



Comment

Evolutionary considerations on complex emotions and  
music-induced emotions  
Comment on “The quartet theory of human emotions: An integrative  
and neurofunctional model” by S. Koelsch et al.

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Recent efforts to uncover the neural underpinnings of emotional experiences have provided a foundation for novel neurophysiological theories of emotions, adding to the existing body of psychophysiological, motivational, and evolutionary theories. Besides explicitly modeling human-specific emotions and considering the interactions between emotions and language, Koelsch et al.’s original contribution to this challenging endeavor is to identify four brain areas as distinct “affect systems” which differ in terms of emotional qualia and evolutionary pathways [1]. Here, we comment on some features of this promising *Quartet Theory of Emotions*, focusing particularly on evolutionary and biological aspects related to the four affect systems and their relation to prevailing emotion theories, as well as on the role of music-induced emotions.

The *Quartet Theory*’s emphasis on human emotions is a welcome feature. Nevertheless, we find the claim that complex social and moral emotions are uniquely human to be questionable in the face of recent literature reporting on a broad repertoire of complex emotions in animals [2,3]. Moreover, despite differences in the relative size of its various areas, the orbitofrontal cortex of monkeys and humans appears to have a similar architecture and connectivity with other parts of the brain [4]. However, current empirical evidence for a Theory of Mind in non-human primates remains conflicting [5]. Future research might consider differences between animals and humans on the basis of Haidt’s classification of moral emotions [6], which distinguishes between “Other-Condensing Emotions” (such as anger, contempt and disgust), “Self-Conscious Emotions” (shame and guilt), “Other-Suffering Emotions” (distress and empathy), and “Other-Praising Emotions” (gratitude). A further step would be the integration of basic and complex emotions in animals and humans under a single theoretical framework, acknowledging that social emotions are likely more developed and prevalent in higher primates and especially in humans. This approach would be in line with evolutionary theories of emotion asserting that complex emotions encountered in social settings derive from interactions between basic emotions [7].

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The *Quartet Theory* introduces a useful distinction between emotions based on their capacity to be satiated. We would add that physiological feedback (bodily homeostasis) regulates the satiation associated with diencephalon-generated emotions, whereas, in the case of attachment-related affects mediated by the hippocampus, feedback is provided by conspecifics (in the form of group inclusion or bonding), and more generally by the outer environment. Indeed, Plutchik [7] views all emotions as means to regulate a general “behavioral homeostasis”, seeking to maintain the organism in a state of equilibrium in the face of physiological or environmental (including social) disturbances.

Although the inclusion of language as an essential component of the *Quartet Theory* is appealing, it apparently singles language out as the only important medium involved in the regulation and communication of emotions in humans, relegating music to a subsidiary role. To be sure, language plays a central role due to its capacity to convey semantic meaning and to report subjective feelings. Moreover, the authors address the topic of musical emotions at length, noting that music may transmit emotions more directly than language. Nevertheless, we would go further and argue that, with respect to the regulation and communication of emotions, music is at least equal, if not superior, to language, as has already been proposed in influential theories on the origins of music and language [8]. A case in point is music therapy, in which music is often seen as a more appropriate means of emotional communication than language [9].

Another point that the *Quartet Theory* underscores is that affects traditionally viewed as opposed, such as “relaxed” versus “aroused”, are not necessarily mutually exclusive, a view that seems plausible if indeed different affect systems are responsible for these emotions. Similarly, in the case of musical emotions, sad music can be experienced as pleasant [10]. Unlike dimensional models, the *Quartet Theory* offers a way to deal with such apparent paradoxes. Furthermore, dimensional models also neglect the fact that, at least in the case of voice [11] and music [12], some affects, such as arousal, appear to be more strongly determined by the characteristics of the stimulus than others, such as pleasantness or valence, which may be determined to a larger extent by culture, social norms, and personality traits. Interestingly, if we speculate that “stimulus-determined” emotions are associated with different affect systems than “individual-specific” emotions (the latter being presumably linked to phylogenetically more recent systems such as the hippocampus and the orbitofrontal cortex), the *Quartet Theory* would seem to be able to accommodate this distinction handsomely.

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