likely that music emerged and evolved for a fundamental cognitive function: music makes the accumulation of knowledge and human evolution possible. (**p.2-3**).

4. ***Musical Interaction reveals music as embodied language***

The two components are usually called musicality and music: "Musicality in all its complexity can be defined as a natural, spontaneously developing set of traits based on and constrained by our cognitive and biological system. Music in all its variety can be defined as a social and cultural construct based on that very musicality" (Honing et al., 2015, p. 2, see also Huron, 2001). Life and social sciences often focus on the social nature of music (and language alike). In biology, for example, the three main evolutionary hypotheses about music, i.e., sexual selection (Miller, 2000; Fitch, 2006), parent-infant bond (Dissanayake, 2008; Malloch and Trevarthen, 2009) and group cohesion (Freeman, 2000; Dunbar, 2012), stress its intrinsically social character. Neurobiology thereby stresses the neuronal and hormonal underpinning of musicality. In line with these approaches, the present paper aims to suggest that the proper way to capture the social interactive nature of music (and, before it, musicality), is to conceive of it as an embodied language, rooted in culturally adapted brain structures. (**p.2**).

5. ***The Routledge Handbook of Embodied Cognition (pp. 81 – 89)***

In this case the sequence D7-D7- Dmin7 culminating to G7 creates tension, while the G7 going to Cmaj7 creates a relaxation. In short, perceptive processes evoke anticipations that lead to the emergence of tensions and relaxations, which ultimately lock into practices that give rise to signification, such as mood regulation, bonding and aesthetic experience. (**p.82**).