

## CHAPTER 13

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# EMOTIONAL REACTIONS TO MUSIC

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## INTRODUCTION

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It is often viewed as one of life's great mysteries that music, which seems to consist of only abstract sound sequences, may arouse intense emotions in listeners. Why does music touch us so deeply? In this chapter, I shall consider the best possible answers to this question that the psychology of music can currently provide. Although the study of music and emotion is clearly a multidisciplinary enterprise (Juslin and Sloboda, 2010, pt. II), psychology may be uniquely situated to model the process that mediates between music and emotion.

First, we need to make a distinction between *perception* and *induction* of emotions, which is sometimes referred to as the “locus” of the emotion (Juslin and Zentner, 2002, p. 11). We may simply *perceive* (or recognize) an emotion expressed in the music or we may actually *feel* an emotion in ourselves. This ancient distinction is often, although not always, made in modern studies (Gabrielsson, 2002). It seems, however, that listeners are able to distinguish between perception and induction of emotions, if properly instructed (Zentner, Grandjean and Scherer, 2008).<sup>1</sup> The distinction matters because different mechanisms and emotions may be involved depending on the process.

This chapter focuses on induction of emotion, whereas perception of emotion is discussed in Gabrielsson, Chapter 14 and Juslin and Lindstrom, 37, this volume. However, it is important to note that emotion constitutes only one out of several aspects of music experience, which also comprises physical, behavioral, perceptual, cognitive, existential, and developmental aspects (Gabrielsson, 2011). Indeed, we often hear music without feeling any emotion at all (Juslin, Liljeström, Västfjäll, Barradas and Silva, 2008). Yet, the emotions that *do* occur belong at center stage in any account of the attraction that music holds for most people.

<sup>1</sup> The precise instructions were “please indicate the frequency at which you *feel* the emotional states described by the terms” and “please rate the frequency at which you *perceive* the emotional state described by the terms” (p. 498).

## THE DEFINITION AND MEASUREMENT OF EMOTIONS

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Emotions belong to the field of affect (e.g., Oatley, Keltner and Jenkins, 2006, pp. 29–31). *Affect* is generally used as an “umbrella term” which covers various affective phenomena. The defining feature is *valence* (i.e., the evaluation of an object, person, or event as being positive or negative). Most researchers also require a certain degree of *arousal* in order to distinguish affect from purely cognitive judgments. Accordingly, musical affect could comprise anything from *preference* (e.g., liking) and *mood* (a mild, objectless, and long-lasting affective state) to *aesthetic judgments* (see “Towards a Unified Framework: BRECVEMA”) and *emotions* (defined below).

The word *emotion* comes from a Latin word which means “to move” or “to stir up” (Plutchik, 1994). What, then, does it entail to become “moved” by an event? Whereas lay people might think of emotions mainly in terms of the phenomenological *feelings* they engender, emotion researchers tend to define emotions in terms of a wider range of components that are all part of an emotional episode. Emotions are thus commonly described as brief (lasting minutes to a few hours) but intense reactions to (potentially) important events in the external or internal environment that involve *cognitive appraisals* (e.g., you appraise a situation as “dangerous”), *subjective feelings* (e.g., you feel “afraid”), *physiological responses* (e.g., your heart begins to beat faster), *emotional expressions* (e.g., you cry), and *action tendencies* (e.g., you run away). These components are often “synchronized” during an emotional episode (Mauss, Levenson, McCarter, Wilhelm and Gross, 2005). Changes in the intensity, quality, and complexity of an emotion might occur from moment to moment, and such changes can be captured in terms of shifts along such emotion dimensions as *arousal* and *valence* (Russell, 1980). However, emotions may also be analyzed in terms of qualitatively distinct categories (e.g., *joy*), which remain throughout an episode (Izard, 1977; see also Lench, Flores and Bench, 2011).

## PRIMARY ISSUES AND METHODS

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The fundamental issues to address in the study of music and emotion are: Does music induce emotions? If so, which emotions does music usually induce? How exactly does music induce those emotions? Are emotions to music different from other emotions? How may scientific knowledge about musical emotions be used in applications for the benefit of greater society?

Although much work remains, the field has made significant progress in answering the above questions during the last two decades. These advances have come through the use of a variety of research methods which include experiments (Rickard, 2004), questionnaire studies (Juslin, Liljeström, Laukka, Västfjäll and Lundquist, 2011), experience sampling (Sloboda, O’Neill and Ivaldi, 2001), interviews (DeNora, 2000), and brain imaging (Koelsch, Fritz, von Cramon, Müller and Friederici, 2006). Since each method has both advantages and disadvantages, the best overall approach may be to combine various methods in a kind of “method triangulation.”

For instance, one useful approach has integrated different methods to achieve a (more or less) representative sampling of listeners (questionnaire), situations (experience sampling

method), and pieces of music (experiments) (Juslin and Sloboda, 2010, pp. 607–608). This approach was based on the idea that musical emotions reflect a complex interplay between the *listener*, the *music*, and the *situation* (Gabrielsson, 2001), henceforth referred to as “the musical event.”

## DOES MUSIC INDUCE EMOTIONS?

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Although most musicians and listeners would seem to take the emotional powers of music for granted, it has been the matter of some controversy whether music really can evoke emotions (see Kivy, 1990). Strong empirical evidence has been slow to emerge, although an increasing number of studies have now obtained evidence in terms of various emotion components, such as self-reported feelings (Gabrielsson, 2001), physiology (Nyklíček, Thayer and Van Doornen, 1997), activation of brain areas associated with emotions (Blood and Zatorre, 2001); emotional expression (Witvliet and Vrana, 2007); and action tendencies (Fried and Berkowitz, 1979).

Most studies in the field have looked at only one of the emotion components (e.g., self-report or physiological response). To enhance the validity of conclusions concerning the occurrence of emotional reactions, Scherer and Zentner (2001, p. 363) suggested the more “conservative” criterion that an emotion to music should involve “evidence of a synchronized response of all or most organismic subsystems.”

Establishing that some degree of “synchronization” has occurred is highly useful, because it enables the researcher to distinguish arousal of emotions from mere perception of emotions, which is still a problem in this field. A number of recent studies have presented evidence of “synchronization” (e.g., Lundqvist, Carlsson, Hilmersson and Juslin, 2009). This can involve, for instance, a combination of self-reported *happiness* with an increase in zygomatic (smile) muscle activity (positive valence) and raised skin conductance (high arousal). As argued by James (1884), the physiological reaction may be the aspect that gives emotions their distinct phenomenological feelings. Results show that more intense emotions to music involve more pronounced physiological responses (Rickard, 2004), including “chills” (Panksepp 1995; see also Hodges, Chapter 12, this volume).

In cases where “synchronization” has *not* been observed, researchers have been inclined to interpret this as evidence that musical emotions do not generally lead to “synchronization” (Grewe, Nagel, Kopiez and Altenmüller, 2007), though a more parsimonious (and plausible) explanation is that these particular studies simply failed to evoke strong emotions in listeners. It is not obvious that emotions will be readily aroused in artificial laboratory environments featuring unfamiliar and/or experimenter-selected music. It is well known that self-report is subject to “demand characteristics,” the total sum of cues that convey the researcher’s hypothesis to the subject and thus can influence the subject’s behavior (Orne, 1962), which could lead the listener to report an emotion, when in fact there is none. It is for precisely this reason that it is advisable to combine self-report with measures that are less sensitive to demand characteristics.

Some researchers have suggested that music can only arouse moods. However, the available empirical evidence strongly suggests that what listeners experience are emotions, rather than just moods. Besides the fact that the induction process involves a specific

“object” (a musical event), the states last for a fairly short duration (Scherer, Zentner and Schacht, 2002), have a relatively strong intensity (Juslin et al., 2008), and include autonomic responses (Krumhansl, 1997). All these features are believed to be associated with emotions, rather than moods, as generally defined (Beedie, Terry and Lane, 2005).

## WHICH EMOTIONS DOES MUSIC INDUCE?

An important step in developing a theory of music and emotion is to obtain a description of the emotions music typically arouses. The *prevalence* of musical emotions (i.e., the relative frequency of occurrence in the population of interest) can only be estimated by field studies in a natural environment. The results accumulated to date are relatively clear-cut and permit the following five conclusions: (1) music can arouse a wide range of emotions (Gabrielsson, 2001, Table 19.2); (2) music arouses mostly positive emotions (Juslin et al., 2008, 2011); (3) music may arouse both basic (e.g., *sadness*, *happiness*, *interest*) and complex (e.g., *pride*, *nostalgia*) emotions (Juslin et al., 2011); (4) the most frequent emotional states across studies include the following categories: *calm-relaxation*, *happiness-joy*, *nostalgia-longing*, *interest-expectancy*, *pleasure-enjoyment*, *sadness-melancholy*, *arousal-energy*, *love-tenderness*, *pride-confidence*, as well as different synonymous terms (Juslin and Laukka, 2004; Juslin et al., 2008, 2011; Sloboda, 1992; Wells and Hakanen, 1991; Zentner et al., 2008); and (5) “mixed” emotions (e.g., *joy* and *sadness*) occur, although in a minority of the episodes (e.g., 13% in Gabrielsson, 2001; 11% in Juslin et al., 2011).

The emotions evoked have been conceptualized in terms of both “everyday” and “aesthetic” emotions (Juslin, 2013). Although several authors use the term “aesthetic emotion” simply to refer to *all* emotions to all art objects (e.g., music, theater, painting) without implying that the emotions themselves are of a particular kind, the term has also been used more narrowly to refer to a “special” emotion thought to be aroused (only) when perceivers are engaged with artworks. This can be contrasted with the view that art evokes “everyday emotions” that are similar to other emotions experienced in daily life: while the circumstances surrounding art perception may be special, the emotions experienced are a subset of the ordinary emotions.

Are there emotions unique to music? Careful consideration of the empirical findings reported so far reveals that the emotions claimed by some scholars to be “aesthetic emotions” unique to music (e.g., *wonder*, *tenderness*, *nostalgia*, *tension*) can also occur in other everyday contexts that do not involve music, or even works of art more generally. Thus, the notion that there are emotions had when and only when a work of art is apprehended aesthetically is not supported. However, Juslin (2013) argues that the term “aesthetic emotions” can still retain its usefulness, if we define “aesthetic emotions” as emotions caused specifically by the aesthetic properties of a work of art (e.g., admiration for the skill of the artist or the beauty of the composition). That is, “aesthetic emotions” can be distinguished by their *causes* (i.e., aesthetic judgments; see “Towards a Unified Framework: BRECVEMA”), rather than by their unique states. According to this view, music can evoke both “everyday emotions” and “aesthetic emotions,” although the former may be more common.

The occurrence of emotions depends in part on the *social context*. Juslin et al. (2008) offered the first data on prevalence of specific emotions in response to both musical and nonmusical events using a representative sample of everyday situations during a two-week

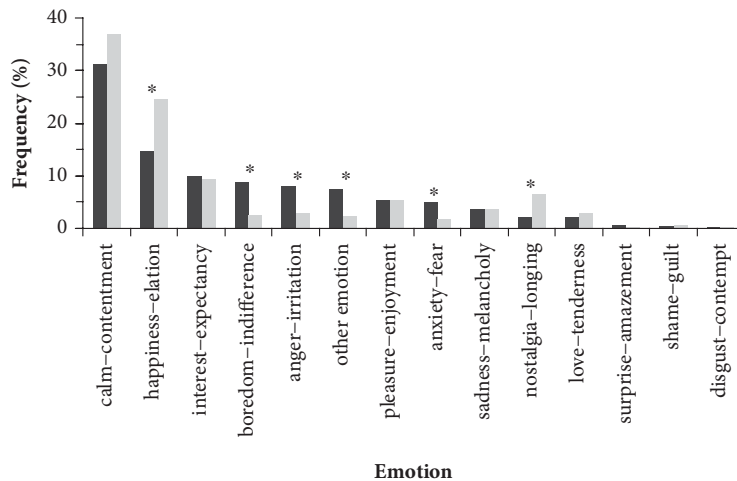


FIGURE 13.1 Relative frequency (in percent) of felt emotions for nonmusical emotion episodes (dark bars) and musical emotion episodes (light bars) during a two-week period as indexed by experience sampling in everyday life.

(\* $p < .05$ )

(Reproduced from Patrik N. Juslin, Simon Liljeström, Daniel Västfjäll, Gonçalo Barradas, Ana Silva, An experience sampling study of emotional reactions to music: Listener, music, and situation, *Emotion*, 8(5), pp. 668–683, DOI: 10.1037/a0013505 © 2008, American Psychological Association.)

period. Figure 13.1 shows the relative frequency of 14 emotions. As can be seen, *happiness* and *nostalgia* were more common in episodes that included music, whereas *anger*, *boredom*, and *anxiety* were more common in nonmusical episodes. However, emotions such as *happiness*, *pleasure*, and *anger* occurred commonly in social settings (e.g., listening with friends), whereas others, such as *calm*, *nostalgia*, and *sadness*, occurred commonly in solitary settings (e.g., listening alone). Although few of the musical episodes in this study (7%) involved “live music,” it appears that some of our most intense experiences might occur during concerts (Lamont, 2011), where the social setting is also conducive to evoking *collective emotions* (von Scheve and Salmela, 2014).

In interpreting all these results, the difficulties involved in translating emotional experiences into verbal labels must be kept in mind. The issue of verbalization goes even further than that: language also affects the way we *think* (Athanasopoulos and Bylund, 2013). Thus, we are to some extent imprisoned in culture-specific English concepts in current theory and research (Wierzbicka, 2013).

## HOW DOES MUSIC INDUCE EMOTIONS?

“Music arouses strong emotional responses in people, and they want to know why” (Dowling and Harwood, 1986, p. 202), but a literature search revealed that few studies make any attempt to test theories about underlying causes (Juslin and Västfjäll, 2008). In general, two approaches have been adopted in exploring possible causes of musical emotions.

One approach has been to map the contributing features in the music, the listener, and/or the context. Most studies have focused on musical features. Implicit in much of this work is the notion that musical features “directly” cause emotions (Gomez and Danuser, 2007). However, the story is more complex. The belief that objects or events “directly” cause our emotions is called the “nativist fallacy” (Silvia, 2012). It appears particularly common in music research, probably because we tend to think of music as abstract sound sequences, devoid of semantic meaning. Thus, many scholars have aimed to obtain direct links between surface features of the music and evoked emotions. But such correlations do not constitute an explanation: they simply move the burden of explanation from one level (“Why does the second movement of Beethoven’s *Eroica* symphony arouse sadness?”), to another level (“Why does a slow tempo arouse sadness?”). This approach confuses (re-)description with explanation. More crucially, a “direct” approach fails to explain why different listeners react differently to the same music (Gowensmith and Bloom, 1997).

A second research approach, in contrast, aims to explain both why a musical event will evoke an emotion (“elicitation”) and why the aroused emotion is of a specific kind (“differentiation”). The psychological process through which this is achieved is referred to here as the underlying *mechanism*. The term “mechanism” refers to a functional description of what the mind “does” in principle (e.g., “retrieving a memory”), which should not be confused with its implementation in the brain or with the phenomenological experience it seeks to explain. The process involves stored and incoming information, resulting from a dynamic interaction with the musical event (as defined in “Primary Issues and Methods”).

In research outside the music domain, the most commonly discussed mechanism is *cognitive appraisal*. This refers to a process whereby an emotion is aroused in a person because an event is interpreted as having important implications for the person’s goals, plans, or motives (e.g., in terms of goal congruence, coping potential, or compatibility with social norms). However, distinguished appraisal researchers have long acknowledged the inability of appraisal theory to explain musical emotions (Ellsworth, 1994, p. 195). The problem is that when we listen to music, only rarely does the music per se have implications for our goals or plans in life.

Because appraisal theories are insufficient, many authors have suggested other mechanisms. Leonard Meyer (1956) was arguably the first modern scholar to understand the essential role of psychological theory in explaining relationships between musical structure and emotional response, and offered a useful theory of “musical expectancy.” Dowling and Harwood (1986) argued that “conditioned responses” form part of the composer’s toolkit for evoking emotion and provided several examples of this process. Baumgartner (1992) suggested that “episodic memory” plays an important role in emotional responses to music, and provided survey data to back up the claim. Juslin (2000) proposed that “contagion” (discussed further below) may explain many emotions to music. Sloboda and Juslin (2001) and Scherer and Zentner (2001) discussed some of the above mechanisms, but did not try to develop a combined framework featuring a set of hypotheses.

## Towards a Unified Framework: BRECVEMA

An ambitious attempt to specify underlying mechanisms was made in the mid-2000s (Juslin, 2005, 2013; Juslin and Västfjäll, 2008), and resulted in the “BRECVEMA framework,”

which currently includes eight mechanisms, in addition to the “default” mechanism, *cognitive appraisal*.

An evolutionary perspective on human perception of sounds suggests that the survival of our ancient ancestors depended on their ability to detect patterns in sounds, derive meaning from them, and adjust their behavior accordingly. Proceeding from this assumption, it is theorized that there are multiple induction mechanisms, consisting of a number of more or less distinct “brain networks” which developed gradually and in a particular order during evolution—from simple reflexes to complex judgments. Different mechanisms rely on distinct types of mental representation<sup>2</sup> (e.g., associative, analogical, and sensori-motoric) which serve to guide future action. The representations are “intentional,” in the sense used by philosopher Franz Brentano (1973): they are always *about* something (even if the “beliefs” of each mechanism may not be consciously available). They have in common that they can be “triggered” by information in a musical event (Juslin, 2013).

*Brain stem reflex* refers to a process whereby an emotion is evoked in the listener because one or more simple acoustic features exceed a certain cut-off value, for which the auditory system has been designed to quickly alert the brain to a potentially important event. In music this can involve sounds that are sudden, loud, or dissonant, or that feature accelerating patterns. Brain stem reflexes are quick, automatic, and unlearned. A famous example that may induce a brain stem reflex in a listener given a certain sound level is the kettledrum stroke in Joseph Haydn’s Symphony No. 94 (2nd movement). Brain stem reflexes typically increase *arousal* and induce feelings of *surprise* in the listener (Juslin, Harmat and Eerola, 2014). The term “brain stem reflex” is apt as it highlights that the process can occur very early in the auditory processing (e.g., in the inferior colliculus of the brain stem; Brandao, Melo and Cardoso, 1993) before a more elaborate classification of the sound event has taken place.

*Rhythmic entrainment* refers to a process whereby an emotion is evoked by a piece of music because a powerful, external rhythm in the music influences some internal bodily rhythm of the listener (e.g., heart rate), such that the latter rhythm adjusts toward and eventually “locks in” to a common periodicity (Clayton, Sager and Will, 2005). The adjusted heart rate can then spread to other components of emotion, such as feelings, through “proprioceptive feedback.” Harrer and Harrer (1977) observed that listeners tended to synchronize either their heart rate or their breathing to the music, and that one could “drive” their pulse with appropriate music. Entrainment is presumably enhanced by a marked pulse—as evident in techno music, march music, and certain types of film music—and can increase *arousal*, evoke feelings, and create a sense of “social bonding” (Levitin, 2010).

*Evaluative conditioning* refers to a process whereby an emotion is induced because a certain aspect of the music (e.g., the melody) serves to trigger a conditioned response in the listener. For example, a specific piece of music may have occurred repeatedly together in time with a specific event that always makes you happy, such as meeting your friend. Over time, through repeated pairing, the music itself will eventually arouse *happiness*, even in the absence of the friendly interaction. The use of melodic themes to evoke emotions associated with characters or events was part of Wagner’s famous “leitmotif” strategy, and is also a common feature of movie scores. Conditioning has thus far been studied primarily in marketing

<sup>2</sup> A representation is a physical state that conveys some meaning or information about the state of the world within a specific processing system (Fox, 2008).



(Blair and Shimp, 1992), but it is an intriguing mechanism because it involves subconscious, unintentional, and effortless processes that could be subtly influenced by musical events in everyday life.<sup>3</sup>

Emotional *contagion* refers to a process whereby an emotion is induced by a piece of music because an independent “brain module” responds to certain stimulus features *as if* they were coming from a human voice that expresses an emotion, which leads the listener to mimic the moving expression internally (Juslin, 2000). The process could be implemented by means of a “mirror-neuron system” (Rizzolatti and Craighero, 2004). Preliminary support comes from a brain imaging study by Koelsch et al. (2006) that indicated that listening to expressive music activated brain regions associated with pre-motor representations for vocal sound production. The contagion mechanism is made plausible by the fact that most music heard today is vocal music, but even voice-like features of a violin or a cello might arouse basic emotions such as *sadness* in listeners (Juslin et al., 2014).

*Visual imagery* refers to a process whereby an emotion is evoked in the listener because he or she conjures up inner images through a nonverbal mapping between “metaphoric affordances” of the music and “image-schemata” grounded in bodily experience (Lakoff and Johnson, 1980): “a slowly ascending passage may evoke a visual image of a beautiful sunrise, which may then induce feelings of joy and optimism” (Thompson, 2009, p. 137). Music seems highly effective in stimulating imagery (Osborne, 1980), although there are wide individual differences among listeners. Some experience it regularly, whereas others hardly experience it at all. Yet, when it occurs, it may produce deep relaxation with far-reaching implications for clinical applications (McKinney, Antoni, Kumar, Tims and McCabe, 1997).

*Episodic memory* refers to a process whereby an emotion is induced in a listener because the music evokes a personal memory of a specific event in the person’s life (Baumgartner, 1992). This has been referred to as the “Darling, they are playing our tune” phenomenon (see Davies, 1978). When the memory is evoked, so also is the emotion associated with the memory. Such emotions may be rather intense, perhaps because the physiological pattern associated with the original event is stored in memory (e.g., Lang, 1979). Episodic memories linked to music can evoke emotions such as *nostalgia* (Janata, Tomic and Rakowski, 2007) and *pride* (DeNora, 2000), as the music may bring a sense of self-identity and belonging. Data suggest that episodic memory is one of the most common of sources of emotions to music in everyday life (Juslin et al., 2008).

*Musical expectancy* refers to a process whereby an emotion is induced in a listener because a specific feature of the music violates, delays, or confirms the listener’s expectations about the continuation of the music. The expectations are based on the listener’s previous experience of the same musical style (Pearce, Ruiz, Kapasi, Wiggins and Bhattacharya, 2010), as argued by Meyer (1956). His influential theory received support from an investigation by Steinbeis, Koelsch, and Sloboda (2006) which used subjective and physiological measures to capture emotional reactions to unexpected harmonic progressions in a Bach chorale. Violation of expectancies may evoke *anxiety* (Meyer, 1956, p. 27), *surprise* (Huron, 2006,

<sup>3</sup> Notably, the so-called *mere exposure effect* can be explained by evaluative conditioning, if one assumes that the absence of aversive events constitutes the “unconditioned stimulus” (Zajonc, 2001). In other words, stimuli that we have encountered repeatedly without suffering negative consequences will produce positive responses.



p. 348), and *thrills* (Sloboda, 1991). More recently, Huron (2006) proposed that for a given musical event, the listener's overall feeling reflects several response stages (imagination, tension, prediction, reaction, appraisal), which occur in quick succession. However, this particular theory of expectancy has not yet been tested.

*Aesthetic judgment* refers to a process whereby an emotion is evoked in the listener because of his or her evaluation of the music's aesthetic value. First, the listener adopts an "aesthetic attitude," which means that aesthetic criteria (e.g., beauty, novelty) are brought to bear on the music (see Figure 13.2). Perceptual, cognitive, and emotional inputs about the musical event are then filtered through a relative weighting of the subjective criteria by the listener. Evaluation occurs in a continuous manner, though judgment outcomes may occur as "read-out" episodes at certain points in time (e.g., "cued" by significant moments in the music, such as the ending of a jazz solo). Liking (or disliking) is a mandatory outcome of the judgment process (which is not necessarily explicit), whereas an emotion is a possible additional outcome, if the result is that the music is judged as extraordinarily good (or bad) overall or on one of the criteria ("aesthetic threshold" in Figure 13.2). This mechanism may arouse emotions such as *awe* (Haidt and Seder, 2009; Konečni, 2005). For further description of the aesthetic judgment model, see Juslin (2013, pp. 246–257).

By synthesizing theory and findings from several different domains outside music, Juslin and Västfjäll (2008) were able to provide the first set of hypotheses that might help researchers to distinguish between the proposed mechanisms. An expanded version featuring 98 hypotheses was provided by Juslin (2013) and could serve to guide future experimentation in the domain.

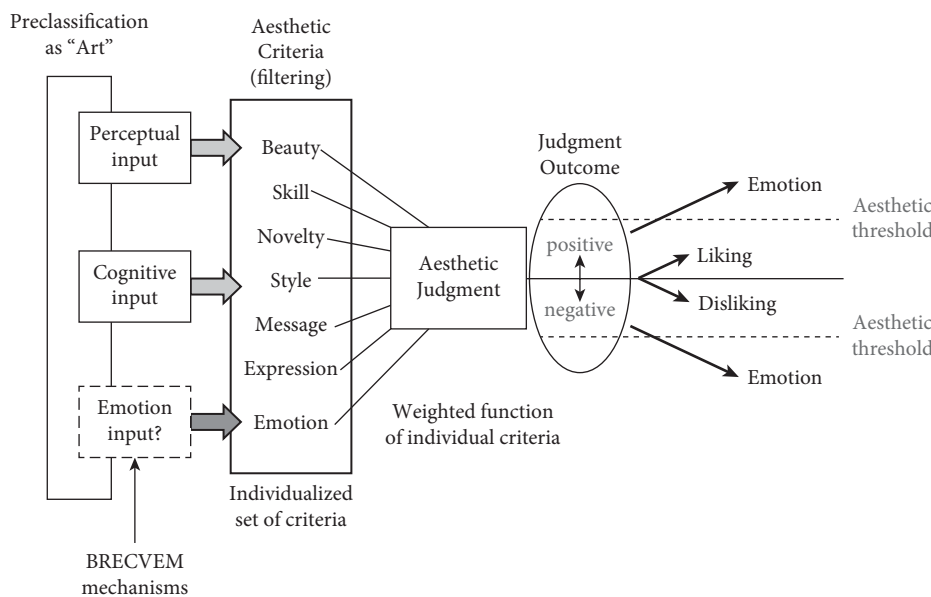


FIGURE 13.2 Schematic model of the aesthetic judgment process during music listening (see Juslin 2013, pp. 246–257 for a full description).

Reproduced from *Physics of Life Reviews*, 10(3), Patrik N. Juslin, From everyday emotions to aesthetic emotions: Towards a unified theory of musical emotions, pp. 235–266, Figure 1, doi:10.1016/j.plrev.2013.05.008, Copyright (2013), with permission from Elsevier.

## Implications of the Framework

One implication is that contradictions of different approaches can be reconciled by observing that they focus on different mechanisms. Which emotions might music arouse? How early do musical emotions develop? Is the listener active or passive in the causal process? Are musical emotions innate or learned reactions? For all of these questions, the answer depends partly on the mechanism in question. It follows from this that, before one can understand an emotion in any given situation, it is necessary to know which of these mechanisms is in operation. This is because listeners may activate different mechanisms to the same piece of music—which could help to explain individual differences in response.

Another implication of the BRECVEMA framework is that since several of the psychological processes and mechanisms are implicit in nature and may occur in parallel, music researchers cannot rely merely on phenomenological report to explain emotions. Most of what goes on in the causal process may not be consciously available, and we may attribute causality to salient stimuli even when salience is unrelated to the causal effect (e.g., Fox, 2008). Hence, although phenomenological description may provide some clues, the music experience is the thing that needs explaining, rather than being that explanation.

Accordingly, it is necessary to conduct experiments in a laboratory setting where particular mechanisms can be manipulated so as to yield an immediate effect on behavioral measures. A recent study (Juslin et al., 2014) made a first attempt to adopt this approach. We manipulated a piece of music to activate four mechanisms: brain stem reflex, emotional contagion, episodic memory, and musical expectancy. This was done by means of a careful editing of computerized although natural-sounding performances, inserting or removing the information needed for particular mechanisms. The resulting music excerpts were played to 20 listeners, who were asked to rate felt emotions on 12 scales. Pulse rate, skin conductance, and facial expressions were also measured. The results indicated that the target mechanisms were activated, and aroused specific emotions as predicted by the BRECVEMA framework. For instance, the brain stem reflex condition evoked *surprise*, whereas the episodic memory condition evoked *nostalgia*.

## THEMES IN CURRENT RESEARCH

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### Is Sadness Induced by Music Pleasurable?

One phenomenon that has attracted much interest in recent research is that, although people tend to avoid experiencing sadness in real life, they appear to find the experience of sadness *pleasurable* in the context of music listening (Levinson, 1982). This (apparent) paradox requires explanation. Kivy (1990) would probably argue that music listeners do *not* experience any sadness at all. They simply perceive sadness *expressed* in the music, and confuse emotions perceived with emotions felt. If this is the case, there is no paradox: there is nothing strange about listeners reporting pleasure if they only perceive a sad expression. However, while Kivy's hypothesis can perhaps account for *some* cases of reported "pleasurable sadness," there is now evidence that music with a sad expression can arouse sadness in

listeners, and that (at least some) sadness-arousing music can be experienced as pleasurable (e.g., Vuoskoski, Thompson, McIlwain and Eerola, 2012).

An alternative hypothesis, suggested by Schubert (1996), seems better able to explain this paradox. Similar to Berlyne's (1971) notion that, "in stimulus situations classifiable as art, there are cues that inhibit the aversion system" (p. 93), Schubert proposed that an aesthetic context will activate a node in a neural network which inhibits the displeasure center of the brain while pleasure comes from mere activation. But this notion appears inconsistent with findings in Vuoskoski et al. (2012), which suggested that the experience of "sad music" was rated as somewhat pleasurable, whereas the experience of "scary music" was rated as (only) unpleasant. If "dissociation from displeasure" takes place in an aesthetic context, why is not "scary" music pleasurable also?

Juslin (2013) offered another explanation, based on the BRECVEMA framework, in terms of an interaction between two mechanisms, namely the contagion mechanism and the aesthetic judgment mechanism. According to this perspective, listeners *do* indeed experience "genuine" sadness—resulting from the contagion mechanism—but they *also* experience pleasure which results from the perceived beauty of the music. The fact that "scary" music is perceived as less beautiful than "sad" music can explain the above findings reported by Vuoskoski et al. (2012).

It should be noted that listeners may choose to listen to music that makes them sad even if the sadness is not pleasurable. (They may want to "match" existing emotions, release emotions, or reflect on problems in life.) Ultimately, the phenomenon of "pleasurable sadness" has perhaps received too much attention. Considering that music arouses mostly positive emotions, *this* is arguably where our attention should be directed.

## Are Musical Emotions Special?

There is no simple "yes" or "no" answer to this question, since the answer largely depends on what we mean: "special" in what sense? Scholars have failed to specify any unique emotions that occur only in a musical context, but interactions between mechanisms, and the complex emotions they produce together, may perhaps explain why some scholars have been inclined to postulate unique or music-specific emotions. Moreover, although music appears to merely arouse a particular subset of emotions that occur also in other contexts, the *circumstances* of the process may still be special. Much of what makes music experiences special may be non-emotional aspects such as the conscious perception of musical form and its dynamic changes over time. If we let "emotions" carry the sole burden of accounting for the *qualia* of all music experiences, we are probably doing the field of music and emotion a disservice.

However, one recurrent issue in philosophical discourse regarding emotions is "the apparent reality of aesthetic emotions": why do we respond to fictive objects *as if* they were real even though we know they are not? The BRECVEMA framework provides one explanation of the dilemma: Emotions can be evoked at multiple levels of the brain, some of which are implicit and independent of other psychological processes; thus, emotional reactions to "fiction" (e.g., theater, movies, music) may be treated as "real" at *one* brain level, while at the same time we are consciously aware of their "non-critical" nature on another, more conscious level. That is, the "real" emotions aroused by the stimulus at "lower" sub-cortical

levels are “discounted” on subsequent, higher levels of processing, which could ultimately explain the lack of “adaptive action” undertaken.<sup>4</sup>

This hypothesis might, in turn, partly explain the tendency to experience music in a “special” way, as captured by the notion of *refined emotions* (Frijda and Sundararajan, 2007). This does not refer to a special subset of emotions, but rather to a special *mode* of experiencing all the “ordinary” emotions, characterized by attitudes of detachment, restraint, self-reflexivity, and savoring. These characteristics, which appear typical of at least some music experiences, are largely made possible by a disconnection between mechanisms at different levels of the brain.

The notion that emotions to music are somehow special has led to attempts to develop self-report measures for emotions to music (Bartel, 1992; Juslin and Laukka, 2004; Zentner et al., 2008). The best-known example is the Geneva Emotional Music Scale (GEMS) featuring nine emotion categories: *wonder*, *transcendence*, *tenderness*, *nostalgia*, *peacefulness*, *power*, *joy*, *ten-sion*, and *sadness*. However, as a scale intended to cover the range of emotions that music can arouse, the scale is arguably more valuable for setting an example of how a scale might be developed than for the rating scale as such: the scale lacks musically relevant categories such as *interest* and *surprise*; it places arguably different emotions (e.g., *anxiety*, *irritation*) in the same category; it underestimates the extent to which music evokes negative emotions such as *boredom* (when we are unable to choose the music!); and it lacks some aesthetically relevant terms such as *awe*. Further work is thus needed to devise a scale suitable for music.

## FUTURE RESEARCH DIRECTIONS

### Cross-Cultural Perspectives

Although there are numerous ethnographic studies of emotional reactions to music (see, e.g., Becker, 2004), there is an urgent need for cross-cultural studies which adopt a psychological perspective. Such studies are required in order to evaluate the generalizability of results, and also have implications for theory. To what extent are emotional reactions to music universal? As far as the underlying mechanisms are concerned, it appears feasible to adopt a version of *moderate universalism*. Juslin (2012) notes that an account of the arousal of emotions can be cross-culturally valid at the level of mechanisms—despite cross-cultural diversity in musical surface features (e.g., tempo) and aroused emotions. Though music that arouses *nostalgia* in listeners in one culture may sound different from music that arouses *nostalgia* in listeners in another culture, this does not rule out that the emotions were aroused for the same reasons in both cases. Theories of mechanisms could provide the necessary “bridge” between biological and constructionist approaches, by helping to delimit what is biologically constrained and what is socially constructed in particular instances of emotion. It seems likely that the cross-cultural differences in emotional responses we might find in future studies will partly reflect different uses and functions of music in different cultures (for a review, see Saarikallio, 2012).

<sup>4</sup> It should be noted that such inhibition of action occurs frequently also in non-fictional emotion episodes, for instance when there is a “false alarm” or when social norms prohibit certain behaviors.

## Individual Differences

Individual differences between listeners seem to be larger for induction of emotions than for perception of emotions, and research has revealed several factors in the individual that might potentially affect emotional reactions to music, such as the listener's age, gender, personality, music training, music education, music preferences, and current mood (see Abeles and Chung, 1996). I estimate that greater focus on individual differences will be key to making progress in this field. As noted by Davidson (2012), "the fact of individual differences is the most salient characteristic of emotion" (p. 7). Music researchers have yet to take the consequences of this observation. Doing so requires adopting a *statistical-ideographic* approach (Brunswik, 1956), in which listeners' responses are first modeled on an individual level before they are aggregated or summarized. Much of the apparent diversity observed in psychological experiments aimed at emotional reactions to music is not due to the inadequacy of the theoretical models applied, but rather due to the fact that the models must be applied on an individual level—preferably with more focus on the relationship between emotion and preference (see Greasley and Lamont, Chapter 17, this volume).

## Practical Applications

For some people, the most important issue in this field concerns the possible applicability of musical emotion findings. Real-world research has shown that music is intentionally used by listeners to regulate moods and emotions (Saarikallio and Erkkilä, 2007), as their "ideal affect" (Tsai, 2007) changes over the course of the day, and also that positive emotions dominate in their reactions. The latter result has stimulated interest in the effects of music on physical health and subjective well-being (see, e.g., chapters in MacDonald, Kreutz and Mitchell, 2012). The development of such applications would obviously benefit from a better understanding of the underlying mechanisms. The framework discussed above could hopefully contribute to more hypothesis-driven approaches to exploring different mechanisms of musical emotions. Other current applications of research on emotional responses to music include music therapy, film music, marketing, healthcare, and the gaming industry. Indeed, many current applications of music presume its effectiveness in evoking emotion, yet we are only beginning to understand the mechanisms that make this possible. We also know little about the dynamics of reactions to longer pieces of music, which could involve far more complex, ambiguous and temporally shifting emotions. Some of these emotional shifts may involve "the law of affective contrast," as formulated by Beebe-Center (1932), which postulates that a shift in adaptation level might lead to an enhanced emotional response. More often than not, music is intentionally designed to stir our emotions, exploiting whatever means available, and we have seen that music might induce emotions in several different ways. Thus, one answer to the question "why does music move us?" is "because we *want* music to move us and have designed it so that it will do it with the maximum effect." However, rather than "destroying the magic," our understanding of how music can arouse emotions will only increase our never-ending fascination with it.

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