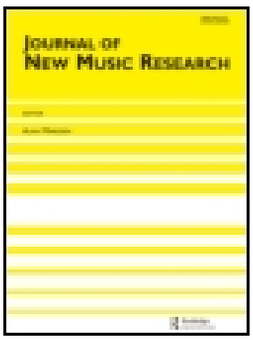

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Expression, Perception, and Induction of Musical Emotions: A Review and a Questionnaire Study of Everyday Listening

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Abstract

In this article, we provide an up-to-date overview of theory and research concerning expression, perception, and induction of emotion in music. We also provide a critique of this research, noting that previous studies have tended to neglect the social context of music listening. The most likely reason for this neglect, we argue, is that that most research on musical emotion has, implicitly or explicitly, taken the perspective of the musician in understanding responses to music. In contrast, we argue that a promising avenue toward a better understanding of emotional responses to music involves diary and questionnaire studies of how ordinary listeners actually use music in everyday life contexts. Accordingly, we present findings from an exploratory questionnaire study featuring 141 music listeners (between 17 and 74 years of age) that offers some novel insights. The results provide preliminary estimates of the occurrence of various emotions in listening to music, as well as clues to how music is used by listeners in a number of different emotional ways in various life contexts. These results confirm that emotion is strongly related to most people's primary motives for listening to music.

1. Introduction

One of the most exciting but difficult endeavors in research on music is to understand how listeners respond to music. It has often been suggested that a great deal of the attraction of music comes from its "emotional powers". That is, people tend to value music because it expresses and induces emotions. While emotion as a field has often been standing in the shadows of its bigger brother, cognition (i.e., research on "higher" mental processes of information processing such as thinking and decision making), research on emotion is finally on the rise again, also with regard to music (e.g., Juslin & Sloboda, 2001a). It is a topic that is often approached with ambivalence. Emotions in music are clearly important, still many issues remain stubbornly difficult to resolve. Can music convey specific emotions? Does music really evoke emotions in listeners? If so, why do we react emotionally to music? For a long time, satisfying answers to these queries have been difficult to come by. In addition, do we really want the answers? A common sentiment is that too much knowledge may "destroy the magic". Yet we cannot reverse time, and music is already used to manipulate the emotions of listeners in many areas of society (e.g., in advertising). Researchers might as well assume the role of a more *responsible* explorer of the secrets of music and emotion, as a counterweight to commercial interests. Moreover, can we afford to ignore the possible health benefits that a better understanding of musical emotions may offer?

Considering that music and emotion is becoming increasingly popular as a research topic (Juslin & Zentner, 2002), it is important that future studies proceed from whatever knowledge we have already gained from a century of research. Hence, the goal of this article is to offer an up-to-date review of research on expression, perception, and induction of musical emotions, which will allow researchers to take stock of what we currently know. This could be particularly valuable to researchers who would like to apply aspects of musical emotion to various technical innovations, such as software that provides automatic synthesis and recognition of musical emotion. However, we will also highlight a domain that we believe will be very important in future research, and will present new data with regard to this domain.

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2. Conceptual framework

The study of musical emotion has generally suffered from conceptual confusion. To enhance the cumulativeness of research efforts, and to promote fruitful debate, it may be heuristic to adopt certain conceptual distinctions from previous research. These distinctions may help researchers to become more systematic in specifying their research focus. First, we need a working definition of emotion. There are many different ways to define emotions, but most emotion researchers would probably agree that emotions can be seen as relatively brief and intense reactions to goal-relevant changes in the environment that consist of a number of *components*:

- cognitive appraisal (e.g., you appraise the situation as "dangerous");
- subjective feeling (e.g., you feel afraid);
- physiological arousal (e.g., your heart starts pounding);
- emotional expression (e.g., you scream and call out for help);
- action tendency (e.g., you are strongly inclined to run away);
- emotion regulation (e.g., you try to calm yourself).

Different researchers of musical emotions focus on different components, as these enter into the musical communication process. For instance, some focus on the emotional expression of the performance; others focus on the cognitive appraisal of the music that may induce an emotion, or on how the induced emotion affects physiological measures; still others focus on how music may be used to regulate emotions. It is important to note that what counts for one emotion component, theoretically and empirically speaking, does not necessarily hold for another component. Thus, it is important that researchers are clear about what component they are investigating.

Researchers disagree as to whether emotions are best conceptualized as *categories* (Ekman, 1992), *dimensions* (Russell, 1980), *prototypes* (Shaver et al., 1987), or *component processes* (Scherer, 2001). Different theories of emotion have been adopted in studies of music and it is fair to say that there is currently no dominating theoretical paradigm in research on musical emotion. Most music researchers have not explicitly adopted one or the other of these approaches, but their implicit orientation can still be inferred from the manner in which they have operationalized emotional responses. For instance, the researcher who asks his or her participants to respond by choosing an emotion from a list of emotion labels is implicitly assuming that there are discrete emotion categories. In contrast, the researcher who asks the participant to respond by rating the emotional intensity of different pieces of music is implicitly assuming that all emotions can be placed along a common emotion dimension. It appears preferable that researchers are clear about their theoretical orientation, so that the underlying assumptions may be scrutinized. On the other hand, the choice of orientation may also depend on the goals of the study or application.

There are many different *sources of emotion* in music (e.g., Sloboda & Juslin, 2001); that is, there are different ways in which a musical event may express and evoke emotions. For instance, some emotions may be aroused mainly by structural characteristics of the music, whereas others reflect personal associations. Note that what counts for one particular source of emotion may not count for another source and different theories may be required to explain each source (a review of different theories of music and emotion is provided later in this article). Importantly, failure to specify which source(s) of emotion one is studying could lead to unwarranted controversies with those who study other sources. Different sources of emotion involve and are influenced by a large number of *causal variables in the music, the person, and the situation* (Jørgensen, 1988). Given such complexity, it is important that researchers are careful in how they select causal variables to include in their studies, and that they are aware that they leave out others.

Finally, it is important to make a distinction between *perception* and *induction* of emotions. We may simply perceive emotions in the music, or we may actually feel emotions in response to the music. This distinction, known since the time of ancient Greece, is often but not always made in modern research. It is important to make this distinction for three reasons. First, the underlying mechanisms might be different depending on the process involved. Secondly, measuring induced emotion is more difficult than measuring perceived emotion, and researchers must therefore adapt methods accordingly. Third, the types of emotions usually expressed and perceived in music may be different from the set of emotions usually induced by music.

3. Review of previous research

3.1 Expression and perception of emotion

The simple observation that underlies all the work reviewed in this section is that music is perceived as expressive of emotions. Indeed, this tendency to find music expressive is so strong that "if the composer leaves no interpretation of his production, it is usually not long before one is invented" (Rigg, 1942, p. 279). Already in ancient Greece, we find the basic notion that particular properties of music covary with particular emotions, and more or less precise proposals regarding the expressive properties of musical elements have been made, on and off, from Plato to modern research on expression that begun in the nineteenth century (see Gabrielsson & Juslin, 2003).

Can music express specific emotions?

Emotion perception is relatively easy to measure and is a "cognitive" process in the sense that it may well proceed without any emotional involvement on the part of the listener.

Yet the actual information-processing may be handled by a specialized neural "module" for perception of emotions, as suggested by Juslin and Laukka (2003) and Peretz and Coltheart (2003). In principle, a listener might perceive *any* emotion in a piece of music, and in a sense, it may be inappropriate to claim that the listener is "wrong". However, researchers are usually interested in cases where emotions in music are perceived *similarly* by different listeners (or perceived in the way *intended* by a composer or a performer), perhaps because such common impressions relate strongly to the nature of the music. Can music express various emotions in this way? This issue has been examined in terms of (a) *listener agreement* (where the music is said to express a particular emotion "reliably" when there is a certain level of agreement among listeners about what the music expresses) and (b) *accuracy* (which refers to listeners' "correct" recognition of emotional expression according to some "independent criterion", such as the composer's or the performer's intention). Most previous research has relied on measures of agreement, because it is usually difficult to obtain reliable indices of composers' expressive intentions.

The results from over 100 studies have indicated that listeners are generally consistent in their judgments of emotional expression in music. That is, listeners' judgments are systematic and reliable, and can thus be predicted with reasonable accuracy. However, there is usually high agreement among listeners about the *broad* emotional category expressed by the music, but less agreement concerning the nuances *within* this category (Campbell, 1942; Downey, 1897; Juslin, 1997c). Hence, the *precision* with which music can convey different emotions is clearly limited. Listeners' agreement about the perceived expression varies depending on many factors (e.g., the piece of music, the musical style, the response format, the procedure), yet perception of emotions in music is robust in that listener judgments are only marginally affected by musical training, age, and gender of the listener (e.g., Robazza et al., 1994). That musical training is not required to perceive emotions in music (e.g., Juslin, 1997a) suggests that general mechanisms of emotion perception might be involved, a hypothesis that is supported by the finding that abilities to recognize discrete emotions in music are correlated with measures of "Emotional Intelligence" (Resnicow et al., 2004). Listeners' perception of emotion is usually tested by means of experiments in which listeners judge the musical expression by means of *forced choice* (that is, choosing one emotion label from a short list), *adjective checklist* (that is, marking any number of suitable adjectives from a list), *adjective ratings* (that is, rating the stimulus on selected adjective scales that range from, say, 1 to 7), and *free description* (that is, describing the stimulus using any words that come to mind). As may be expected, there is greater variability in listeners' responses when they use free description than when they use forced choice or adjective ratings (e.g., Juslin, 1997c; Rigg, 1937). Furthermore, listener agreement seems to be greater for some emotions (e.g., happiness, sadness) than for others (e.g., jealousy), which clearly suggests that music can convey some emotions, but not others.

Most studies have focused on emotion categories. Attempts to reduce perceived emotions to a smaller number of dimensions have mainly yielded dimensions corresponding to those obtained in other domains of emotion, such as *activation*, *valence*, and *potency* (Kleinen, 1968; Nielzén & Cesarec, 1981; Wedin, 1972), but also some dimensions that probably are more typical for music (e.g., *solemnity*), and that could reflect a distinction between "serious" and "popular" music in the music excerpts used. Much of music's expressiveness lies in the *changes* in musical features over time, and a dimensional approach may be particularly suitable for describing gradual movements of the musical expression in the "affective space". Thus, there has recently been some progress in tracing listeners' perception of emotions in music over time, using "continuous response formats" (e.g., Schubert, 1999; Sloboda & Lehmann, 2001; see also similar applications in other domains of emotion, e.g., Cowie et al., 1999). While attractive, these models have some problems associated with them. One such problem is that positive and negative affect may be two, partly independent dimensions (Cacioppo & Gardner, 1999). If this is true, certain states cannot be properly represented by a two-dimensional space with a single "valence" dimension. In addition, two dimensions may not adequately differentiate some emotions, such as anger and fear, that occupy a similar position in the affective space, but that really sound and feel very differently with regard to music. Finally, there is some evidence that there are category boundaries that mark out discrete segments of the circumplex model in people's representations of affect (e.g., Haslam, 1995), suggesting that some of the assumptions underlying dimensional approaches (e.g., that of continuity) are incorrect. Therefore, results obtained with continuous response formats need to be corroborated using other response formats (for an example, see Schubert, 1999).

Knowledge gained from experimental studies of emotional expression is complemented by information gained from more "impressionistic" studies of expression, for example, in sociology (Harris & Sandresky, 1985; Middleton, 1990), musicology (Cook & Dibben, 2001), philosophy (Davies, 1994), and psychoanalysis (Noy, 1993). Freed from the constraints of operationalization (i.e., the translation of theoretical concepts into concretely defined measures) researchers are able to address more subtle and complex aspects of musical expression, although obviously with more uncertainty regarding the underlying causal relationships. These alternative approaches may help us to address various problems with psychological research on emotion perception in music. For instance, very little is known about how the social context may influence judgments of emotional expression, since practically all psychological studies have been conducted in laboratory settings. Similarly, we know rather little about how the lyrics in music may influence how we perceive the emotional expression (Stratton & Zalanowski, 1994).

That listeners may perceive the music as expressive of different emotions seems clear, but to what extent can composers and performers actually *communicate* particular emotions to listeners? Few studies have explicitly investigated the extent to which composers can communicate specific emotions to listeners. However, a rare exception is the study by Thompson and Robitaille (1992). They asked five highly experienced musicians to compose short melodies that should convey six emotions: joy, sorrow, excitement, dullness, anger, and peace. They were required to rely on such information (pitch, temporal and loudness information) that is contained in musical scores. Dead-pan performances of the resulting compositions by a computer sequencer were played to fourteen listeners moderately trained in music. They successfully recognized the intended emotions in the pieces. Thus, it would seem that music composers can convey at least *some* emotions reliably.

Several studies have investigated the extent to which *performers* can communicate emotions to listeners. These studies have provided fairly precise estimates of the communication accuracy. In the most extensive review of emotional expression in music performance to date (see Juslin & Laukka, 2003) including 41 studies, a meta-analysis of the communication accuracy showed that professional performers are able to communicate five emotions (happiness, anger, sadness, fear, tenderness) to listeners with an accuracy approximately as high as in facial and vocal expression of emotions. The overall decoding accuracy, across emotions, was equivalent to a raw accuracy score at $p = 0.70$ in a forced-choice task with five response alternatives (i.e., the mean number of emotions included in studies so far). In accordance with what has been found in studies that use listener agreement as the dependent variable (see above), the evidence from performance studies suggests that the communication process operates in terms of broad emotion categories, whereas finer distinctions within these categories are difficult to communicate reliably without additional context provided by, for instance, lyrics, program notes, or visual impressions.

For example, Juslin and Lindström (2003) asked nine professional music performers to play various pieces of music in such a way that they would communicate each of the following twelve "basic" and "complex" emotions: anger, contentment, curiosity, disgust, fear, happiness, jealousy, love, pride, sadness, shame, and tenderness. Complex emotions were included to explore whether musicians really would be able to communicate such subtle states to listeners. The results showed that they could not. Basic emotions were easier to communicate than were complex emotions – as hypothesized by Juslin (1997a).

What are the reasons for music's inability to communicate more specific emotions reliably? There are, in fact, several reasons: first of all, music's ability to communicate emotions is heavily dependent on its similarity to other forms of nonverbal communication and the kinds of emotions that are possible to communicate through *those* channels (cf. Clynes, 1977; Davies, 1994; Juslin, 1997a); for instance, the patterns of communication accuracy for various basic emotions in music seem to closely mirror those of emotional speech (Juslin & Laukka, 2003). Secondly, the musical features involved in expression of emotions are partly *redundant* (Juslin, 2001a), which limits the complexity of the information that can be conveyed (Shannon & Weaver, 1949). Finally, because precision of communication is not the only criterion by which we value music, reliability is often compromised for the sake of other musical virtues, such as beauty of form. For instance, emotion may be only one of several components of expressivity in music performance (e.g., Juslin, 2003; Juslin et al., 2002, 2004).

How does music express different emotions?

There are numerous features of music that have been reported to be suggestive of discrete emotions. Table 1 shows an updated summary of these features for the most commonly studied emotions. As can be seen in Table 1, the features include tempo, mode, harmony, tonality, pitch, micro-intonation, contour, interval, rhythm, sound level, timbre, timing, articulation, accents on specific notes, tone attacks and decays, and vibrato. Note that there are *different configurations of musical features for different emotions*, as predicted by a categorical approach to emotion. Note also that the same feature can be used in a similar manner in more than just one emotional expression (e.g., fast tempo is used in both anger and happiness). Hence, "each cue is neither necessary nor sufficient, but the larger the number of cues used, the more reliable the communication" (Juslin, 2001b, p. 430). The relationships among features and emotions are only *probabilistic* (i.e., uncertain) and are therefore best thought of as correlational, as captured by the *Lens Model* (Juslin, 2000). One of the most important goals for future research is to better understand how the different features in music composition and performance *combine* to produce various emotional expressions (discussed below). Moreover, most of the investigated features are rather simple, whereas more complex features of music (e.g., harmonic progression, melody, musical form) remain to be thoroughly investigated (Gabrielsson & Juslin, 2003). It has been demonstrated that computer-synthesized music performances that vary with regard to these acoustic features may communicate emotions as reliably as "real" performers (Juslin, 1997b; see also Bresin & Friberg, 2000; Juslin & Lindström, 2003). Music synthesis remains a central topic in research on perception of emotion in music, and with increasingly sophisticated models being developed, there are many potential future applications for synthesis (e.g., in music education). It should be noted that many of the techniques used in synthesis of emotion in speech could also be used in synthesis of emotion in music (for a review, see Juslin & Scherer, in press).

What are the *origins* of these relationships between musical features and different emotions? There is no simple answer to this question. However, an important distinction is between (more) composer-related features (such as mode)

Table 1. Summary of musical features correlated with discrete emotions in musical expression.

Emotion	Musical features
Happiness	Fast tempo, small tempo variability, major mode, simple and consonant harmony, medium-high sound level, small sound level variability, high pitch, much pitch variability, wide pitch range, ascending pitch, perfect 4th and 5th intervals, rising micro intonation, raised singer's formant, staccato articulation, large articulation variability, smooth and fluent rhythm, bright timbre, fast tone attacks, small timing varibility, sharp contrasts between "long" and "short" notes, medium-fast vibrato rate, medium vibrato extent, micro-structural regularity
Sadness	Slow tempo, minor mode, dissonance, low sound level, moderate sound level variability, low pitch, narrow pitch range, descending pitch, "flat" (or falling) intonation, small intervals (e.g., minor 2nd), lowered singer's formant, legato articulation, small articulation variability, dull timbre, slow tone attacks, large timing variability (e.g., rubato), soft contrasts between "long" and "short" notes, pauses, slow vibrato, small vibrato extent, ritardando, micro-structural irregularity
Anger	Fast tempo, small tempo variability, minor mode, atonality, dissonance, high sound level, small loudness variability, high pitch, small pitch variability, ascending pitch, major 7th and augmented 4th intervals, raised singer's formant, staccato articulation, moderate articulation variability, complex rhythm, sudden rhythmic changes (e.g., syncopations), sharp timbre, spectral noise, fast tone attacks/decays, small timing variability, accents on tonally unstable notes, sharp contrasts between "long" and "short" notes, accelerando, medium-fast vibrato rate, large vibrato extent, micro-structural irregularity
Fear	Fast tempo, large tempo variability, minor mode, dissonance, low sound level, large sound level variability, rapid changes in sound level, high pitch, ascending pitch, wide pitch range, large pitch contrasts, staccato articulation, large articulation variability, jerky rhythms, soft timbre, very large timing variability, pauses, soft tone attacks, fast vibrato rate, small vibrato extent, micro-structural irregularity
Tenderness	Slow tempo, major mode, consonance, medium-low sound level, small sound level variability, low pitch, fairly narrow pitch range, lowered singer's formant, legato articulation, small articulation variability, slow tone attacks, soft timbre, moderate timing variability, soft contrasts between long and short notes, accents on tonally stable notes, medium fast vibrato, small vibrato extent, micro-structural regularity

Note. Shown are the most common findings in the literature. For a more detailed treatment of studies, see Gabrielsson and Juslin (2003), Juslin (2001a), Juslin and Laukka (2003), and Juslin and Lindström (2003).

and (more) performer-related features (such as tempo). Performance features such as tempo, loudness, and timbre, many of which music has in common with the non-verbal aspects of speech (Juslin & Laukka, 2001), may largely reflect a speech code. We recently made a systematic comparison of 104 studies of emotional speech and 41 studies of emotion in music performance (Juslin & Laukka, 2003). Results showed among other things that performers use primarily the same emotion-specific patterns of acoustic parameters that are used in emotional speech (as originally argued by Spencer, 1857). This is one example of cross-modal similarities in expressive form between different non-verbal communication channels, which has been suggested by several authors (e.g., Clynes, 1977; human movement is another candidate for explaining musical expressiveness, e.g., Davies, 1994). Speech prosody may also help to explain some of the emotional connotations associated with melodic contours (e.g., Fónagy & Magdics, 1963; Papoušek, 1996), which seem to play an important role in the early interactions of infants and caregivers. Various other aspects of composed musical structure are not as easily explained. However, features of a piece of music that are usually indicated in the notation of the piece (e.g., harmony, tonality, melodic progression) are likely to reflect to a larger extent characteristics of music as a human art form that follows its own intrinsic rules and that varies from one culture to another. Some of the effects of composer-features (e.g., consonance/dissonance) may originate in psychophysical relations between acoustic parameters and basic perceptual mechanisms (e.g., as evident in the hypothesis concerning critical bandwiths and perceptual dissonance; Moore, 1989, p. 188), but most probably reflect cultural conventions developed over the long course of music's history, and are in that sense more or less "arbitrary". At this stage of the historical development, these alternative but not mutually exclusive explanations are not easily teased apart. Furthermore, in addition to these musical features with mainly "iconic" relationships to emotions, there are also "associative" sources that may affect how listeners perceive music (e.g., organ music might sound "churchy" and "religious"). Such sources of expression have received little systematic study.

Do we have sufficient knowledge about emotional expression in music to be able to actually model the process mathematically? Are the regularities – probabilistic or not – so consistent that we may predict judgments of emotional expression? Indeed, there have been successful attempts at quantifying various aspects of the emotional communication process, using a modified version of Brunswik's *Lens Model* (Juslin, 1995, 2000). This model can help us understand many crucial issues concerning expression of emotion in music. One important goal in this domain is to better understand how composed and performed cues *interact* in expression of emotion (Juslin, 1998, p. 50). The problem, of course, is the enormous complexity: there are so many musical fea-

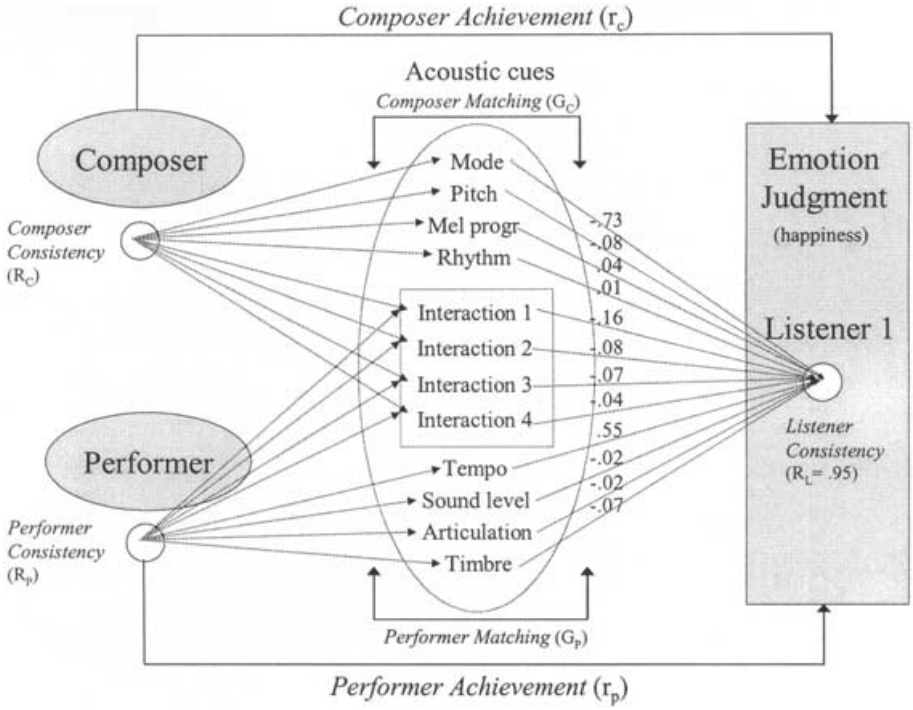

Fig. 1. Extended lens model (ELM) of musical communication of emotions (from Juslin & Lindström, 2003). Note. The results included in the figure come from a simultaneous regression analysis of a listener's happiness ratings of musical pieces (R = .95, adj. R^2 = .90). Values for individual cues refer to the beta weights (β) of the regression analysis.

tures and their potential interactions to consider (see Table 1). Hevner's (1935, 1936) pioneering work was important, though she lacked a number of modern research tools, such as computer synthesis and certain multivariate techniques, that may be needed to make real progress. How can we approach the complex interplay between musical features in a practically feasible way?

We have recently proposed an *Expanded Lens Model* (Juslin & Lindström, 2003; see Figure 1). The Lens Model was originally applied only to performance features (Juslin, 2000). However, in the expanded version, both composer cues and performance cues are included to make it possible to explore their relative contributions. In addition, important interactions between performer and composition cues are included as predictors in the model. The goal is also to be able to model the emotion judgments of individual listeners. As in our previous research (Juslin, 1997b, 2000), we are using a statistical approach based on multiple regression analysis. Contrary to popular belief, it is actually possible to investigate the relative contributions of interactions between predictors within the framework of multiple regression analysis. Recent research based on this framework, using both analysis and synthesis (e.g., Juslin & Lindström, 2003), indicated that a large amount of the variance in listeners' emotion ratings can be explained by a linear combination of the main effects alone (typically around 75–85%). Furthermore, results indicated that interactions between composed and performed features made small (but not negligible) contributions to the predictive power. An important lesson from this research was thus that, although there *are* interactions among musical features, we should not overstate their importance; they might be fewer and smaller than expected (e.g., Gabrielsson & Lindström, 2001, p. 243). An example of an Extended Lens Model of an individual listener's judgments of happiness in music is seen in Figure 1. Using this model, we could explain about 90% of the variance in the listener's judgments on the happiness scale.

3.2 Induction of emotion

Does music induce emotions in listeners?

It might appear obvious from everyday experience that music induces emotions in listeners. Anecdotal evidence on the emotional powers of music is certainly abundant. Is there scientific evidence supporting the hypothesis that music may produce emotions? Different authors seem to take different views (Gabrielsson, 2001; Kivy, 1989). In our view, there are problems associated with measuring emotion reliably in laboratory settings, which this domain shares with the emotion domain in general. Even so we would claim that there is now overwhelming evidence in favor of the view that musical events induce emotions in listeners.

Emotion is inferred on the basis of three kinds of evidence: (a) *self-report*, (b) *behavior*, and (c) *physiological reaction*. The most common, and deceptively simple, way to measure emotional responses to music is by *self-report* – either *verbal* (e.g., adjective checklist, quantitative ratings,

questionnaire, free description) or *non-verbal* (moving a slider, pressing a bar, drawing a picture). Verbal reports are associated with problems such as demand characteristics and choosing which words to include in checklists or scales. Nonverbal reports involve the problem of interpreting the responses in a meaningful way. Yet, self-report remains the most important method of measuring emotional reactions (Gabrielsson, 2002).

Because use of self-reports is not always possible (or reliable), another approach has been to measure different forms of *behavior* or products of behavior. This may include facial expressions, vocalizations, and body language, but also some behavioral measures that are less "obvious" (e.g., writing speed, purchase intentions, and helping behavior). This form of evidence can be valuable, because it is less subject to demand characteristics than are self-reports, although it is problematic in that felt emotion does not *always* result in specific behavior (Fridja, 1986).

The third kind of evidence used to infer emotions involves various *physiological measures* of emotion. The measures used include heart rate, respiration, skin conductance, startle response, muscle tension, electrocardiogram (ECG), blood pressure, and electroencephalograph (EEG) (for a review, see Levenson, 2003). Another kind of physiological measures of emotions comes from brain imaging techniques such as PET and fMRI. Neuropsychological studies of musical emotion are only beginning (Peretz, 2001), but recent research suggests that we may eventually be able to distinguish perception of emotion from induction (Davidson, 1995, p. 364) and also to distinguish discrete "basic" emotions from one another (e.g., Damasio et al., 2000; Murphy et al., 2003; Phan et al., 2002) based on brain imaging measures alone. So far, however, it is still frustratingly difficult to establish clear-cut and consistent relationships between emotions and physiological responses. Hence, physiological measures should necessarily be used in connection with other measures (such as self-report). Indeed, one should preferably use multiple measures to establish that an emotional response to music has taken place. Evidence of emotional reactions to music comes from a number of different strands of research that are reviewed below. While each source of evidence may be uncertain, the *combined* evidence is too strong to be dismissed.

- *Experimental studies* using self-report (e.g., Pike, 1972; Waterman, 1996), self-report as well as physiological indices (e.g., Krumhansl, 1997; Pignatiello et al., 1989; Vaitl et al., 1993), or self-report, physiological and behavior indices (Lundqvist et al., 2000) have provided evidence of emotional reactions to music.
- *Qualitative in-depth interviews* with music listeners have indicated that they use music to regulate, enhance and change qualities and levels of emotion. They show considerable awareness about the music they need to hear in different situations, and at different times, in order to induce particular emotions (DeNora, 2001; see also Gomart & Hennion, 1999).
- *Brain imaging and EEG studies* have suggested that listeners' responses to music involve subcortical and cortical regions of the brain that are known from earlier research to be involved in emotional reactions (e.g., Altenmüller et al., 2002; Blood & Zatorre, 2001; Blood et al., 1999; Peretz, 2001; Schmidt & Trainor, 2001). Supporting evidence also comes from lesion studies (e.g., Gottselig, 2001).
- Studies of *peak experiences* have indicated that music might be one of the most effective triggers of such experiences (Maslow, 1976; Panzarella, 1980), and further that peak experiences with music typically involve strongly felt emotions with accompanying physiological responses, as indicated by hundreds of retrospective, free phenomenological reports (Gabrielsson, 2001).
- Recent *physiological studies* suggest that, in contrast to the discouraging findings of most early studies (Bartlett, 1996), pieces of music that express different emotions may really produce different physiological reactions in listeners (Davis & Thaut, 1989; Krumhansl, 1997; Lundqvist et al., 2000; Nyklíček et al., 1997; Vaitl et al., 1993; Witvliet & Vrana, 1996). Researchers have also investigated a particular kind of response to music called "thrills" or "chills", proposing that such responses are fairly common and may be more prevalent for sad than for happy pieces of music (Goldstein, 1980; Panksepp, 1995).
- *Questionnaire and diary studies* confirm that listeners respond emotionally to music, and that music may serve different emotional functions (Behne, 1997; North et al., 2000; Roe, 1985; Sloboda & O'Neill, 2001; Stratton & Zalanowski, 2003; Thayer et al., 1994; Wells & Hakanen, 1991; Zillman & Gan, 1997; see also the present study).
- *Mood induction studies* that use various methods to induce moods in order to explore their effects on cognitive processes and behavior indicate that music could be the most effective of the mood induction strategies available (Westerman et al., 1996). Studies using music (for a review, see Västfjäll, 2002) indicate that, in addition to producing reliable effects on self-report, there are effects of music on several other behavioral measures that are believed to reflect moods (e.g., word association, writing speed, distance approximation, decision time).[1]
- Further evidence of music's emotional impact on human behavior and action tendencies comes from *consumer research* (North & Hargreaves, 1997a) and *social-psychological studies* concerning, for instance, music's effects on helping behavior (Fried & Berkowitz, 1979; North et al., 2004) and interpersonal attraction (May & Hamilton, 1980) and conflict (Honeycutt & Eidenmüller, 2001).
- *Applications and empirical evaluations of music therapy* emphasize the roles of music in facilitating the expression, identification, and experience of emotions; improving the

[1] It has been proposed that even the controversial "Mozart effect" (i.e., the positive effects on spatial-intellectual abilities supposedly due to listening to Mozart's music) is simply an artifact of musically induced mood (Thompson et al., 2001).

control and modulation of one's own emotional behavior; helping to "trigger" emotionally-laden memories of past events; and helping to diagnose patients' psychiatric conditions (Thaut, 1990).

- Studies that investigate *expressive behavior* have suggested that, even when suppressing overt motor response to music, many listeners may be engaging in *subliminal* physical action (as indicated by electromyographical measures of muscle activity; Fraisse et al., 1953; Harrer & Harrer, 1977), including facial expressions (Witvliet & Vrana, 1996). Studies have also indicated that people cry when listening to music (e.g., Sloboda, 1992; Waterman, 1996).
- *Anthropological research* indicates that emotional reaction to music is really a "universal" phenomenon, typically involving feelings of happiness and arousal, although the particular forms of engaging with music may differ substantially from one culture to another (e.g., Becker, 2001).

Which emotions does music typically evoke?

If we accept the fact that music can induce real emotions in listeners, one might then ask whether the emotions induced by music include the full range of human emotions. In principle, depending on the particular situation, the person listening, and the music, it would indeed seem possible that music could arouse just about *any* emotion that can be felt in other realms of human life. A more interesting question, perhaps, is which emotions music *usually* induces in listeners. As we will see, the set of emotions typically *induced* by music may be a somewhat different set of emotions than that typically *expressed* by music – for natural reasons. The emotions that are most easy to express and perceive in music are the basic emotions (e.g., happiness, sadness, anger, fear, love/tenderness) that have distinct expressive characteristics in *other* nonverbal communication channels (notably, the nonverbal aspects of speech and human gesture). The evolutionary origin of emotional communication via vocal sounds suggests that, to be useful as guides to action, emotional expressions are decoded in terms of just a few categories associated with such fundamental life issues as danger (fear), competition (anger), loss (sadness), cooperation (happiness), and caregiving (tenderness) (Juslin, 1997a, 2001a). Although musicians may not think in such terms, these principles of the evolutionary past will still operate in terms of biological constraints on what can be communicated reliably via acoustic cues (hence, the finding that music communicates only certain broad categories of emotion). Emotions *induced* by music, on the other hand, are more determined by the nature of the appraisal of the musical event and the specific reasons for engaging with the music in a particular situation. Perhaps the most frequently cited reason for listening to music is *enjoyment*. Thus, we would expect joy to be one of the most frequently experienced emotions in relation to music, which indeed seems to be the case (Becker, 2001; Gabrielsson, 2001; Sloboda, 1992; see the present study). Just like in the emotion domain more generally, it seems important that we devote more attention to various examples of positive emotion in future research on music experience (Juslin & Zentner, 2002; cf. Bonnano & Mayne, 2001). Positive emotion is more than just happiness; it could be relaxation, curiosity, enjoyment, fascination, and so forth. At the same time, given the emphasis on emotional responses to music in this article, we should perhaps note that music does not always arouse emotional responses in listeners. Often, we may listen to a piece of music without feeling anything in particular. In fact, some people claim that they *rarely* experience emotional reactions to music. But, unfortunately, we know little about the *epidemiological* aspects of musical emotions; in other words, how often people experience emotions to music under various circumstances. This represents a crucial area for future research. We should attempt to delineate the conditions (including the music, person, and situation) under which a listener is most likely to react emotionally to music (which, in fact, may be different for different persons). This could involve the kind of "diary approach" (Bolger et al., 2003) that have been used in previous research on epidemiological aspects of emotions in everyday life (Oatley & Duncan, 1994) or a questionnaire approach. Later we report some preliminary findings on the epidemiology of musical emotions from a questionnaire study.

How, exactly, do musical events induce emotions in listeners?

This problem is still puzzling to researchers. One problem appears to be that the conditions of emotion-elicitation in music are different from those in real life. In the paradigmatic case, an emotion is aroused when an event is appraised as having the capacity to influence the goals of the perceiver somehow (Oatley, 1992). Because music has no direct capacity to further or block goals, a challenge for music researchers is to provide an alternative, but plausible, account of how music can arouse emotions (Sloboda & Juslin, 2001). A number of different *theoretical mechanisms* have been proposed to explain how music may arouse emotions, including the following ones:

- *Musical Expectancy*. Meyer's (1956) groundbreaking book on how musical expectations are created, maintained, confirmed, or disrupted offers one fruitful solution to the problem of the formal object of musical emotions (What is musical emotion about?). Meyer (1956) admitted that mere arousal through interruption of expectancies has little value. To have any aesthetic meaning, the arousal or tension must be followed by a satisfying *resolution* of the tension. While influential and respected, Meyer's theory has not actually stimulated much research, presumably because of the problems in testing the theory. A specific piece of music may produce many different musical expectations at different levels of the music (and these expectations may be different for different listeners), wherefore it

is hard to understand or predict exactly what the listener is reacting to. For recent models of expectancy, see Eerola (2003), Hellmuth Margulis (2003), and Rozin (2000).

- *Arousal Potential.* We do not only react to unexpected musical events in pieces of music, we also react to the inherent "arousal potential" of more general stimulus characteristics, such as its speed, complexity, ambiguity, beauty, and familiarity. Thus, arguably, some of our emotional responses could reflect our attempt to "make sense" of the information in the music. According to Berlyne's (1971) influential theory listeners will tend to prefer music that gives them an optimum level of arousal: if the arousal potential of the music is too high, listeners will reject the music; if the arousal potential is too low, listeners will also reject the music. Hence, Berlyne hypothesized that listeners' preferences are related to arousal (or some aspect of it, e.g., perceived complexity) in the form of an inverted U-shaped curve. This notion has received some empirical support (e.g., North & Hargreaves, 1997c), and has been especially influential in accounts of music *liking* and *preference*. It is less clear how his theory could account for the induction of discrete emotions by music (but for some interesting ideas, see North & Hargreaves, 1997b). One particular feature of the musical stimulus that can explain many emotional responses is its perceived *beauty* (see, e.g., Gabrielsson, 2001, p. 447). Unfortunately, there is no thorough theory of musical beauty that can guide work in this area. Similarly, the number of potential reasons for liking a particular piece of music may be so large that it is impossible to cover all of them in a single theory. However, there can be little doubt that emotional responses to music often reflect liking or disliking of particular features of the music (North & Hargreaves, 1997b).
- *Mood Contagion.* There is evidence that people may easily "catch" the emotions of others when seeing their facial expressions or hearing their vocal expressions, perhaps through primitive "motor mimicry" (e.g., Hatfield et al., 1994; Neumann & Strack, 2000). Because music often features expressive acoustical patterns that are similar to those in emotional speech, it has been hypothesized that we get aroused by the voice-like aspects of music through a process in which a neural module reacts quickly and automatically to certain stimulus features, which leads us to "mimic" the perceived emotion internally (see Juslin & Laukka, 2003, pp. 802–803). In fact, recent studies using facial electromyography have indicated that "happy" music leads to increased zygomatic activity in listeners (as in smiling), whereas "sad" music leads to increased corrugator activity (as in frowning) (see Lundqvist et al., 2000; Witvliet & Vrana, 1996). This suggests that some of listeners' emotional responses to music may reflect primitive, "social" responses to the emotion-specific patterns of the music.
- *Associations.* Emotions to music often reflect personal and idiosyncratic associations based on arbitrary and contingent relationships between the music experienced and various non-musical factors related to emotion (what Davies, 1978, refers to as the "Darling, they're playing our tune" phenomenon). Associative responses to music involve "primitive" learning mechanisms (such as conditioning) that are not available to conscious introspection, but the responses typically evoke emotionally laden *memories* of specific places, events, or individuals (Gabrielsson, 2001). In fact, research indicates that listeners often use music as "a reminder of valued past events" (Sloboda & O'Neill, 2001), and that specific pieces of music may be strongly associated with particular time periods of an individual's life (e.g., Schulkind et al., 1999). Hence, nostalgia may be one of the more commonly felt emotions to music (see the present study). This source of emotion may not be liked by musicians, because it seems to reduce music to a memory-cue; yet, it may be one of the most common and powerful sources for music listeners in everyday life.
- *Mental Imagery.* Music can be highly effective in stimulating mental imagery. The images may not necessarily be about the music (or the musicians), but could be about anything. Still, the music may be important in *shaping* the images. Guided imagery in music (GIM) is an established method in music therapy (Bonny & Savary, 1973), where "the traveler" is invited to "share" his or her images as they are experienced in real time during a programmed music sequence. Emotions experienced are presumably the result of an interaction between the structure of the music and the structure of the images. Also in non-clinical settings, mental imagery may be an effective means to enhance emotional responses to music, both for listeners (Band et al., 2001–2002) and musicians (Persson, 2001; see also Godøy & Jørgensen, 2001).

Additional theories of possible causes of musical emotion include "proprioceptive feedback" (e.g., synchronization of internal biophysiological oscillators to external auditory rhythms, which may "spread" to various emotion components; e.g., Scherer & Zentner, 2001), "empathy with the performer" (e.g., Clynes, 1977, p. 60), and "social construction" of musical emotions according to "cultural scripts" (Becker, 2001). Unfortunately, most theories of musical emotion induction have not been thoroughly tested yet.

3.3 Conclusion: the social context of music listening

An important conclusion that can be drawn on the basis of the present review is that most previous research on expression, perception, and induction of emotions has neglected the social context of musical emotion, including everything from the situation in which the musical activity takes place to the wider socio-cultural context. (For similar arguments, see, e.g., Konečni, 1982; North & Hargreaves, 1997c; Sloboda & Juslin, 2001.) For instance, although a number of studies of emotion perception in music have revealed limits on music's ability to reliably convey certain emotions, it may be argued

that under certain circumstances, the context could help in providing more precision to the emotions expressed, thereby making it possible for music to communicate more complex emotions. At the present time, we do not know if this is possible, because previous research has only measured listeners' de-contextualized responses to music in laboratory settings.

The neglect of the social context may be particularly unfortunate for research on induction of emotions by music, because it has obscured several issues that could prove to be critical to an understanding of music and emotion; including, for instance, listeners' motivations for listening to music; epidemiological aspects of musical emotions; and listeners' uses of music in different everyday contexts. Emotional responses to music are likely to depend on what the music is used for. To understand emotional responses to music, we should therefore consider the functions of the music in its particular context. Studies of music and emotion have recently begun to address this issue (e.g., DeNora, 2001; Miller & Strongman, 2002; Roe, 1985; Sloboda & O'Neill, 2001), but there is an urgent need for further research.

Why have researchers tended to ignore the context? As noted by Juslin and Sloboda (2001b), much academic study of music takes as paradigmatic a particular way of listening to music, and talking about it, that is enshrined in the narrow "classical concert culture", where appreciation of music is often taken to mean having an intellectual understanding of the history and form of the musical composition, rather than an emotional response. Even where emotions are valued, they tend to be those rarefied (transcendent or spiritual) forms that are related to "higher" abstract and aesthetic properties of works, rather than the everyday or full-blooded emotions that people may experience in real life. Consequently, we would argue that most research on music and emotion to date has (implicitly or explicitly) taken the musician's perspective (either the composer or the performer). Researchers have, presumably out of respect, focused on how the music is intended by musicians rather than on how listeners actually use the music and respond to it in a real-world context. This is not to deny that musicians have important things to say about music and emotion. We just believe that in order to reach a good understanding of how listeners respond emotionally to music, we need to investigate this problem from the listener's point of view. And, surprisingly, few studies in the past have actually consulted music listeners regarding questions related to how they use and react to music in real life. To address some of the above concerns, we have recently initiated research efforts directed at music and emotion in everyday life.

4. Novel empirical findings: a study of everyday listening

The objective of the present study was to explore expression, perception, and induction of emotion in the context of ordinary listeners' interactions with music in everyday life. In order to obtain listeners' estimates of the frequency of occurrence of various phenomena, we opted for a questionnaire approach. Thus, a questionnaire consisting of 38 items (forced-choice, quantitative ratings, and open-ended responses) was administered to 141 participants in Sweden. The aim was to establish general trends that might guide future research. The listener sample may be described as a "sample of convenience". No attempt was made to achieve a strictly random or representative sample. However, we tried to include listeners with varying backgrounds in terms of age, gender, musical training, musical preferences, education, and occupation to increase the generalizability of the findings. The questionnaire was designed to investigate the following seven themes: *Listening context; Musical expressivity; Musical communication; Emotion perception; Emotion induction; Relationship between perception and induction;* and *Basic motives for listening to music*. This is, to our knowledge, the first questionnaire study to directly ask participants about the frequency of occurrence of certain phenomena related to music and emotion (e.g., the occurrence of particular emotions or situations). By relying on a questionnaire, it complements previous studies that were based on electronic diaries (e.g., Sloboda & O'Neill, 2001). Similarly, by focusing on the relative frequency of occurrence of different phenomena, it complements previous questionnaire research that focused on a single, particularly memorable musical event (e.g., Gabrielsson, 2001; Scherer et al., 2002).

4.1 Method

4.1.1 Participants

The participants were 141 music listeners, 77 females (55%) aged 18–74 years ($M = 36$) and 64 males (45%) aged 17–70 years ($M = 33$). Seventy-two of the participants (51%, 34 females and 38 males) played a musical instrument, and were hence classified as "musically trained", whereas the remaining 49% were classified as "untrained". The musically trained listeners reported having played a musical instrument for between 1 and 43 years ($M = 16$). All participants were Swedish, and participated on a voluntary basis.

4.1.2 Material and procedure

A questionnaire featuring 38 items (forced-choice, quantitative ratings, and open-ended responses) was developed to explore listeners' views in regard to: *Listening context; Musical expressivity; Musical communication; Emotion perception; Emotion induction; Relationship between perception and induction;* and *Basic motives for listening to music*. The questionnaire was designed to proceed from more open-ended questions on each theme (to not influence the answers) to more standardized and targeted questions on the same subject. While this approach created a slight element of redundancy concerning some issues, it also presumably enhanced the reliability and informativeness of the responses. Some of the questions in the questionnaire were

similar to those included in earlier questionnaires aimed at performers (Lindström et al., 2003) and music teachers (Laukka, 2004), which permits us to make a number of comparisons among the samples of participants.[2] The complete set of questions featured in the questionnaire is apparent in Section 4.2. The participants were instructed to fill out the questionnaire individually. Responses to the open-ended questions were coded by the two authors, and inter-coder agreement in categorization was estimated using Cohen's Kappa (κ) (Howell, 1992, p. 148). Mean inter-coder agreement: $\kappa = 0.82$. In cases of disagreement about the response coding, the authors thoroughly discussed the response to arrive at a final assignment to a category.

4.2 Results and discussion

4.2.1 Listening context

Certain studies have suggested that music pervades everyday life. This view is confirmed by the present results, which indicate that the majority of participants listen to music "Several times a day" (64%; Once a day 18%; A couple of times a week 16%; Once a week 1%; A couple of times a month 1%; A couple of times a year 1%). An overall chi-square test showed that the differences among the categories were significant, χ^2 (5, N = 141) = 253.00, $p < 0.00001$. Chi-square tests also revealed that "Several times a day" was chosen significantly more often than the other categories, and that "Once a day" and "A couple of times a week" were chosen significantly more often than "A couple of times a month" ($p < 0.00001$).

In what situations is the music encountered? Previous research (e.g., DeNora, 2001; Sloboda & O'Neill, 2001) has suggested that music listening often occurs in situations where listening to music is not actually the main activity. This view receives some support from the present results. When asked "How often, in your estimation, is listening to the music the *main* activity in those situations of your life where music occurs?", the participants' responses indicated that music was the "main activity" only some of the time (Always 4%, Often 50%, Seldom 46%, Never 1%), although there appears to be individual differences in this regard. Individual differences are also apparent in the listeners' estimates of how much of the total time they spend listening to music they listen *alone* (i.e., without other people being present). Hence, though the average estimate across listeners is 53% of the time, individual estimates range from 10% of the time to 95% of the time (*SD* = 23.5%).

If music is commonly encountered in situations where other activities also occur and other people also are present, what are these activities? The questionnaire featured an item in which participants were asked to judge "how often each activity occurs in connection with music". The activities were selected on the basis of the findings from a previous study (Sloboda & O'Neill, 2001), and hence serve to replicate that study using a listener sample from a different country. As may be seen in Table 2, the most common contexts for music listening that involves other activities seem to be "while doing housework", "as background when socializing", and "while driving, cycling, or running". However, a great variety of activities, such as eating, exercising, relaxing, and traveling, seem to be common according to many participants. The present results thus confirm that music frequently occurs in the context of mundane everyday activities as a "background" to other activities (Rentfrow & Gosling, 2003; Roe, 1985). Moreover, the results replicate Sloboda and O'Neill's (2001) findings that music listening often occurs while doing housework or during personal travel.

4.2.2 Musical expressivity

An important question concerns how participants define "expressivity". Free responses to the question "In your view, what does it mean to play expressively?" were content-analyzed and divided into five categories (inter-coder agreement, $\kappa = 0.82$). The results suggest that participants defined "playing expressively" primarily in terms of "communicating emotions and/or messages" (43%) (e.g., "to convey a certain emotion", "to experience as a listener what the musician wants to communicate") and "playing with feeling" (41%) (e.g., "to play with feeling insight", "to play with soul", "to play as you feel"). These two categories are not always easily distinguishable in the participants' responses, but the first involves more focus on actually conveying something to the audience, whereas the second involves more focus on the performer's own "involvement". A third group (9%) gave answers referring to "a focus on the music itself" (e.g., "being able to use dynamics and energy", "to vary the tempo"). A fourth group (10%) defined expressivity in terms of "personal expression" (e.g., "to give your own interpretation of the piece"), whereas 5% of the participants offered responses that could not be sorted into any specific category. McNemar's chi-square tests revealed that "communicating emotions and/or messages" and "playing with feeling" were

[2] A copy of the questionnaire may be obtained by contacting the authors. The questionnaire was administered to listeners by members of the *Feel-ME* project (http://www.psyk.uu.se/hemsidor/musicpsy/): Patrik Juslin, Petri Laukka, Erik Lindström, Jessika Karlsson, and Roberto Bresin. The following instructions were provided on the first page of the questionnaire: "In this folder, you will find a set of questions that concern music and its role in your life. We would be very grateful if you could answer these questions as carefully as possible. There are no 'right' or 'wrong' answers to these questions, so please respond spontaneously in accordance with the first thoughts that come to mind. It is very important that you answer the questions in the order they are posed, and that you do not go back and change your answers to previous questions. It may happen that you find a specific question difficult to answer. Please, still try to answer the question to the best of your ability. We are very grateful for your participation and guarantee that your responses will be handled confidentially. Thank you very much for your participation!"

Table 2. Listeners' responses to the following question: "If you listen to music in connection with other activities, then what are these activities? (Indicate how often each activity occurs in connection with music)".

	Never (%)	Sometimes (%)	Often (%)
When I wake up	43	37	20
While bathing	58	28	14
While exercising	25	36	39
While working	22	47	32
While doing housework	4	31	64
When relaxing	12	51	37
While eating	25	61	15
As background when socializing	6	48	46
As background to romantic company	17	59	25
While reading	56	36	–
Going to sleep	64	25	11
While driving, cycling, or running	8	46	46
On the train, bus, or plane	34	47	19

mentioned significantly more frequently than were the other alternatives ($p < 0.00001$).

What is the relative importance of expressive skills as compared to other virtues of a musical artist? The participants were asked to rank a number of characteristics in terms of how much they appreciate the characteristics in artists. Figure 2 presents the results in terms of the frequencies of various rankings of seven characteristics. As can be seen, "good songs/compositions" received the highest frequency of first-rankings, followed by "expressive performance" and "a unique sound". Wilcoxon's matched pairs tests showed that "good songs/compositions" was ranked significantly higher, and "theoretical knowledge" significantly lower, than the other artist characteristics (p values < 0.0000001). "Expressive performance", the second most highly ranked characteristic, was ranked significantly higher than the other characteristics ($p < 0.01$). It should also be noted that musically trained listeners ranked "technical skills" significantly higher than did untrained listeners (Mann–Whitney's U-test, $z = 2.25$, $p < 0.05$).

What, then, can music express? Listeners in the present study were required to tick items that seemed reasonable from a list of alternatives (see below), and they could also add their own alternatives. The list was based on a survey of the literature on expressivity (e.g., Gabrielsson & Juslin, 2003; Jørgensen, 1988). We tried to include the main views on the topic, as proposed by philosophers, psychologists, musicologists, and musicians. The results show that "emotions" was the most frequently selected item (100%), followed by "psychological tension/relaxation" (89%), "physical aspects" (88%), "beauty" (82%), "sound patterns" (80%) and "events and objects" (77%). Then followed "experiences that cannot be described in words" (72%), "religiosity" (60%), "social conditions" (57%), and "personality characteristics" (50%). The least reasonable items, according to the participants, were "musical conventions" (38%), and

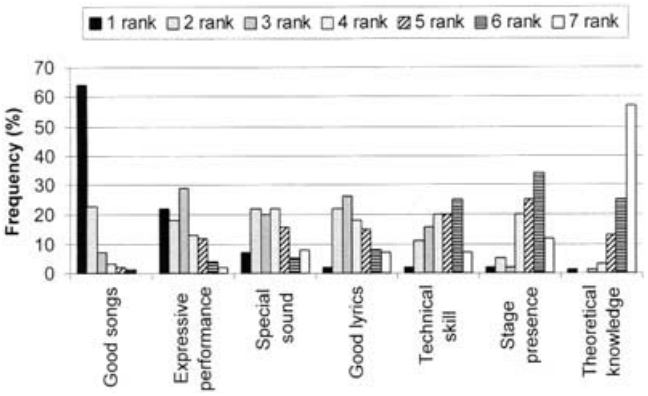

Fig. 2. Listeners' rankings of the relative importance of different virtues of a musical artist.

"other" (6%). These findings strongly suggest that listeners conceive of expressivity as a *multidimensional* phenomenon, because most participants ticked a large number of alternatives. However, although there were large individual differences with regard to many of the alternatives, there was complete agreement that music can express emotions. The present results are quite similar to those obtained in a study of performers (Lindström et al., 2003), the main difference being that performers appear to be much more inclined to think that music can express "personality characteristics" (89%) than listeners are (50%).

4.2.3 Musical communication

Several questions explored the extent to which ordinary music listeners conceptualize music in terms of communication. Thus, the participants were asked whether they experience that music (or musicians) communicates with them as listeners. Their responses suggested that this is indeed com-

monly the case (Always 4%, Often 67%, Seldom 23%, Never 6%). Chi-square tests indicated that "Often" was selected significantly more often by the present participants than were any of the other response alternatives ($p < 0.0001$). An open-ended follow-up question asked the participants (who did not respond "never" to the previous question) what it is that music communicates. Their free responses were content-analyzed and categorized (inter-coder agreement, $\kappa = 0.92$). The most common type of response was "emotions" (47%) (e.g., "emotions: sadness, joy, anger", "moods", "happiness"), followed by "emotions and messages" (34%) (e.g., "opinions, emotions, messages", "everything from politics to emotions"), and "messages" (7%) (e.g., "a message, like "live now", "an explanation of why life is the way it is"). The remaining 12% of the responses consisted of disparate answers and were simply categorized as "others". Pairwise chi-square tests revealed that "emotions" and "emotions and messages" were mentioned significantly more often than the other response categories (p values < 0.0001).

Most participants also believed that performers have "a need to communicate with listeners" (Always 15%, Often 76%, Seldom 8%, Never 1%). When directly asked whether they experience that music "communicates emotions", most participants agreed (Always 15%, Often 78%, Seldom 6%, Never 1%). Chi-square tests confirmed that "often" was chosen significantly more often than the other alternatives ($p < 0.00001$). In addition, in agreement with what many performers believe (e.g., Lindström et al., 2003), many listeners believe that a performer has to *feel* the emotion he or she wants to convey in order to communicate it reliably to listeners (Yes 44%, No 32%, I don't know 24%; "Yes" was chosen significantly more often than "No", $p < 0.05$).

4.2.4 Emotion perception

Given that there is 100% agreement among the listeners in the present study that music can express emotions, an important question is how often they perceive that the music they listen to expresses emotions. The results suggest that this may be common, since most listeners responded "Often" (76%, Always 14%, Seldom 10%, Never 0%). Chi-square tests indicated that "Often" was chosen significantly more often than the other alternatives (all p values < 0.00001). A related question asked *which* emotions (out of 38 in random order) music is able to express (i.e., given that music *can* express emotions). The list of emotions was based on a review of the literature (e.g., Oatley & Jenkins, 1996; Plutchik, 1994), and can be regarded as a representative sample of emotions in that it includes a variety of emotions that most researchers would regard as common or important. In addition, participants could add their own response alternatives. Table 3 presents the results in terms of the frequencies with which each emotion term was chosen by the participants. Joy was selected by almost everyone (99%), followed by sadness, love, calm, anger, tenderness, longing, solemnity, and anxiety (>75%). The second quartile includes hate, humor, loneliness, tension, pride, pain, desire, hope, nostalgia, fear, contempt, tiredness, regret, and expectancy (>50%). The third quartile includes confusion, disgust, surprise, curiosity, boredom, disappointment, guilt, satisfaction, admiration, jealousy, sympathy, shame, trust, interest, and humiliation (>25%), and the final quartile consists of the few participants (10%) who took the opportunity to add terms not already included in the list, the modal response being "*all* emotions".

It is noteworthy that commonly proposed "basic emotions" such as joy, sadness, anger, fear are among the top ten rankings, whereas "complex" emotions, such as jealousy and

Table 3. Frequencies with which various emotion labels were selected in response to the question "What emotions can music express?" ($N = 141$).

Emotion	Freq.	Emotion	Freq.	Emotion	Freq.
Joy	99% (98%)	Pride	71% (69%)	Curiosity	46% (63%)
Sadness	91% (91%)	Pain	70% (86%)	Boredom	45% (47%)
Love	90% (89%)	Desire	69% (74%)	Disappointment	43% (49%)
Calm	87% (89%)	Hope	67% (70%)	Guilt	42% (43%)
Anger	82% (83%)	Nostalgia	67% (76%)	Satisfaction	42% (57%)
Tenderness	82% (86%)	Fear	63% (79%)	Admiration	37% (37%)
Longing	77% (71%)	Contempt	55% (53%)	Jealousy	35% (42%)
Solemnity	76% (73%)	Tiredness	55% (52%)	Sympathy	34% (39%)
Anxiety	75% (90%)	Regret	53% (56%)	Shame	31% (39%)
Hate	74% (69%)	Expectancy	51% (66%)	Trust	30% (33%)
Humour	74% (87%)	Confusion	49% (65%)	Interest	29% (44%)
Loneliness	73% (79%)	Disgust	47% (51%)	Humiliation	28% (31%)
Tension	72% (89%)	Surprise	47% (68%)	Other	10% (16%)

Note. Numbers within parantheses indicate the corresponding results from a questionnaire study of 135 musicians who received the same question (Lindström et al., 2003).

shame, occur towards the lower end. (Emotion researchers commonly regard anxiety as belonging to the "fear family" of emotions; e.g., Oatley & Jenkins, 1996; Plutchik, 1994.) Note further that "tension" is among the 13 most frequently selected terms, which seems reasonable considering that this term is often used in regard to music. Also included in Table 3 are the corresponding findings from a study of 135 expert musicians who responded to the same question (numbers within parentheses). The main tendencies are similar, although it is notable that the musicians rated some of the terms, (e.g., anxiety, humor, tension, expectancy) higher than did the listeners. Some of these terms – in particular "tension" and "expectancy" – are strongly related to musicological discourse. It can also be noted that the 11 most highly ranked emotions in Table 3 are relatively similar to the emotion clusters included in Schubert's (2003) updated version of Hevner's (1936) adjective circle.

What do listeners, in their own estimation, base their judgments of the emotional expression of the music on? Content-analysis and categorization (inter-coder agreement, $\kappa = 0.83$) of listeners' free responses indicated that 74% of the listeners thought it was based on "musical factors", 28% on "the listener's mood", 35% on "memories and personal experiences", 29% on "lyrics", and 7% on "other" (note that the categories are not mutually exclusive, as some listeners mentioned more than on factor). "Musical factors" were mentioned significantly more often than the other categories, as indicated by McNemar's chi-square tests (p values < 0.00001). Nevertheless, the results suggest that the perceived emotional expression of the music does not depend solely on the music (which is often implicitly assumed by researchers) but depends also on highly personal associations to the music.

4.2.5 Emotion induction

The participants were required to estimate approximately how much of the total time spent listening to music they feel strong emotions. The data reveal considerable individual differences, with estimated proportions ranging from 5% of the time to 100%. However, the responses are roughly normally distributed, with most responses clustering around the average of 55% of the time. That is, most listeners claim that they experience strong emotions to music only about half of the time they spend listening to it. This finding indicates that emotion induction is more rare than emotion perception. Participants were also asked to rate (0–10) what is more common; that they experience "specific emotions" (0) or "unspecific emotions" (10) when they listen to music. The responses differed widely (range = 0–10), suggesting that some individuals are more prone to experience specific emotions, whereas others are more prone to experience unspecific emotions. This is similar to what has been found with regard to the experience of "ordinary" emotions (e.g., Feldman Barrett & Gross, 2001). However, it is somewhat more common, overall, to experience specific emotions to music (M = 4.3), according to these participants. Interestingly, listeners who report often experiencing emotions to music also report being more prone to experience "specific" emotions than are those that rarely experience emotions (Pearson's $r = 0.39$, $p < 0.0001$), suggesting the possibility that listeners who experience emotions often are more able to distinguish and label their own emotional reactions.

Given that music listening appears to often take place in situations where other people are present (see the section on listening context), it seems pertinent to ask listeners when they find it most *easy* to experience emotions to music, "alone or together with others?". The results indicate that 53% thought that emotional reactions to music are easiest to achieve while "listening alone", 4% thought that they are easiest to achieve "together with others", and 43% thought that they are "equally easy in both cases". Hence, although music commonly occurs in social contexts, it appears that a significant proportion of *emotional* responses to music occur while people are listening to music alone; this is confirmed by the participants' free responses to the question "In what *situations* are you especially prone to experiencing emotions to music?". The responses were content-analyzed and divided into four categories (inter-coder agreement, $\kappa = 0.76$). Thus, 50% of the listeners reported being especially prone to experiencing emotions to music when "alone" (typically in combination with highly attentive listening); 41% mentioned "social situations" (e.g., parties, concerts, disco); 35% mentioned "emotional situations" (e.g., romantic moments, tragic events, feeling alone); and 21% mentioned "other situations" (the most common responses were "when I'm drunk", "after or during physical exercise", "when I have chosen the music myself", and "while dancing").

A related question asked the participants "In what *states of mind* are you especially prone to experience emotions to music?". Content analysis of their free responses (inter-coder agreement, $\kappa = 0.92$) revealed that 47% of the participants' responses could be categorized as "when already in an emotional state"; 16% "when being rested, relaxed, and calm"; 8% "when being tired"; and 6% "while drunk"; 20% of the participants responded with a variety of answers (e.g., "I don't know", "always", "when I'm receptive").

One final open question of a similar type asked listeners "With what types of *music* are you especially prone to experience strong emotions?". Categorization of styles and characteristics of music is a highly complex topic. To simplify matters, we tried to stay as close as possible to the listeners' own responses in the categorization (inter-coder agreement, $\kappa = 0.75$) that produced nine categories (that are not mutually exclusive): "happy music" (8%), "sad music" (8%), "calm music" (22%) "arousing music" (11%), "magnificent and/or solemn music" (4%), "popular music" (47%), "classical music" (29%), "music that one recognizes and likes" (14%), and "others" (23%). These results indicate, more than anything else, that no particular kind of music dominates in emotional reactions to music – the music may be calm or arousing, classical or popular.

There is little research on the "epidemiological" aspects of musical emotions. However, we are able to present preliminary evidence in this study. Table 4 shows the emotions reported to be "felt most frequently" by participants while listening to music. These results suggest that positive emotions (e.g., "happy", "relaxed", "moved") dominate among the most commonly felt emotions. This is what we should expect. After all, people can usually (although far from always) exercise choice over what music to listen to. Given this choice people will tend to prefer to listen to music that they like and that makes them "feel good". Hence, it should come as no surprise that positive emotions are most frequent in musical experiences (Becker, 2001; Gabrielsson, 2001; Sloboda & O'Neill, 2001), whereas this may *not* be the case in "everyday life" (see Oatley & Duncan, 1994). Secondly, the results in Table 4 clearly suggest that music *does* induce so-called "basic emotions" in listeners – contrary to some claims in the literature – although probably more often happiness, sadness, and tenderness than anger or fear (fortunately!). Happiness and sadness could be the two emotions that are easiest to express, perceive, and induce in listeners, judging from the research on emotional expression and musical mood induction, respectively. "Complex" emotions such as jealousy, shame, and regret seem to occur rarely (see Table 4).

Table 4. Preliminary evidence on the relative frequency of felt emotions in response to music, as estimated by the present listeners. *Note:* the emotions are listed from the most commonly experienced to the least commonly experienced (N = 141).

1. Happy*	23. Empathic
2. Relaxed*	24. Proud
3. Calm*	25. Spiritual
4. Moved	26. Curious
5. Nostalgic	27. Relieved
6. Pleasurable*	28. Bored
7. Loving*	29. Indifferent
8. Sad*	30. Frustrated*
9. Longing*	31. Tense*
10. Tender	32. Disappointed*
11. Amused	33. Surprised*
12. Hopeful	34. Honored*
13. Enchanted	35. Regretful
14. Expectant*	36. Contemptuous
15. Solemn*	37. Confused*
16. Interested	38. Anxious*
17. Admiring	39. Afraid*
18. Angry*	40. Jealous
19. Ecstatic*	41. Disgusted
20. Lonely	42. Guilty
21. Content*	43. Shameful*
22. Desiring	44. Humiliated

* These emotions were mentioned in free descriptions of strong experiences of music (SEM), as reported by Gabrielsson (2001, Table 19.2).

It has recently been argued that listeners do not only react passively to music, but that they are rather actively using the music as a resource to serve certain *emotional functions* (DeNora, 2001; Roe, 1985; Sloboda & O'Neill, 2001). The present questionnaire featured four questions that addressed this aspect of music listening. Thus, some previously suggested hypotheses about the uses of music were confirmed by the present results, which suggest that many listeners "use music to change your mood" (Never 7%, Seldom 43%, Often 49%, Always 1%); "choose music to match your mood" (Never 2%, Seldom 28%, Often 67%, Always 13%); "vent your emotions through listening to music" (Never 3%, Seldom 33%, Often 61%, Always 3%); and have music "evoke strong, emotional memories" (Never 2%, Seldom 37%, Often 59%, Always 2%). These intentional uses of the emotion-inducing qualities of music by the listeners themselves might be contrasted with the "manipulative" uses of music by others (e.g., in advertising). One item in the questionnaire stated that "music is commonly used today in order to influence the emotions of the listeners in different contexts" and asked "How do you spontaneously feel about this?". The data revealed wide individual differences in the rated positivity (range = 0–10, SD = 2.39) with a mean of M = 5.19. In commenting the responses, those who were positive emphasized the use of music in film, whereas those who were negative emphasized the use of music in shops.

We also asked listeners to rate the relative importance of the listener's psychological state, the music, and the situation in determining their emotional reactions to music. The results show that the music received the highest rating (M = 8.31, SD = 1.73), followed by the listener's state (M = 8.01, SD = 1.97), and the situation (M = 7.39, SD = 2.05). A repeated-measures ANOVA, with Source of emotion (three levels: listener, music, and situation) as a within-subjects factor, was conducted on the importance ratings. A significant main effect of Source of emotion was found ($F_{2,278}$ = 13,90, p < 0.00001), and post-hoc multiple comparisons (Fisher's LSD) showed that Music and Listener received significantly higher ratings than Situation (p < 0.01). Still, it is clear that all three aspects were judged to be of importance by the listeners (all means > 7).

4.2.6 Relationship between perception and induction

As already noted, we know little about how perceived and induced emotions relate to each other (for a discussion, see Gabrielsson, 2002). Therefore, the present questionnaire included an item that asked listeners "If you perceive that the music expresses a certain emotion, do you also feel that emotion?" The results suggest that this may happen quite often (Always 6%, Often 65%, Seldom 29%, Never 1%). To examine this issue further, we asked listeners to rank four different alternatives with regard to "how common they are when you listen to music". Thus most listeners thought it was more common that they "experience emotions while listening to music" (41% first ranks) and "*both* perceive that the

music expresses emotions and experience emotions" (39% first ranks), than that they only "perceive that the music expresses emotions" (14% first ranks), or that they "*neither* perceive that the music expresses emotions, and nor experience emotions" (6% first ranks). Wilcoxon's matched pairs tests indicated that the first two alternatives were significantly higher ranked than the third alternative (p values < 0.000001), which, in turn, was significantly higher ranked than the fourth alternative ($p < 0.000001$). This result is quite surprising, considering that listeners reported that they only experience emotions about 50% of the time they listen to music (on average), but that they "often" perceive that music expresses emotions (see previous items). Perhaps, participants found this item difficult to understand. It has been suggested that ordinary listeners may find it difficult to distinguish these aspects in an abstract way (Gabrielsson, 2002).

4.2.7 Basic motives for listening to music

Last but certainly not least, we asked the participants about their reasons for engaging with music: "Why do you listen to music?" Content analysis of listeners' free responses (inter-coder agreement, $\kappa = 0.77$) revealed the following ten categories (again, the categories are not mutually exclusive): "to express, release, and influence emotions" (47%); "to relax and settle down" (33%); "for enjoyment, fun, and pleasure" (22%); "as company and background sound" (16%); "because it makes me feel good" (13%); "because it's a basic need, I can't live without it" (12%); "because I like/love music" (11%); "to get energized" (9%); "to evoke memories" (4%); and "other" (11%). Hence, the present findings suggest that emotional states figure prominently in listeners' primary motives for listening to music.

5. General discussion

The preceding review has shown that there are a number of ways in which music can express and induce emotions. Our knowledge about music and emotion has increased rapidly over the last decade. Yet, much remains to be done. In particular, an important conclusion that could be drawn from the present review is that previous research has largely neglected the social context of music and emotion. This has probably shaped our views on music and emotion more than we realize. To address this problem, we presented novel findings from a questionnaire study. The present results replicate, as well as extend, and partly also *modify*, the results from previous studies of emotional responses to music in everyday life. From these findings emerges a picture of the ordinary music listener as someone who listens to music many times a day, often in mundane everyday contexts where music listening is not the primary activity. It's a listener who chooses to listen to music to a large extent because of the valued emotional experiences it offers. Music is used to enhance or change emotions (to relax, to arouse, to comfort) or to evoke emotional memories. The strongest emotional experiences often occur while listening alone (while listening attentively to the music), but it may also occur in social and emotionally charged situations. Positive emotions dominate in people's emotional responses to music, with some of the most common emotions appearing to be feeling happy, relaxed, calm, moved, nostalgic, pleasurable, loving, sad, longing, or tender. Some of the states that are among the most frequent are emotions that have been hypothesized by many researchers to be "basic" (i.e., happiness, sadness, tenderness). It would thus seem incorrect to say that music does not induce "basic" emotions (cf. Scherer, 2003).

Evidence on what emotions music induces also comes from Gabrielsson's studies of strong experiences of music (SEM), which involved hundreds of extensive, retrospective verbal reports from listeners on their most profound musical experiences. Gabrielsson (2001) noted that "in the reports, we find numerous examples of so-called 'basic' emotions" (p. 446). He also noted, with respect to the question of whether there are emotions that music does *not* induce, that "too hasty exclusions should be avoided" (p. 446). However, his results also suggest that positive emotions dominate in SEM. Those emotions in Table 4 that were mentioned in Gabrielsson's SEM reports are indicated with asterisks (based on Gabrielsson, 2001, Table 19.2). Overall, these findings, in combination with the results from the present study, suggest that music may induce a number of different emotions that certainly include many basic emotions. What emotions music induces has little to do with whether an emotion is "basic" or not, but much to do with the reasons for listening to music. People listen to music to feel good, to enjoy themselves, to vent their emotions etc. This could involve basic as well as non-basic emotions, wherefore this distinction is not very useful in this context. Perhaps some of the controversy and confusion in discussions of music and emotion reflects a failure to distinguish between three subsets of emotions that are relatively more common in some contexts than others. The relationships between (a) emotions commonly induced in real life, (b) emotions commonly expressed by music, and (c) emotions commonly induced by music may be illustrated using a Venn diagram that shows the hypothesized overlap of the different subsets of emotions, which are all part of the full range of human emotion (see Figure 3).

However, it is also clear from the present study, as well as from previous studies, that some emotions are more commonly induced by music than others. Perhaps researchers should consider this in regard to how they measure emotion? Indeed, a number of researchers have argued that we should develop a specific vocabulary to measure induction of musical emotion (see Asmus, 1985; Bartel, 1992; see also Scherer & Zentner, 2001). Researchers wanting to use verbal self-report are advised to consider using scales intended for music. Table 5 shows the terms proposed by Asmus (1985) and Bartel (1992) in their respective scales for measuring

emotional reactions to music, as well as those terms that we propose based on the data from our questionnaire study. In proposing our own list of 15 affect terms, we have tried to strike a balance between practical feasibility and sufficient differentiation of emotions that can be expected to occur frequently in relation to music (both in the laboratory and in everyday contexts).

The results of this study obviously need to be replicated and extended using other listener samples. Further, results based on self-report must always be interpreted with caution. It can be difficult for listeners to reliably determine the precise nature of the processes that underlie their emotional reactions to music, because most information-processing involved in such reactions is unconscious. On the other hand, there are certain issues that ordinary listeners seem much better equipped to resolve than, say, a philosopher or a musicologist; namely questions concerning the uses and experiences of music in everyday life. Regarding these issues, there is no real reason to suspect that listeners cannot give us reasonably accurate accounts of their habits and experiences. The neglect of the social context of music listening (e.g., the way that listeners actually use music and experience it in real-life) might easily lead to a musicological view that emphasizes sublime, "aesthetic" emotions to "works of art". While this view may be popular with musicians, no doubt, it has limited validity in terms of fully accounting for how most *listeners* actually relate to music. The consequence might be theories of musical emotion that overly emphasize musical structures, and sources of emotion related to structure (e.g., expectancy, iconic sources) at the expense of the rich personal associations listeners have to music, and that may involve a wider variety of human emotions. Hence, we argue that a move to extend research on music and emotion to everyday life contexts represents one of the most promising avenues towards a more accurate understanding of how human beings experience emotions in connection with music.

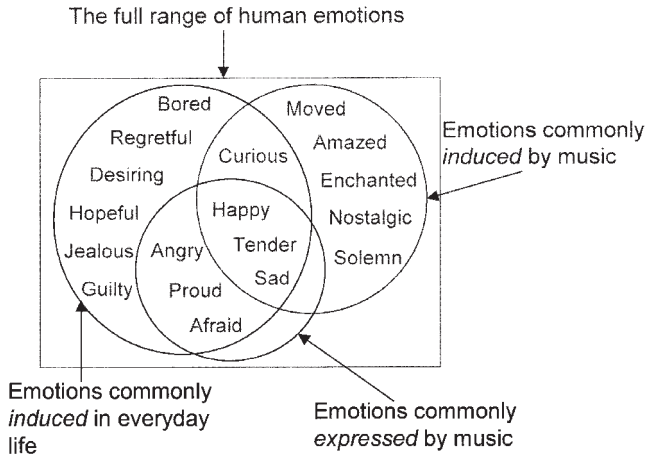

Fig. 3. Hypothesized relationships between (a) emotions commonly induced in everyday life, (b) emotions commonly expressed by music, (c) emotions commonly induced by music (illustrated by a Venn diagram).

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Table 5. Adjective scales intended specifically for the measurent of musically induced emotions, as proposed by Bartel (1992), Asmus (1985), and Juslin and Laukka (this study).

Investigator		
Bartel (1992)	Asmus (1985)	Juslin & Laukka (this study)
Unmoved-moved	*Evil factor*: anger, rage. Cruelty, hate, frustrated	Happy
Emotional–unemotional	*Sensual factor*: love, tender, beautiful, romantic	Relaxed
Forgettable–unforgettable	*Potency factor*: victorious, heroic, stately, patriotic, majestic	Sad
Joyful-sad	*Humour factor*: comical, humorous, amused, playful, cheerful	Moved
Inspiring–uninspiring	*Pastoral factor*: peaceful, calm, relaxed, gentle, pleasant	Bored
Exciting–depressing	*Longing factor*: yearning, longing, lonely	Nostalgic
Deadening–enlivening	*Depression factor*: depressed, dreary, blue, sad, gloomy	Tense
Cold–hot	*Sedative factor*: contemplative, reflective, serene, tranquil, sedative	Amused
Dejected–elated	*Activity* factor: determined, vibrant, vigorous, exuberant	Solemn
Thrilling–boring		Tender
Distasteful–delightful		Interested
Pleasant–disturbing		Angry
		Spiritual
		Longing
		Pleasurable

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