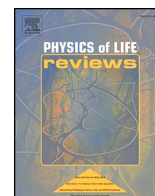


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I gotta feeling: Beyond major and minor dichotomy in music emotions. Comment on “The major-minor mode dichotomy in music perception” by Giulio Carraturo, Victor Pando-Naude, Marco Costa, Peter Vuust, Leonardo Bonetti, Elvira Brattico

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ARTICLE INFO

Communicated by Prof. Jose Fernando Fontanari

Carraturo et al. synthesized a wide array of psychological and neuroscientific findings on major-minor mode perception, offering a comprehensive overview of how these musical structures shape emotional responses. While highlighting the complexity of this phenomenon and acknowledging the interplay between psychoacoustic features, individual differences, and culture, they underscore how the major-minor dichotomy has become one of the main frameworks for studying musical emotions, particularly in its association with happiness and sadness. This emphasis reflects both historical tendencies in Western tonal music and its use in experimental implementations, linking major modes with positive affect and minor modes with negative affect.

However, and interestingly, this work raises the question of whether this binary classification fully captures the nuances of emotional responses to music. We here address this issue through three key points: (1) potential confounds and learned associations, (2) the impact of task design, and (3) the interpretation of neural correlates. This will lead to broader considerations about how musical emotions are conceptualized and studied.

(1) From a methodological standpoint, a key issue is whether major-minor perception constitutes a distinct and isolable construct, or is tied to broader musical and contextual features. Although music theory gives clear definition of modes, listeners typically encounter them within complex musical sequences, where they co-occur with other attributes, such as tempo, harmonic complexity, timbre, and dynamics. These elements do not merely accompany mode, they rather actively contribute to shaping its expressive effect. Consequently, mode perception is rarely experienced in isolation, but rather embedded within a network of cues that jointly shape emotional experience. This co-occurrence makes it difficult to separate the emotional impact of mode from that of other expressive features. For instance, in Western tonal music, major modes are often presented with faster tempi and brighter timbres, while minor modes are commonly associated with slower tempi and darker timbres. Through repeated exposure, listeners internalize these patterns via implicit statistical learning, leading to stable associations between certain mode-feature combinations and emotional meanings,

DOI of original article: <https://doi.org/10.1016/j.plrev.2024.11.017>.

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Received 16 May 2025; Accepted 16 May 2025

Available online 17 May 2025

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such as happiness or sadness. Mode-based emotional associations are thus not necessarily intrinsic to the modes themselves, but reflect learned patterns that become perceptually salient through experience. This learning perspective also highlights the role of cultural context: if mode-emotion links arise also from exposure to culturally typical musical systems, they may not generalize across cultures and traditions. Evidence from non-Western musical systems shows that emotional meaning often relies on other features, such as melodic contour, ornamentation, tempo, or microtonal inflection, rather than the major-minor distinction (see [1]). And conversely, non-Western cultures (e.g., the native African population Mafa) listening to Western tonal music use other cues than mode to classify major excerpts as happy, just like Western listeners [2]. Accordingly, a more cross-culturally informed approach is crucial to assess the validity of mode-emotion mappings and to avoid assuming universality where cultural conventions may differ.

(2) A further consideration concerns the role of task design in shaping conclusions about major-minor perception. The authors cite findings showing that musicians are more sensitive to major-minor distinctions than nonmusicians, yet this effect may be partly attributable to the specific tasks used in these experiments. Nonmusicians, for instance, may struggle with explicit mode categorization, but still respond to major-minor differences in affective evaluations [3]. This influence of task demands aligns with other findings in music perception research, where nonmusicians reliably respond to musical syntax and tonal regularities without being able to verbalize them [4,5]. Similarly, listeners may form internalized knowledge of mode-emotion associations through repeated exposure, even without explicit knowledge of mode. In other words, nonmusicians may not *know* the mode, but they have learned how it tends to feel. This influence of investigation methods raises the question of whether observed differences in performance reflect true perceptual insensitivity or merely differences in conceptual understanding and explicit labeling. To fully assess the individual sensitivity to major and minor modes, it is therefore critical to employ indirect investigation methods, such as affective ratings, priming paradigms, or neuro-physiological measures, which go beyond explicit mode identification.

(3) The neural evidence presented in the review raises questions regarding the specificity of neural correlates related to the processing of major-minor modes. Neural activations linked to major-minor perception consistently overlap with broader affective and reward-related circuits rather than revealing distinct or dedicated mechanisms. These findings suggest that mode might be processed as part of domain-general systems involved in emotional appraisal, memory, learning and evaluation—reinforcing the hypothesis that emotional responses are dynamically shaped by multiple interacting factors. Behavioral and neuroscience research also highlights the central role of prediction in shaping emotional responses to music, independently of mode (e.g., [6,7]). Studies have consistently shown that affective responses often reflect the fulfillment or violation of temporal and tonal expectations and are supported by the dopaminergic transmission in the reward system (e.g., [8–10]). Major-minor mode structures may thus act as one among several cues contributing to listeners' predictive models, rather than functioning as direct emotional triggers.

The methodological complexities surrounding the investigation of major-minor mode perception ultimately raise theoretical questions about how music induces emotions. The long-standing association of major mode with happiness and minor mode with sadness suggests a straightforward mapping of music to discrete emotional categories. However, findings increasingly challenge this binary view, revealing a broader spectrum of emotional responses with diverse underlying mechanisms (see [11]). Experimental evidence shows that musical emotions are experienced by both expert and naïve listeners beyond categorical labels, and can be described along multiple dimensions that remain stable across time (test-retest) and across level of musical expertise [12]. If major and minor modes are not universally hardwired to specific emotions, but rather emerge through learned associations, then the investigation of musical emotions will benefit from moving beyond static mappings of musical features to emotional labels. While useful for understanding music-driven basic emotions such as happiness or sadness, a dichotomic approach may hinder explanations of more profound music-related aesthetic states, such as intense pleasure, awe, or transcendence.

Taken together, the here outlined concerns challenge the view that major and minor modes operate as isolated, direct emotional cues. Rather than reflecting an intrinsic, universal property of music, their emotional associations likely emerge from the interplay of structural features, cultural exposure, and listeners' experience.

Moving beyond dichotomies and adopting ecologically more valid approaches that reflect the dynamic and context-dependent nature of musical emotion will substantially enrich our understanding of this fundamental dimension of human experience and its associated well-being. The authors' focus on the major/minor distinction represents a valuable starting point for re-examining long-standing assumptions in the field. Building on this foundation, future research will benefit from exploring a wider range of emotional responses and employing implicit investigation measures to capture listeners' perceptions beyond explicit theoretical labels, and accounting for inter-individual variability not only in terms of musical training, but also in music-related traits, such as musical (an) hedonia or amusia. These extensions will lead to more refined models of musical emotions and enhance the development of targeted applications, including personalized music-based interventions in clinical settings.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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