categories that psychologists use to describe emotion. Music produces aesthetic pleasure, a sense of peace and relaxation and/or stimulation and arousal, along with the narrow category of entities that psychologists have carved out and called emotions. Juslin & Västfjäll (J&V) have accurately described what psychologists mean by emotion, but by limiting the feelings aroused by music in this way, they have missed much of the appeal of music. Pleasure itself, and its companion liking, do not fall under the heading of emotion, but are surely an important part of understanding music. Music produces a sense of aesthetic pleasure (e.g., Berlyne 1971) that defies our linguistic categories. Psychologists distinguish pleasure, pain, and moods from emotions. This is a very questionable set of distinctions; "emotion" is not even represented as a word in all languages. And pleasure itself is multifaceted, including sensory, mastery, and aesthetic pleasure (summarized in P. Rozin 1999).

The single defining feature of emotion and pleasure is feeling. If someone feels sadness or pleasure, regardless of physiology and expression, affect has occurred. If someone does not feel sadness or pleasure, regardless of physiology and expression, there is no affect. Either, then, we should consider *emotion* a broader term, encompassing more than the standard set of discrete phenomena that psychologists study, or we should study musical *affect* rather than musical emotion. Perhaps, then, Leonard Meyer's (1956) groundbreaking take on the subject should have been called *Affect and Meaning in Music* (instead of *Emotion*...).

J&V have done us all a favor by putting a diverse set of material about music and emotion in one place and in highlighting the different ways that music can generate emotion. In so doing, they break out of some field-wide ruts that have limited our ability to comprehend how an abstract string of sounds could possibly arouse sadness, hope, and other emotions.

J&V reasonably oppose the accepted definition of emotion as necessarily the result of cognitive appraisal. That said, we disagree with the authors' insistence that all emotions, including musical emotions, must have intentional objects. Certain musical emotions are not *about* the music. One is not sad *about* Barber's *Adagio for Strings* or angry *at* a punk song. Other musical "emotions" do take music as an object. One can feel disgust for the quality of a performance, awe at compositional virtuosity, or joy about the sequence of musical feelings experienced throughout a piece. Such meta-emotions are important phenomena that do not fit into J&V's taxonomy. Their six mechanisms help distinguish between very different sources of musical affect. All contribute to musical affect. But we feel that one of these, which they label "musical expectancy," has an especially important and powerful role in accounting for the universal appeal of music.

Consider the following examples:

1. We hear a foghorn. Surprising, emotional. A brain stem reflex. The foghorn reminds us of a ferry on Puget Sound (visual imagery) and the day we crossed the sound in a pouring rain (episodic memory). This scenario shows many of the mechanisms for the induction of musical emotion, and yet, this situation is not musical. Yes, brain stem reflexes, evaluative conditioning, emotional contagion, and, in a much more idiosyncratic way, visual imagery and episodic memory, all contribute to musical affect. But, in our view, music is more like a novel or well-crafted meal than it is like a foghorn; that is, it is the structure as incorporated implicitly in the listener, in accordance with the implication-realization model pioneered by Meyer (1956) and furthered by Narmour (1990; 1991; 1992).

2. We hear a Mozart piano sonata. The lightness of texture, major key, and fast tempo help create positive feelings. We hear a cadence coming: The dominant chord (e.g., a G-major triad in the key of C major) sounds as though it will resolve to the tonic chord (e.g., a C-major triad in the key of C major) but instead progresses to an Ab-major triad. This *deceptive cadence*, as it is called in music theory, surprises us and instantly changes our affective response to the music. All of these effects are feelings, but many don't qualify as emotions according to the definitions of psychologists.

This is music, and the aesthetic affect induction is due primarily to our appreciation of the implications in the music. What both of these examples demonstrate is the importance of temporal sequence for the experience of musical affect. The affective responses to the foghorn and to the deceptive cadence derive from the same basic source: surprise. The distinction between the two is that we react to the foghorn without any need for prior exposure, whereas we react with surprise and aesthetic pleasure to the deceptive cadence only if we have experience listening to specific musical styles. As Narmour (1990; 1991; 1992) argues, expectations, musical and otherwise, stem from both innate (bottom-up) and learned (top-down) processing. We are born with the ability to detect changes in our environment such as a sudden loud (or sudden soft) sound, or the violation of a continuing repetitive event (accounting for a reaction to the AAB sequence in music of humor) (Rozin et al. 2006). We develop a sense of musical expectations within a specific style such as those that derive from tonal hierarchies (e.g., major and minor). Thus, one could combine these two – brain stem reflexes and musical expectancies – into one more general category of implications.

Without the realizations and denials of implications, music might be sad or joyous, but it would not be an affective, aesthetic experience. The flow of the music, its temporal sequence, is the essential ingredient. Loud and fast music tends to make us happy, but it is primarily the structure that gives us the affective character and intensity.

We agree with J&V about ways that sounds, and that subset of them that we call music, can produce emotions. It is important to understand all six of the affect induction features of sounds and music, and to understand how they interact, usually to reinforce one another. But while we do this, we should remember that, at its core, music is about aesthetic pleasure linked principally to musical structure, its implications, and their probable realizations. Emotion, as a category in psychology, subtly limits our conception of music, and misses much of the story.

The role of exposure in emotional responses to music

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Abstract: A basic aspect of emotional responding to music involves the liking for specific pieces. Juslin & Västfjäll (J&V) fail to acknowledge that simple exposure plays a fundamental role in this regard. Listeners like what they have heard but not what they have heard too often. Exposure represents an additional mechanism, ignored by the authors, that helps to explain emotional responses to music.

At the most basic level, emotional responses to stimuli, including music, involve simple evaluations. Such evaluations are often measured with self-reports, typically by using rating scales with *like a lot* or *extremely pleasant* at one end, and *dislike a lot* or *extremely unpleasant* at the other end. If a perceiver likes one stimulus more than another, or considers one stimulus to be more pleasant, liking and pleasantness judgments extend readily to *preferences*.

These evaluative responses are more basic than so-called *basic emotions* (Ekman 1992b), such as happiness and sadness. This claim is supported by evidence of approach and avoidance behaviors in nonhuman species, and by the fact that brain imaging and lesion studies reveal differential activation solely on this basis. In the musical domain (for a review, see Peretz, in press), different brain areas are activated in response to consonant (pleasant sounding) and dissonant (unpleasant sounding) stimuli (Blood et al. 1999; Gosselin et al. 2006; Koelsch et al. 2006) and to music that sounds scary or threatening (Gosselin et al. 2005; 2007). To date, however, there is no evidence of differential activation patterns in response to, say, happy and sad sounding music,[1] probably because these responses do not map directly onto evaluations (i.e., valence; Russell 1980). Although listeners typically exhibit a preference for happy-sounding over sad-sounding music (Gosselin et al. 2005; Hunter et al. 2008; Husain et al. 2002; Schellenberg et al. 2008; Thompson et al. 2001), people often like and choose to listen to sad-sounding music. Indeed, listeners' typical preference for happy-sounding over sad-sounding music disappears as a consequence of manipulations that induce fatigue and frustration (Schellenberg et al. 2008).

For many years, researchers have documented the role that exposure plays in stimulus evaluations (for a review, see Bornstein 1989). For reasons that seem obvious from an evolutionary perspective, people and animals have an adaptive fear of the unknown (*neophobia*) that extends across modalities. After exposure to a particular stimulus reveals that it is relatively benign (i.e., with no adverse consequences), evaluative responses become more favorable (Zajonc 2001). In line with this view, listeners respond more favorably to music and music-like stimuli they have heard previously compared to novel music (Peretz et al. 1998; Schellenberg et al. 2008; Szpunar et al. 2004; Thompson et al. 2000), even if they do not recognize the stimuli (see Zajonc 1980; 2001). Because the to-be-exposed and novel stimuli are assigned randomly for each listener, favorable evaluations can be attributed to exposure rather than to stimulus differences. Such favorable responding is related to Juslin & Västfjäll's (J&V's) second mechanism (evaluative conditioning), but it differs substantially in that the association involves *learned safety* (Kalat & Rozin 1973), which stems from the absence of negative consequences.

Liking often increases with additional exposure, a phenomenon that is typically attributed to *perceptual fluency* (Jacoby 1983). On this view, a previously encountered stimulus is processed quickly and effortlessly, compared to a novel stimulus, because of the reactivation of an existing mental representation. When asked to make evaluations, people misinterpret this ease of processing as a favorable disposition toward the previously encountered stimulus. This perspective helps to explain increased liking as a function of exposure to stimuli that are aesthetically impoverished or highly controlled (e.g., line drawings: Kunst-Wilson & Zajonc 1980; random tone sequences: Szpunar et al. 2004). Nonetheless, positive misattributions should become less likely with further increases in exposure and explicit memory for the stimulus, such that processing fluency is an obvious consequence of exposure (Bornstein 1989). For real music, however, there is evidence contrary to the hypothesis that liking and memory are associated negatively. Listeners often like pieces they remember (Schellenberg et al. 2008; Szpunar et al. 2004).

Berlyne's (1970; 1974) two-factor model (which J&V mention in a different context) describes liking as a consequence of the arousal potential of a stimulus, which should be neither too great nor too small. Initial wariness towards a novel stimulus results from its arousal potential being too great. With additional exposure that has benign consequences, arousal potential is reduced to optimal levels. Finally, over-exposure leads to boredom as the arousal potential of the stimulus becomes less than optimal. In other words, Berlyne's first factor refers to increases in liking that accompany decreases in arousal potential, due to learned safety; the second factor refers to decreases in liking that accompany further decreases in arousal potential, due to satiety. Berlyne's model is under-specified in describing interactions between liking and memory, yet it explains increases in liking for music that accompany a moderate amount of exposure (e.g., recall when you heard *The Macarena* for, say, the third time), as well as decreases that occur as a consequence of overexposure (when you heard *The Macarena* for the umpteenth time).

Indeed, there is abundant anecdotal evidence of increases followed by decreases in liking for music as a function of exposure. This inverted U-shaped function has also been documented systematically with real music (Schellenberg et al. 2008; Szpunar et al. 2004). Again, because the musical stimuli were assigned randomly to different exposure frequencies (i.e., 0, 2, 8, or 32) separately for each listener, the same stimulus was novel for some listeners, presented at moderate frequencies for other listeners, and over-exposed for still others. In short, the design ensured that liking ratings were independent of differences among stimuli and can be attributed solely to exposure frequency.

In sum, any consideration of mechanisms that underlie emotional responding to music must include exposure as a very basic mechanism, and learned safety, perceptual fluency, and satiety as sub-mechanisms that are related directly to exposure. As J&V acknowledge, failing to account for underlying mechanisms could lead to "inconsistent or non-interpretable" findings (target article, Abstract). This problem is likely to be particularly acute when a well-documented mechanism is ignored.

NOTE

1. Mitterschiffthaler et al. (2007) compared brain activity when participants listened to happy-sounding or sad-sounding music. These authors did not control for liking or pleasantness, however, and several of their findings parallel those from studies that compared activation to pleasant and unpleasant music.

Music evoked emotions *are* different – more often aesthetic than utilitarian

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Abstract: We disagree with Juslin & Västfjäll's (J&V's) thesis that music-evoked emotions are indistinguishable from other emotions in both their nature and underlying mechanisms and that music just induces some emotions more frequently than others. Empirical evidence suggests that frequency differences reflect the specific nature of music-evoked emotions: aesthetic and reactive rather than utilitarian and proactive. Additional mechanisms and determinants are suggested as predictors of emotions triggered by music.

We applaud Juslin & Västfjäll's (J&V's) comprehensive overview of mechanisms of music-induced emotion, which is reminiscent of our production rule framework (Scherer & Zentner 2001). However, whereas we distinguished between central and peripheral route mechanisms (appraisal, memory, and empathy vs. proprioceptive feedback and facilitation), the authors' description of mechanisms tends to confound levels of analysis by addressing phenomena (emotional contagion), content (memory schemata), procedures (visual imagery), and substrata (brain stem). For example, the term *emotional contagion* describes a phenomenon: the spread of an emotion from one person to another. Yet, the mediating procedures and substrata can be quite different. In our 2001 chapter, we showed how contagion can occur through