MUSIC AND EMOTIONS: THE LANGUAGE CONNECTION[1]

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> There is sense and coherence in music, but it is musical sense and musical coherence; music is a language that we can speak and understand but are unable to translate. (Hanslick 1854/1988, 21)

> The only language with the contradictory attributes of being at once intelligible and untranslatable, music [is] the supreme mystery of the science of man. (Lévi-Strauss 1964/1970, 18)

Since the beginning of written history, one of the most pervasive descriptions concerning the art of music has been that it is a language of the emotions. The powerful affective influence of music on human mind and behavior indeed appears as a universal theme not only in music treatises from all periods, but also in literature, philosophy and religious thought. The mysterious susceptibility of humans to musical sounds has formed the basis of the age-old argument that there exists an essential relationship between music and the ethical character of its listeners. Many

[1] Part of this article was presented in a research seminar held at Middlesex University, London, on 28 April 2005. The complete text of this presentation titled 'Music and Knowledge' is printed in the June 2005 issue of *In Medias Res,* Music Research Journal of Middlesex University.

have argued that music shapes the moral character by evoking emotions, which are closely connected with such phenomena as pleasure/pain, approach/withdrawal, and ultimately good and evil. In a well-known passage of *The Republic,* Plato, after considering various types of music with regard to their ethical nature, prohibits the teaching of certain modes in his ideal state, since musical training in his view

> is a more potent instrument than any other, because rhythm and harmony find their way into the inward places of the soul, on which they mightily fasten, imparting grace, and making the soul of him who is rightly educated graceful, or of him who is ill-educated ungraceful. (401.d-e)

Music can cause such changes in one's character because, according to Plato, there is an affinity between the movements of music and those of the soul. Indeed, a basic assumption in music aesthetics since antiquity has been that the sympathetic responses generated by tonal vibrations lead to various affective states in listeners. Aristotle, for example, argues that

> rhythm and melodies contain representations of anger and mildness, and also of courage and temperance and all their opposites and the other moral qualities, that most closely correspond to the true natures of these qualities; and this is clear from the fact of what occurs - when we listen to such representations we change in our soul. (*Politics* Bk.VIII, 1340.a)

That music can profoundly alter the affective state of the human mind is an idea at the core of the story of David, the singer of psalms in the Old Testament. The strong affective influence of music and its ethical impact come together in this story, which constitutes one of the oldest narratives in Western civilization about how music composes distressed minds and changes the feelings of those who hear it. It is thus written that "when the evil spirit from God was upon Saul, David took a harp, and played with his hand: so Saul was refreshed, and was well, and the evil spirit departed from him" (I Samuel 16/23).

Modern music psychology has accumulated abundant evidence — through experiments, self-reports and interviews — that humans indeed establish strong affective ties with the art of music (Juslin and Sloboda 2001). Researchers repeatedly demonstrate that listeners make use of music to alter their moods and emotions in everyday life (Sloboda 1992; Sloboda and O'Neill 2001; DeNora 2000). While the intimate relationship between music and our affective lives has thus been acknowledged universally since the earliest times, precisely how music is capable of casting an emotional spell and bringing about joy or grief has remained a mystery until recently. It is only during the last few decades that — thanks to the collaborative research carried out by neuroscientists, psychologists and music theorists— some of the mysteries about the connections between emotions and music are being unravelled. The knowledge we have today of this fascinating phenomenon is the result of interdisciplinary efforts. With the advent of impressive neuroimaging techniques in neuroscience that allow the monitoring of brain activity as it unfolds in real-time, invaluable scientific data has for the first time become available to researchers in music psychology and theory. When interpreted in the light of the practical wisdom musicians have handed down from generation to generation, such data will no doubt lead to great progress in our understanding of the affective powers of music.

Recent discoveries made in affective neuroscience and psychology challenge a long tradition in Western culture that regards reason and emotion as antagonistic forces. According to this view, which has its roots in Plato, emotions are in essence irrational drives and constitute the "lowly" part of the human mind; they should always be under the control of reason. However, one of the most important hypotheses put forward by the leading neuroscientists Joseph LeDoux and Antonio Damasio in their ground-breaking works about the nature of emotions is that affective phenomena play an essential role in the proper functioning of the cognitive mechanisms of the human mind (Damasio 1994, 1999, 2003; LeDoux 1996). The apparatus of rationality fails without the input of emotions. Damasio, after describing numerous cases of patients with damage to brain cites associated with emotional processing, each of whom experience severe defects in such cognitive functions as decision-making, memory, learning, etc., concludes that "well-developed emotion seems to be a support system without which the edifice of reason cannot operate properly" (Damasio 1994, 42). Another line of evidence regarding the impact of emotions on reason concerns a well-documented fact that positive and negative feelings cue different cognitive processing styles (Clore 1994; Lazarus 1994; Isen 2000). Accordingly, positive affects lead to the mobilization of mental resources for the purpose of organizing and re-structuring available information, while negative affects have a disorganizing impact.

Scientific evidence further indicates that the essential connection between the affective and cognitive realms indeed works both ways: as much as reason requires emotion for proper rationality, affective phenomena employ the cognitive mechanisms of the brain in most if not all cases. The cognitive status of the various processes that activate emotional experiences is a much-debated topic in affective psychology (Lazarus 1999; Zajonc 2000). To be sure, there are both cognitive and non-cognitive processes that can trigger affect: certain tastes, smells and sounds, for instance, are experienced as intrinsically pleasing or displeasing, and their mental processing requires minimal employment of higher-level abstract cognitive operations such as reasoning and problem-solving. There is, however, growing consensus that humans commonly develop emotional responses to the *meanings* they assign to events, rather than to events per se; events generate emotions mainly as they are evaluated and interpreted *cognitively* in accordance with the beliefs, values, and desires of an individual (Ellsworth 1994; Stein et al. 2000; Ellsworth and Scherer 2003). According to the psychologist Frijda

> there seems little doubt that the meaning of events (their implication for well-being and the achievement of goals and values), rather than their objective nature as stimuli, is the primary determinant of most emotions. There also seems little doubt that one often is aware of that meaning, at least dimly and partially. This awareness shapes

> both the emotional experience and its development over time (Frijda 1994, 197).

While the degree of cognitive involvement in different affective experiences can vary widely, if learning-based memory is regarded as a cognitive function of the human mind, almost all affective experiences can be argued to rely on cognition, i.e. on previous perceptual exposure to the world. In this sense, emotional experiences are intimately related to knowing and understanding, the most fundamental cognitive activities of the human mind.

There is no evidence to suggest that music elicits affective responses in a manner fundamentally different from other events or stimuli. Recent research in neuropsychology indicates that emotional involvement with music employs those very brain structures associated with emotional processing. Trainor and Schmidt write, for example, that “music does activate autonomic, subcortical and cortical systems in a manner similar to other emotional stimuli” (Trainor and Schmidt 2003, 310). Furthermore, the hemispheric lateralization that is observed in the processing of negative and positive emotions has also been observed in musical experiences. Just as positive emotions are processed in the left prefrontal areas, while negative ones activate the right prefrontal region (Silberman and Weingartner 1986; Davidson, R.J. 1993), listeners exhibit “greater relative left-frontal activity to music expressing joy and happiness, and greater relative right- frontal activity to music expressing fear and sadness” (Peretz 2001, 119).

The similarities involved in the formation of affective responses to music and to other kinds of phenomena extend to the cognitive realm. In other words, affective responses to music often have cognitive determinants. While the degree of cognitive involvement differs from one context to the other — certain bright timbres, for instance, may generate positive affect through minimal cognitive processing — numerous investigations have revealed that listeners develop non-conventional affective responses to music which they cannot make sense of cognitively (Gregory and Varney 1996; Harré 1997; Meyer et al. 1998). For instance, according to an experiment carried out by Parrott and Harré, listeners who were familiar only with the Western tonal idiom were unable to identify the intended emotional content of Buddhist religious music performed by the Dalai Lama's chorus, and "all reported a feeling of distinct unease while listening to Tibetan music" (Harré 1997, 114). The hypothesis that humans need to comprehend, understand, make sense of the musical structures they hear in responding to them affectively receives further support from the fact that listeners will automatically apply the musical knowledge they have acquired through their experiences with a certain musical idiom to unfamiliar pieces of music (Meyer et al. 1998). Such applications indeed explain the "confusion" of Western listeners who were asked to evaluate Buddhist music. The human mind has evolved to make sense of incoming sensory data, no matter how unfamiliar, new, and surprising these may be, and it is often during this sense-making process that affect arises.

In order to explain how music is related to our affective lives, then, one of the main questions that must be addressed is how humans make sense of music. According to a widely accepted view, listeners make sense of and understand music *as a language.* During the twentieth century, this view led to extensive interdisciplinary research among music theorists and psychologists (Bernstein, 1976; Lerdahl and Jackendoff 1983; Sloboda 1985; Burrows 1990). Prior to the twentieth century, it occupied philosophers and scientists, as well as musicians (e.g. Descartes 1618; Mattheson 1981; C.P.E.Bach 1949; Rousseau 1788; Hanslick 1988; Spencer 1857; Darwin 1871). One of the oldest views relating our comprehension of music to language finds the common ground for the two activities in the concept of *rhetoric.* According to musicologist Bonds, many of the terms used in music theory, i.e. meter, rhythm, cadence, period, etc. are rooted in the verbal art of rhetoric (Bonds 1991), and can be traced back to the treatises on rhetoric and oratory by ancient Greek and Roman authors. It was, however, after the rediscovery of Quintilian's *Institutio oratoria* in 1416 that the relationships between music and rhetoric were systematized into a coherent theory, which became the hallmark of Baroque musical thought. During this period, the activities of the orator and the composer/performer came to be regarded as essentially identical, both aiming to stir, move and direct the emotions of their audiences. It followed that music destined to touch the emotions of its listeners had to first make sense, i.e. be clearly comprehensible just like an oration. The ideal model for composing musical structures was thus sought in the structural principles of classical rhetoric. Similarly, performers were frequently advised to get familiar with the principles employed by orators in delivering their speeches. One of the most important music theorists of the Baroque period, the German Johann Mattheson (1681-1764) argued that the activity of composing music went through the stages of *inventio* (invention of an idea), *dispositio* (arrangement of the idea into the parts of an oration), *decoratio* (the elaboration or decoration of the idea), and lead to the final stage of *pronuntiatio* (the performance or delivery of the oration).

The rhetorical principles of composition continued to form the background for teaching composition during the eighteenth century. One of the leading music theorists of the era, Heinrich Christoph Koch (1749-1816), went so far as to *define* melody as "speech in sound" (*Tonrede*) with its proper rules of grouping and accentuation. Throughout his writings, the reader discerns the subtext common to all eighteenth-century treatises on compositional practice, namely the idea that the composer has to structure his work along recognizable, *comprehensible* paths in order to elicit affective responses. The so-called "mechanical" rules of composition concerning metric-rhythmic organization and phrase structure — the teachable aspects of the art of music — must be observed in order to render the music intelligible to listeners. Intelligibility is thus regarded as a necessary condition for affective responses to music. In this context, Koch argued that

> certain more or less noticeable resting points are generally necessary in speech and thus also in the product of those fine arts which attain their goal through speech, namely poetry and rhetoric, if the subject they present is to be comprehensible. Such resting points are just as necessary in melody if it is to affect our feelings. This is a fact which has never yet been called into question and therefore requires no further proof (Koch 1782-93/1983, 1).

It should be noted that Koch, like all the other eighteenth-century music theorists, believed that even if the rhetorical principles of composition are strictly observed, the result could be affectively unimpressive. He argued that the initial stage of creating a musical idea as the basis of the larger form, i.e. the stage of *inventio,* is the realm of genius, and there are no rules to teach "invention." Indeed, such elusive aesthetic qualities as originality and beauty are part of the process of inventing a musical idea, and they no doubt play a role in evoking affective responses in listeners.

One of the most important consequences of the application of rhetorical concepts to musical structures is that it highlights the awareness of large-scale tonal relations in the listening experience. If a melody is tone-speech, then a listener — to understand and be moved by it — needs to follow not only local events such as individual intervals, rhythmic motives, or timbral qualities, but also large-scale relations such as the grouping of phrases, the connections between these groups, rhythmic/metric irregularities, etc. This kind of "global listening," sometimes referred to as "structural hearing" in music theory, involves the operation of high-level cognitive processes.

It is possible that the experience of local details and of global structure depends on different cognitive strategies, resulting in different kinds of affective involvement with music. Furthermore, it is a well-documented fact that the degree of experience with a certain musical idiom influences the way local and global details are processed: pitch relations, for instance, are processed differently by musicians and non-musicians (Schlaug 2003). In this sense, the large-scale tonal connections and continuities in a piece of tonal music may play a less significant role in the formation of affective responses in non-musicians. In fact, Nicholas Cook argues that even musicians are far from perceiving the tonal connections at the global structural level: "In perceptual terms," he writes, "an extended composition cannot have the tonal unity that a single phrase has" (Cook 1994, 75). This, to be sure, does not mean that large-scale tonal relationships have no effect on listeners: it may be the case that the mind employs different conceptual categories in making sense of global as opposed to local tonal relations, and unity of the kind observed in single phrases may not be one of them. Furthermore, musicians have always been sensitive to the affective meaning implied by modulations, i.e. changes in tonal center during the course of a piece of music (Steblin 2002). After all, if different kinds of modulations at the global level make no difference in terms of the affective experiences of listeners, the tonal worlds of Mozart and Wagner would not sound so different, and have such differing effects. It is not only the degree of local chromaticism that makes Wagner's music experientially different from that of Mozart, but also the large-scale pitch relationships the two composers employ.

From the neurological point of view, there is evidence to suggest that the processing of large-scale musical structures indeed involves brain circuits that are different from the ones processing local events. Storr reports an experience he himself had while he was acting as a "guinea-pig" for one of his colleagues investigating the effects of the drug mescaline. He writes that while under its influence, his emotional reactions to local, momentary musical events were enhanced, but his perception of form lost. Accordingly,

> mescaline made a Mozart String Quartet sound as romantic as Tchaikovsky. I was conscious of the throbbing, vibrant quality of the sounds which reached me; of the bite of bow upon string; of a direct appeal to my emotions. In contrast, appreciation of form was greatly impaired. Each time a theme was repeated, it came as a surprise. All that was left was a series of tunes with no connecting links: a pleasurable experience but onewhich also proved disappointing (Storr 1992, 40).

The commonalities between music and language are not established only through the compositional principles of rhetoric. According to another line of reasoning, music and language have their meeting point in the actual act of delivery or performance such that humans make sense of musical phenomena through its similarities to *language as spoken.* In this connection, there is a long tradition in Western thought of attributing the origins of the art of music to the vocal cries our prehistoric ancestors supposedly uttered as a kind of impassioned speech (Levman 2000). The most famous advocate of this view is the French writer and philosopher Jean-Jacques Rousseau (1712-1778), who believed that humans first communicated with each other by singing. In his view, first languages were chanted because song is the natural expression of feelings, and man's first need was to express his emotions, not his thoughts. The voice, in this sense, served as the universal foundation for the two acoustic communicative systems of our species employing highly structured auditory and motor patterns, namely language and music. According to Rousseau, music could elicit emotions by recruiting its original unity with the voice and impassioned speech. He wrote:

> by imitating the inflections of the voice, melody can express cries of grief, complaints, threats, and groans. It is concerned with all the vocal expressions of passion. It imitates the accents of language and the turns of phrase that reflect every movement of the soul...The sounds of a melody do not only act on us as sounds but as signs of our affections and feelings (Rousseau 1753/1988, 74/76).

Whether or not music and language have a common origin in evolutionary terms, developmental psychologists point to the early affective vocal utterances displayed by infants as the foundation for language and music. Psychologist Dowling, for instance, argues that

> there are at least two forms of early babbling; patterns of proto-syllables and vocal play, often exploring the extremes of pitch, timbre, and loudness ranges of the voice. Between the ages of 9 and 12 months the first of these babbling patterns leads to speech, while both patterns lead to spontaneous singing (Dowling 1994, 253).

The traditional view regarding the neural processing of language and music has been that in spite of a common origin residing in the vocal apparatus, in adults music and speech are separately represented in the two hemispheres of the brain. For a long time, it was believed that speech, representing conceptual thought, is a left-hemisphere phenomenon, while music is mainly processed in the right hemisphere. This view was first challenged in 1974 by scientists Bever and Chiarello who showed that professionally trained musicians exhibit left-hemisphere dominance for music processing (Bever and Chiarello 1974). More recent investigations in neuroscience indicate that the situation is in fact more complex. While some of the language areas in the brain are clearly involved in music processing (Besson and Schön 2003), there are important divergences between the cognitive and neural architecture of music and language (Marin and Perry 1999). Significantly, while it is relatively clear that language cognition is predominantly a left-hemisphere phenomenon, music cognition does not display a comparable right-hemispheric lateralization. Musical functions appear to be much more broadly distributed in the brain. According to Peretz,

> neuropsychological observations have consistently and recurrently suggested that music might well be distinct from other cognitive functions, in being subserved by specialized neural networks...Presently, support for the existence of such specialized neural networks is compelling (Peretz 2003, 192).

Most of the compelling evidence in this connection comes from studies of perceptual and cognitive disorders in music processing. The generic term for such disorders is *amusia*, and it refers to brain malfunctions related to music perception and performance, as well as music reading and writing. The most significant aspect of amusia is that it does not arise from a disruption of basic perceptual-cognitive or motoric functions. Amusic individuals can continue to process and produce language without any difficulties. Peretz cites the case of a nurse, for instance, who lost her ability to recognize music unless accompanied by words, but retained recognition of environmental sounds and understanding of speech, as well as her verbal communication skills (Peretz 1993). Researchers reported other similar cases (Ayotte et al. 2002; Weiser 2003). The finding that some amusic individuals can recognize the voices of speakers, understand speech, recall the lyrics of familiar songs, but fail to recognize any of the melodies that were once familiar raises important questions: for example, if the words and melody of a song are dissociable in terms of neural processing, why did vocal music dominate the greater part of music history in the West, as it still does in many indigenous cultures? Why did the human mind insist on *the unity* of lyrics and melody rather than developing absolute instrumental melodies at a relatively earlier historical stage? Could the answer be related to the powerful affective nature of the human voice?

At the most fundamental level, the alliance between music and speech is based on common non-conceptual communicative patterns that carry emotional messages, which are in part processed by the same neural resources in the brain. Such patterns are indeed none other than those produced by the voice under the impact of various emotional states. The technical term for these vocal patterns is *intonation.* From the developmental perspective, it is only logical that speech and song would originate in common mental representations based on intonation in early life, since at that stage "the most important components of language are those which are concerned with emotional expressiveness rather than conveying factual information" (Storr 1992, 8). For humans, the voice, whether it speaks or sings, is first experienced in its emotional significance. As Besson and Schön write, the idea that the first basic function of both language and music "was to express emotive meaning through variations in the intonation of the voice and rhythm seems to be an object of consensus" (Besson and Schön 2003, 271).

The phenomenon of intonation has been a common topic of research in linguistics, psycholinguistics, music psychology and music theory (e.g. Bolinger 1955; Chomsky and Halle 1968; Scherer 1986; Lerdahl 2003). Intonation can be defined as the prosodic dimension of speech: it is the pattern that results from the changes in pitch, duration, tempo, loudness and timbre of the voice when speaking. Some writers have in fact referred to it as "the melody of language" (Bolinger 1955;

Handel 1989, 442). Linguistic analysts consider intonation not as language proper, but as a dimension added on to syntax and semantics for affective purposes. As evidenced by written language, linguistic communication can take place without intonation. However, it is sometimes intonation alone that reveals the intention and affective state of a speaker. Scientific research indicates that recognition of intonational information expressing affect is dissociable from the recognition of semantic information expressed vocally (Peretz 2001). In aphasic patients, i.e. patients with language-related brain disorders, recognition and production of affective language can be retained while speech comprehension is lost.

Extensive research has been done to understand how intonation conveys emotional messages and which vocal parameters reveal the emotional state of the speaker (for a recent review, see Scherer et al. 2003). In one of the earlier studies, researchers asked professional actors to read a single sentence in Czech so as to express eight different emotions (Sedlacek and Sychra 1963). Listening tests showed that subjects from Asian, African and Latin American cultures with no knowledge of the Czech language were able to determine the emotional content of the sentences with a high degree of accuracy, indicating that expression of affect through intonation is based on universally recognizable vocal cues. The results also revealed that subjects were using the information from the frequency pattern of the voice fundamental — otherwise known as the "phonation frequency" —to make judgments about emotional content. These results were repeatedly confirmed by later studies. Research carried out by Williams and Stevens, for instance, indicates that when the same sentence is spoken with different affective intent, the intonation changes in terms of phonation frequency and tempo (Williams and Stevens 1972). Accordingly, anger is expressed with higher pitches, attaining peaks more than once, while sorrow has a steadily descending contour. Fear, on the other hand, involves sharp contrasts and rapid changes.

If externalization of affect through vocalization forms the basis of both speech and music, then in making sense of music humans must indeed employ the intonational knowledge they acquire through linguistic communication. However, intonation in speech, though contributing to our knowledge of the expressive dimension of the voice, is far from accounting for all the emotional powers of music and for the cognitive mechanisms involved in musical understanding. This is mainly because intonation does not provide an exact counterpart to the musical structure known as *melody,* but only to *melodic contour.* In this sense, references to intonation as "the melody of language" are metaphorical. *Contour* refers to the general shape of a melody regardless of the precise distances between successive pitches. The findings of psychologists indicate that children first relate to music in terms of melodic contour. Jourdain writes, in this connection, that

> devoted parents may divine a budding Mozart in their child's early musical efforts, but there is far to go before the child can really be said to be making music. She will repeat the same melodic figure again and again, holding its overall contour, but distorting the intervals between tones by stretching them wide during one repetition, then flattening them the next. All the while the average pitch level wanders drunkenly up and down. This means that young children lack an awareness of harmonic relations nested within melodies. For them, melody is just a contour, a ride on a vocal roller coaster (Jourdain 1997, 62).

Melodic contour certainly acts as an expressive factor in music and affects us emotionally. A melodic contour that starts low and rises up continuously feels different from one that starts low, rises up and descends at the end. Melody proper, however, is more than mere contour — it is a musical structure with specific rhythms, accents and intervals. Linguistic intonation and musical melodies differ significantly in terms of the pitch categories they employ: while the pitches of a spoken language cover a certain range of sliding tones, musical melodies are based on discrete pitches organized with respect to a scale.[2] A scale is an arrangement, in ascending or descending order, of the pitch material that constitutes the basis of a

2. Recently, several researchers have argued that speech is indeed based on scales with discrete pitch levels, all the while asserting that musical and speech scales differ in important ways. For a review of the scale-theory of speech, see Brown 2000.

musical composition. It is common knowledge that in different historical periods and in different cultures, different scales have been devised and favored. However, linguists have discovered no natural languages employing musical scales, and ethnomusicologists have never found a culture that builds its music primarily on sliding tones. This crucial distinction was already noted during the nineteenth century by the German scientist Hermann Helmholtz (1821-1894) who argued that

> an endeavour to imitate the involuntary modulations of the voice and make its recitation richer and more expressive, may very possibly have led our ancestors to the discovery of the first means of musical expression...But it is quite clear that every completely developed melody goes far beyond an imitation of nature. The very fact that music introduces progression by fixed degrees both in rhythm and scale, renders even an approximately correct representation of nature simply impossible, for most of the passionate affections of the voice are characterized by a gliding transition of pitch (Helmholtz 1863/1954, 371).

Musical scales divide the continuous frequency spectrum into discrete pitches, and create a musical space within which musical movement unfolds. As different from the perception of linguistic intonation, perception of musical melody makes use of complex cognitive structures such as internalized mental schemata of the pitch-space in question. Listeners who are sufficiently exposed to music based on a certain scale system internalize not only the contour relations between tones in terms of their highness-lowness, but also the structural importance each tonal location within the scale assumes.

To give a concrete example, both music theorists and linguists have noted that speech and music display similarities in terms of the way phrase boundaries are treated. It has been demonstrated that phrase-endings are cued by a certain amount of slowing down both in language and in music (Klatt 1976; Todd 1985). The similarity ends, however, when pitch-changes at the end of linguistic and musical phrases are taken into account. While a pitch-drop or raise in many languages — depending on whether the statement is a question or not — can cue the listener the end of a spoken sentence, sense of closure in musical melodies is independent of a lowering or raising of the pitch relative to the previous note. This is because closure in music, which almost always draws forth an affective response, has to do with the degree of relative stability that each tone implies in relation to the others. Hence, in order to experience the degree of melodic closure and be affected by it, a listener needs to have access to an internalized schema of the scale in question. A musical phrase can attain closure by leaping up or down in pitch, and unless the listener is familiar with the scale structure, he may not be able to infer closure merely from the contour information at a particular moment along the music. A crucial difference between speech and music, in this connection, concerns the phenomenon of *octave equivalence*: the two pitches constituting the musical interval known as the octave, resulting from the simple frequency ratio of 2:1 between them, are universally recognized as categorically identical. Octave equivalence plays an essential role in the development of musical scales and compositional rules, unlike in the case of language. Linguistic syntax is insensitive to the phenomenon of octave equivalence. In this sense, the major scale in the Western tradition, for instance, achieves the same degree of closure by climbing up to the tonic pitch or descending down to it.[3]

The differences between phonological contour and musical melody are also highlighted by recent neurological investigations. Accordingly, while phonological and musical *contours* are processed in the same region, musical *pitch intervals* employ different brain structures (Peretz 1993; Patel and Peretz 1997). Certain amusic individuals can recognize the intonational contour of speech, but not melodies, since they fail to process pitch-intervals (Ayotte et al. 2002; Weiser 2003). Interestingly, this kind of impairment works only in one direction such that if one cannot process contour, one cannot process pitch-relations. The music theorist

3. In fact, it can be argued that because of the smaller distance between the seventh scale degree and the tonic in the major scale — as opposed to the distance between the second scale degree and the tonic — scalar motion up to the tonic is more strongly closed. Smaller interval size creates a stronger pull towards the tonic.

Lerdahl argues that these research findings make intuitive sense: "if a listener cannot tell up from down," he writes, "how could he or she distinguish between a minor third and a perfect fourth?" (Lerdahl 2003, 426).

Most comparisons between linguistic intonation and musical melodies in the research literature consider the *structural* properties of melodies. Intonation, however, which can be regarded as an aspect of language in "performance," can also be effectively compared to *music performance.* In this connection, Juslin has argued that communication of affect in musical performance relies on acoustic codes that are also used in vocal expression of emotions (Juslin 2001). These codes include specific uses of tempo, loudness, and timbre. In one study, Juslin and Laukka used the method of "cognitive feedback" to improve the emotional expression of performances (Juslin and Laukka 2000): performers first played selected short pieces to communicate various emotions, and their performances were judged by listeners in terms of the intended emotional expressions. Then, performers were asked to change their cue utilization in accordance with the judgments of listeners, resulting in improved emotional communication. The implication of this idea is that listeners experience the affective dimension of musical performances by means of the mental schemas they have for recognizing vocal affect expressions. However, if the assumption that communication of affect in performance makes use of codes used in vocal affect communication is correct, then one needs to explain why listeners — but not performers — seem to have immediate access to such referential vocal codes. Furthermore, some studies report cases of individuals who have lost the ability to recognize the emotional content of music and develop affective responses, but retained their linguistic and general musical skills (Mazzuchi et al 1982; Mazzoni et al. 1993): even though they still had access to schemas for the vocal expression of emotions, this knowledge was not sufficient to retain affective involvement with music.

Perhaps the most important difference between speech and musical melodies is that while intonational properties of speech can be used for musical purposes effectively — e.g. as in music composed by Leos Janacek, and more commonly in electroacoustic works (e.g. *Omaggio a Joyce* by Luciano Berio) —

intonation by itself does not form patterns that are sufficiently memorable to become aesthetic phenomena. People do not "listen to" intonations independently from the semantic content of spoken utterances, and derive aesthetic pleasure from them. Musical melodies, however, are among the most memorable products of a culture, and are often cherished for their affective and aesthetic properties; and because they are highly valued cultural constructs, melodic structures are open to anthropomorphism, as in the words of ethnomusicologist Simon Shaheen who wrote that "a melody is a group of notes that are in love with each other" (Patel 2003, 325).

The primacy of pitch-relations in musical structures, while distinguishing music significantly from speech, also makes it possible for us to talk about *musical syntax*, and underlines once again the idea of *music as a language.* The term *syntax* was first used in the context of music by theorist Hugo Riemann in his *Musikalische Syntaxis* of 1877. The possibility of a musical syntax and grammar provides an explanation for the qualitative difference we experience when we hear a melody as opposed to a mere succession of tones. When we hear a succession of tones as melody, we hear them as music, i.e. as making musical sense and carrying affective meaning. This is because a melody is, in the first place, a musical structure that is grammatical: it involves finite discrete events in a rule-based hierarchical organization, and thus satisfies the basic requirements of a syntactic structure. The philosopher and music critic Roger Scruton likens the difference between mere tones and music to that between a sound and a word, and argues that such transformation — as from tone to music, or from sound to word — takes place within the perceiving, cognizing mind. He writes that the word *bang,* for instance,

> consists, in its token utterances, of a sound. This sound could occur in nature, and yet not have the character of a word. What makes it the word that it is, is the grammar of a language, which mobilizes the sound and transforms it into a word with a specific role: it designates a sound or action in English, and emotional state in German. When hearing this sound as a word I hear the 'field of force' supplied by grammar. The sound comes to me alive with

> implications, with possibilities of speech. I do not merely hear the sound of the voice: I hear *language* which is an experience of meaning...[In a similar fashion], when we hear tones, we hear the grammatical implications in something like the way we hear the grammatical implications of words in a language...When we hear music, we do not hear sound only; we hear something in the sound, something which moves with a force of its own (Scruton 1997, 17-19).

According to Scruton, the additional something that we hear in each sound of a piece of music comes from our knowledge of musical syntax. Just as we naturally know how words behave in our native language, we know how tones behave in our 'native' musical language. Listeners can easily detect a wrong note when they hear it in a piece of music belonging to the tonal idiom they are familiar with. Recognizing syntactical mistakes is a cognitive skill that comes without effort in the case of our native tongue and music. Music psychologists argue that listeners are indeed sensitive to deviations from the pitch-related schemas they have acquired (Dowling 1978), and numerous studies have demonstrated that such schematic knowledge generates *expectations* with regard to the unfolding music. Feelings of expectation are also a prominent part of language comprehension: listeners develop specific expectations about *which* words might follow the ones they have already heard in an unfolding speech, and *when*. Accordingly, the perceptual phenomenon of supplying a missing phoneme or a note is quite common both in language and music (Dewitt and Samuel 1990). When a phoneme within a word or a note within a melody are replaced with noise, listeners have difficulty indicating which phoneme or note has been thus replaced: their expectations generated by their knowledge of words and of musical patterns and styles supplies the missing information unconsciously.

The role of knowledge-based expectations in musical experiences has been employed by music theorist Leonard Meyer as the basis of one of the most influential theories of affective responses to music proposed during the twentieth century. In his *Emotion and Meaning in Music*, published in 1956, Meyer argued that "affect or emotion-felt is aroused when an expectation — a tendency to respond — activated by the musical stimulus situation, is temporarily inhibited or permanently blocked" (Meyer 1956,31). One important shortcoming of Meyer's theory is that the psychological mechanism he proposes as the basis of an affective response, namely *expectation-inhibition-satisfaction*, implies the rather 'perverse' idea that listening to music conditions humans to expect emotional fulfilment only after an experience of inhibition (Doğantan 2002).

One of the most laudable efforts in explaining the syntactic nature of music in the form of a rigorous theory can be seen in the interdisciplinary collaboration of the composer/music theorist Fred Lerdahl and linguist Ray Jackendoff. The book they have co-authored in 1983, *A Generative Theory of Tonal Music,* is already regarded as a classic in music theory as well as the work with which music psychology came of age (Sloboda 1986). As the title of their book makes explicit, their work is greatly influenced by the transformational-generative linguistics put forward by Noam Chomsky in his celebrated *Syntactic Structures* of 1957, and in *Aspects of the Theory of Syntax* of 1965. Chomsky's theories have influenced many different disciplines including philosophy, psychology and anthropology. Indeed, Chomsky puts forward his generative linguistics as a research ground for the investigation of the structure and innate properties of the human mind. Language is only one of the many complex behaviours that humans engage in, and Chomsky's theory has served as a model for scholars in various disciplines within the social sciences investigating the nature of human activities other than language.

Similar to Chomsky's generative linguistic theory, which aims to explain through a formal system of rules or grammar what a person knows when he knows how to speak a language, Lerdahl and Jackendoff state the goal of their theory as "a formal description of the musical intuitions of a listener who is experienced in a musical idiom" (Lerdahl and Jackendoff 1983, 1). However, their generative theory of tonal music is not only about assigning structural descriptions to a given piece of music, but also aims to describe how a listener chooses among various descriptions. Their assumption is that

> the experienced listener is more likely to attribute some structures to music than others. Music is not tied down to specific meanings and functions, as language is. In a sense, music is pure structure, to be 'played with' within certain bounds. The interesting musical issues usually concern what is the most coherent or 'preferred' way to hear a passage. Musical grammar must be able to express these preferences among interpretations, a function that is largely absent from generative linguistic theory. (Lerdahl and Jackendoff, 1983, 9)

Hence, the theory of music developed by Lerdahl and Jackendoff involves well-formedness rules and preference rules, which are not part of Chomskian linguistics: the former indicate the possible structural descriptions for a tonal piece of music; the latter specify those descriptions that correspond to the ways an experienced listener would hear the piece. Preference rules are necessary in a musical grammar because musical syntax is much more flexible than linguistic syntax. Ambiguity in musical syntax, for instance, has been noted as an essential aesthetic feature of the art of music (Aiello 1994). In this sense, linguistic 'communication' and musical 'communication' involve significant differences. While the primary function of speech is communication in the sense of imparting information in an unambiguous way from the speaker to the listener, which requires a rather rigid use of syntax, this is hardly the key to musical communication. As is well-known, composers often strive to find new means of departing from the established syntactical patterns of a musical style for aesthetic reasons. What is communicated via music are not unambiguous messages, but peculiarly musical forms of thought which often incites *communion*, a common mental bonding between participants in a musical experience, rather than *communication*. A good example of musical communication as communion is simultaneous singing that makes use of the harmonious blending of independent melodies. Such simultaneous structures are not part of speech which relies on intelligibility, and hence individuality, for communication. As the quotes from Hanslick and Lévi-Strauss given at the beginning of this essay indicate, the intelligibility of music is peculiarly musical.

In spite of the many significant parallels between transformational-generative linguistics and the generative theory of tonal music — including the use of tree-structures in analysis, and the claims for linguistic and musical universals respectively — the theory of Lerdahl and Jackendoff is built upon a peculiarity of musical syntax which does not have any parallel in natural languages. In tonal music, events have *stability conditions* and they are heard as creating patterns of tension and relaxation depending on their stable or unstable nature. In the dimension of pitch, the traditional terms that define stability/instability are *consonance* and *dissonance*: both terms are customarily explained by reference to the affective response tonal combinations elicit, such that those producing agreeable, pleasant sensations are consonant while those evoking disagreeable, unpleasant sensations are dissonant.

Tonal combinations that are to be treated as consonants vary greatly from culture to culture, and from one historical period to another. During an early period in the history of Western music, the interval of the fourth was considered consonant and the third dissonant. In the syntax of the common-period tonality, however, thirds are the most consonant intervals following the unison and the octave. The implication of this phenomenon is that affective responses to tonal combinations are in part determined culturally.

The fact that pitch events in tonal music have stability conditions further explains the experience, described by Scruton, of hearing ”something else besides the sounds” in music. Whenever we hear intervals or chords within a tonal environment, we experience them as having *dynamic qualities* due to their stable or unstable nature. Some combinations sound stable and complete, appropriate for achieving closure, while others imply movement towards further completion and closure. The representation of such *directed motion* is one of the basic features giving tonal music its po to call forth affective responses from listeners. The schematic knowledge that listeners who are experienced in a certain musical idiom have about stability conditions is what allows them to experience directed motion and the patterns of tension-relaxation in the unfolding music. The generative theory of Lerdahl and Jackendoff presents a formalization of this syntactic knowledge.

The concepts of tension and relaxation in relation to music have received much attention from researchers. As emotional experiences almost always have a physiological dimension, which is defined primarily through the processes of tension and relaxation, the links between music and emotions can be established upon these concepts. Some of the very common physiological aspects of affective responses to music, including goose-bumps, racing heart, lump in the throat, shivers and tears, are rare in responses to linguistic constructs, and research needs to consider in more detail the nature and causes of the markedly embodied nature of affective responses to music. The connections between implicit and emotional memories, in particular, deserve closer scrutiny: implicit memories are rooted in memories of physical skills as well as on the rule-like organization of things and events in the world (Snyder 2000). There is evidence that emotional memories are in part implicit (LeDoux 1996). Contents of implicit memories are not easily translatable into language because they are represented as sensorimotor schemas rather than propositionally. Snyder suggests that music is in fact a metaphor — a representation in sound — of our implicit knowledge and memories (Snyder 2000, 109). In this sense, music as the *language of emotions* would indeed be an untranslatable, yet immediately intelligible language expressing what no natural language can express.

The study of musical experiences involves great potential for expanding our understanding of the human mind. If, as neuroscientists claim, there is “no grossly identifiable brain structure that works solely during music processing, [and] all of the structures that participate in the processing of music contribute to other forms of cognition as well,” (Tramo 2001, 54) then musical experiences can be regarded as providing a model, indeed the essential structure, for various other cognitive and affective behaviors that are specific to the human species. Unraveling the mysteries of music thus means unraveling the mysteries of the human mind. Research that is destined to illuminate the relationships between music and emotions is therefore bound to be interdisciplinary in nature. Historically, research both in music and emotions have relied on various disciplines including philosophy, psychology, anthropology, linguistics, and physiology, and significant contributions in current research concerning the relationships between music and emotions will come from interdisciplinary collaborations, which "provide the royal road to progress" (Sloboda and Juslin 2001, 98). In this sense, musicologists, more so than ever, need to be conversant with the recent conceptual tools and models employed by psychologists, neuroscientists, linguists, and anthropologists — not to mention the research in acoustics, history and aesthetics — in order to pave the way for far-reaching strides in studies of affective responses to music.

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