Purposeful Use of Music

By Lou Fournier Marzeles

"Music is love in search of a word."

—Ambrose Bierce

The universe is one vast orchestra. We are its instruments.

What we hear, what we sing, what we play are expressions of the resonance we experience, as creatures of nature, from nature all around us. And while this description might seem merely rhapsodic, it turns out to be pretty much literally true. Rodgers and Hammerstein didn't have it quite right: Far more than just the hills are alive with the sound of music.

You can make music with a blade of grass, as many have discovered at some point in their youth. As with choosing any good instrument, you need to pick the blade carefully: you want a nice, smooth, thick one. You carefully position the blade of grass vertically between your thumbs. You blow over the grass in the little space that forms just below your knuckles. It's a crude reed instrument; you can't get much tonal variation, of course. But you can make quite a musical sound as your breath causes the grass to vibrate.

A blade of grass, simply used in such a way, shows a very close connection between music and nature. In recent years, research on sound and its properties has come into its heyday; and that research shows more and more how much of a natural phenomenon music really is. And in the ultimate demonstration of making music with a natural object, there is an elderly man in Mexico who regularly makes news and draws sizable crowds as he performs very musically sophisticated concerts—on a leaf!

The fact is that everything in nature can be said to make a potential sound, because *everything in nature vibrates*. Much of natural vibration remains inaudible; we can hear sound only when vibrations occur in something capable of carrying sound waves to our ears, such as air or water. The quintessential sounds of nature that we do hear—such as wind rustling through trees, the syncopation of bubbling water—are preternaturally musical.

When Pythagoras stated that the universe was filled with Music of the Spheres, he was saying, among other things, that the creation is inherently and thoroughly musical. From this perspective, music is not an invention of man; songs and symphonies are, but they are man's expressions of what he hears all around. Some musicologists say that music is organized sound, and by that definition the sounds occurring in nature are not, strictly speaking, music. But let us consider the quite reasonable possibility that nature has its own innate and remarkable sense of musical expression. There are times when nature does its own organizing of sound, with far more musically evocative results than our human efforts. Music as we typically understand it is the human interpretation of the voice of nature.

Scientists discover more every day about the sounds made by the spheres whirling through the heavens. At the time of this writing there is a remarkable Web site at Stanford University where you can download files of the sounds the sun makes. Are these sounds music? Some would say no. But the poet within even the staid scientists of Stanford can't resist calling the site the Singing Sun (http://solar-center.stanford.edu/singing).

But why does any of this matter? What difference does it make whether or not music arises from and is a deeply indigenous aspect of nature? Understanding the "naturalness" of music enables us to use it in a much more focused and powerful way.

Use music? Don't we just *listen* to music?

No. No matter how seemingly undirected our thoughts are when we even casually play music at any time, we always have an intention behind it. We choose the music we listen to, even if ostensibly just for background and notwithstanding how seemingly innocuous such a choice seems. We don't always consciously know what that purpose is. And that's my point. Music can be used consciously and very purposefully, and it is extremely important—and helpful—to do so. This purposefulness must consider two principle aspects of music. First, it must take into account the physical properties of sound itself on the human nervous system, a field of study called *psychoacoustics*. Second, it must consider the intent of the performer and composer or songwriter, for music is also a carrier of *intentionality*, or, one might say, its *consciousness*. If we don't make our musical choices

in a very aware way and with an appreciation of music's true power and influences, at best we won't take full advantage of it. At worst, we defeat our own best desires, sometimes with quite harmful consequences. The use of music, we discover, carries with it a significant responsibility.

Good Vibrations

Music is known to have properties that enhance learning and alter moods. The "mind-alert/body-relaxed" use of music, pioneered by Bulgarian psychiatrist Georgi Lozanov, uses rhythm to slow down bodily functions and induce slower brain wave activity, both of which expand the brain's learning capacities. Indeed, music has long been used by casual listeners and health-care professionals alike to calm nerves and experience the pleasure of sound. But just as there is the beauty of a favorite soft and gentle melody, there is also the screeching of fingernails on the blackboard or the thundering of a jackhammer on the pavement just feet from your ears. The fact is that sound can be either greatly empowering or highly toxic depending on how it's used.

Psychoacoustics

French physician and psychologist Alfred Tomatis, called by some the "Einstein of the ear," was an early pioneer in the development of psychoacoustics. Working through much of the latter half of the 20th century, Tomatis discovered that sound—in particular, certain frequencies of sound—is actually a neurological nutrient that charges the neocortex of the brain. With these frequencies, our higher-order thinking skills become greatly enhanced; conversely, Tomatis discovered, other kinds of sounds can damage or discharge energy from the body.

What distinguishes healthful sounds from unhealthful ones? One of the most critical considerations is the frequency at which the sound vibrates. Sound vibration is measured in the number of cycles per second, and the common unit of such measurement is called *hertz*. The higher the frequency, the more cycles per second, or hertz, it vibrates at. The normal range of hearing for humans is generally between 20 and 20,000 hertz, although some people can hear above 20,000 hertz, as can many animals, including dogs, dolphins, alligators, and elephants.

Everything physical—from people to the earth itself—has a frequency at which it most naturally vibrates. This is its *resonant frequency*. When we hear sounds that do not (literally) resonate with us, we get a sense of vague discomfort on one extreme to outright illness on the other. So what are the sounds that our brains thrive on? What exactly are those vibrations? According to the research of Tomatis, they are the *higher* frequencies of sound: Eighty percent of the neuroreceptors for sound respond only to frequencies above 3,000 hertz, and one-third of the charge that the ear supplies to the brain comes from these frequencies. Tomatis discovered that, in particular, frequencies above 8,000 hertz provide enormous neurological benefit to the brain. Optimal frequencies for charging the neocortex, then, are well above what we hear in our common daily experience.

Ranges of human hearing influence different areas of our lives. Low frequencies—from 125 to 750 hertz – greatly influence the vestibular system and, therefore, have the greatest impact on the body. Human languages usually occur at midrange frequencies—750 to 4,000 hertz—although some use frequencies up to 12,000 hertz.

Unfortunately, we live in a world that is largely unaware of the power of sound. Have you heard cars rolling down the street with the bass turned up loud enough to stun small animals a hundred yards away? Joshua Leeds, a leading psychoacoustics expert, calls such bass-heavy music "sonic Valium." This is because extended exposure to loud bass sounds tends to discharge cerebral energy, thereby dulling the physical senses. Joshua's concern for what he calls secondhand sound has led him to the forefront of a new movement he calls "sonic activism."

Part of my professional work involves consulting to education about their music use. In that work, one of the first things I do is to check music playback systems everywhere in the building. The bass is almost always far heavier than it should be. Keeping the bass in proper balance is critically important to prevent physical burnout, especially for teachers who have music playing most of the school day (and perhaps continue to listen to it on their own time). Likewise, it's important to keep the upper frequencies turned up as high as the playback system will allow while still keeping the music pleasant. Reaching this balance often requires outside ears, because most people's sense of sonic balance itself is out of optimal balance**;** few people realize how toxic their listening habits have become.

Because I'm both a musician as well as an educational consultant, I'm constantly asked by teachers, "What music should we play in the classroom?" This question is often posed with trepidation. Many educators fear a tense showdown with students (or even

with each other) over issues of personal musical taste or cultural preference. The answer gracefully skirts all such issues, because it has to do almost entirely with psychoacoustics.

Any music that provides optimal neurological nutrients is useful. Ideally, that means music recorded, mixed, and mastered with an optimum of high acoustic frequencies and played with the best frequency balance possible. Interestingly, music tends to self-organize by broad categories when considered from a psychoacoustics perspective; for example, classical music is generally more healthful sonically than are most forms of contemporary popular music.

Even governmental agencies have come to realize the significance of psychoacoustics and have used their properties to remarkable benefit. The city of Vallejo, California, attracted international attention in the winter of 2001 when it started playing certain kinds of music over speakers in high petty-crime districts. The crime rate in these areas plummeted dramatically—"Some 25 to 40 percent at the bus transfer station," according to Mark Mazzaferro, public information officer for the city. "We saw similar programs used successfully in New York, Montreal, and Boston, so we decided to give it a try here. At the bus station, the only thing that changed was the music." The program cost all of about $200 per site. "We just went down to Target and bought a CD player, speakers, and CDs," Mazzaferro says. "It was enough to do the job." People whose ears are psychoacoustically accustomed to particular musical properties have a very hard time tolerating sound that does not match those properties.

Listening habits can of course be changed, and there are numerous programs designed to do just that. Such programs can recondition the ears, first to discern the higher, healthier frequencies, and then to listen to them enjoyably. Some of these programs have demonstrated astonishing benefits for people suffering from a huge range of difficulties, from severe depression to autism.

The Undercurrent of Overtones

Pythagoras is remembered today primarily for his famed geometry theorem, but most musicians consider his most profound contribution to our knowledge to be his discovery of the overtone series. There is probably nothing that more powerfully demonstrates the astonishing, natural order of music—and it is further telling that overtones, being very high frequency sounds, are extremely important for the optimal charging of the neocortex.

Overtones, or harmonics, occur in all sounds made acoustically (that is to say, on non-electronic acoustic instruments such as guitars and pianos and by the human voice). Whenever we hear a note played on an instrument or sung by a voice, the note we hear seems to be a single sound. But in fact it's actually made up of many different tones all resonating simultaneously but in differing degrees of strength or prominence. The lowest tone of these frequencies is always the strongest and is the primary tone of the note we hear. The higher frequencies are those heard over the original tone—hence, the overtones. All the frequencies in the tone together help make up its "color" or natural tone, and it would sound very different and unmusical—unnatural—if the overtones were not there.

Sound is carried on waves and is measured, as we said, in vibrational cycles per second. The specific number of cycles per second determines the pitch of a particular tone. When you hear of an instrument being tuned to the standard pitch of A 440, for example, that means that it's being tuned to the note A, vibrating at a rate of 440 cycles per second.

Pythagoras took a single piece of string and stretched it across a board; he called this primitive "instrument" a monochord. With this simple device, he made an astonishing discovery of the correlation of music and its overtones with mathematics and, ultimately, with the nature of the universe itself. He found that if you divided the string into two equal portions, the sound made at that midpoint vibrated at a rate exactly twice that of the entire string. If the note of the whole string were the A 440 in our example above, for instance, when the string was divided in half, it then vibrated at a rate of 880 cycles per second. And the tone made at that midpoint was exactly an octave higher than the tone of the whole string. Likewise, when he divided the string into three equal portions, the tones produced at those points vibrated at a rate exactly three times that of the entire string. And so on: divided into four portions, the tones were exactly four times that of the entire string, and on indefinitely. There is an exact and absolutely predictable correlation, Pythagoras discovered, between equally divided lengths of a string and the vibrational rates of the tones produced at those intervals.

The mathematical precision of overtones seems amazing in itself, but the amazement mounts when we realize that the notes produced by the first several overtones produce a sound that is immensely pleasing—because they just happen to form a major chord. They include the tonic note (the fundamental and its octave notes), a perfect fifth, and a major third; these are the exact intervals of a standard major chord in Western tonality. The Western ear generally hears the early overtone notes more clearly than the later ones; it tends to most readily hear that major chord in the first handful of overtones. I

believe this tendency helps explain our cultural preference for music based on this tonality. We love simple music based around this sound. In other cultures, the ear hears and often favors the later overtones, which become increasingly microtonal; this may likewise help reveal why some cultures love to sing notes that Western tonal consciousness can barely recognize. Interestingly, though, even cultures deeply steeped in microtonality generally love the sound of "simple" Western music; Indian and Asian audiences buy Western popular music by the truckloads.

It was a reasonable conclusion to Pythagoras that the overtone series and its mathematical precision were more than just coincidence. To him and many since, the overtone series was proof of a divine order in the universe. He considered the universe itself to be one vast monochord with one end of a cosmic string attached to the world of spirit and the other end connected to the world of matter. He believed that the study of music and the science of its intervals could bring one to a full understanding of the creation. He wrote of the arrangement of the planets as notes on a musical scale, and he spoke of the Music of the Spheres. An entire school of mysticism formed around these beliefs, and it continues to this day. Small wonder, given that overtones, with their exact mathematical order and "coincidental" beauty, are absolutely essential to our optimal listening health since they are among the high-frequency sounds we need to best charge our brains. Some listening purists, in fact, will listen to no music that was not recorded with acoustic instruments, fearing the loss of their natural overtones.

I share Pythagoras' amazement at the orderliness and natural origins of music. Music is the perfect union of head and heart, of science and art, of will and emotion, of man and nature.

Music as a Carrier of Intentionality

Is music truly love in search of a word? Ambrose Bierce's quote that starts this chapter is delightful, depicting music as science losing its head in song, making its way to union with the soul. But where does the rhapsodic meet the road, so to speak? Is there substance beyond this gentle poetry? Most definitely. If we understand this, we can understand, appreciate, produce, and apply music in its highest, most ennobling expression.

As with all things, music is composed for deliberate purposes. The stirring notes of the aria sung at Mimi's death in *La Boheme* remain one of the most powerful energetic depictions of sorrow ever conveyed in art. The melody of "Yesterday," which came to Paul

McCartney in a dream and seemed to him so exquisite that it must have been something he'd heard sometime before, convey a delicious sense of romanticism. And the urban drive of many rap musicians pointedly carries the fury and frustration of a disheartened populace, producing music that strikingly conveys the disharmonious (and destructive) psychoacoustics of its intention.

The intention, or consciousness, behind how a piece of music is written, and performed, is no less important in choosing music for specific purposes than its psychoacoustic properties; it is, in fact, the most important factor. It is beyond the scope of this article to detail how intentionality becomes fused in the actual music of a piece, integrated into it below the more obvious level of the music and lyrics, though the topic is immensely fascinating and I do live presentations on it. Our point here is to remind the purposeful user of music that intentionality is always present. Choose music carefully for the particular need at hand. *P*ick pieces that appropriately support the situation. If you're an educator whose students are doing a presentation on the history of slavery in America, for example, it's entirely useful to use field hollers, the earliest tunes sung by slaves at work, and songs that convey the awful sense of human denigration. One can use compositions that reflect the human condition of a time and place. But keep such selections in perspective; one does not want to leave people dangling in the despair of a challenging time. Balance it with music that carries intentionality of hope and promise.

Music is, in the end, a mirror of human development. Nature reminds us constantly, in psychoacoustics, its natural origins, and its profound capacity to carry emotional intention, that we are inextricably connected to all things around us and to each other. In the end, music reveals the full range of human consciousness, and it will affect human consciousness commensurate with any particular aspect of consciousness from which it springs.

At its best and highest, music is indeed love in search of a word. My interest in music is in its expression of that longing. I know of no more useful purpose, and that is my purposeful use of music. If God is love, then let music be His word.