

## Music – Sounding Proportions in Motion

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### Abstract

Music reflects and recreates our feelings and emotions through invisible, immaterial structures, which we perceive intuitively. We cannot see those structures, nor we can touch them: they are streams of organized sounds.

Music is the only pure temporal art; this is why music provides the best illustrations for the nature of Time. In a 3-D world, a mirrored 3-D object can be easily recognized as “the same”. It is not so in music. Time-space of music does not have the isotropic symmetry of the 3-D space; hence mirroring of a tune creates new musical individual. We recognize a 3-D object at a glance, yet we cannot recognize a melody if all its notes are played at once without spacing in time. As Henri Bergson wrote in his *Time and Free Will*: “Time prevents everything from being given at once.” A musical composition grows like a living organism from a “point” in time-space. By following development of a musical theme along the arrow of time, we accumulate connections that bring temporal and tonal patterns together. The previous experience—the “past”—forms feeling of “now”, and the “now” spills into the future. While listening to music, we feel the flow of life, which is the flow of time.

Some of the most exquisite metaphors provided by visual arts to music are those that illustrate the structured silence. Mozart once said that the pauses are the most beautiful aspect of music. Windows, doors—any openings that represent the negative space in visual arts—are similar to pauses in music. As an open window or door could create a feeling of possible discovery, musical pauses could create feeling of anticipation and tension. Musicians play with time-space of music by stretching and compressing it. A musical score presents only an approximation of a composer’s idea; it is the task of an interpreter to bring a musical composition to life. By bending the sounding time, a musician molds the listener’s emotional state.

Musical compositions are formed within a force field of tonality that acts like the force of gravity. The tonal gravity finds its origin in the nature of sound. When an ordinary string or pipe vibrates, it generates harmonics, or overtones, whose frequencies are 2,3,4...times the frequency of a fundamental tone. For example, when the strongest overtones of the C string are placed close to each other, they make the C-chord (C—E—G). In other words, a single note of C appears as a chord on its own thanks to the “hidden dimension” of the overtones.

The favorite musical intervals of Pythagoras—the octave, fifth, and fourth—are called consonants. The most important fact about notes of these intervals is the communality of their strongest harmonics. For instance, the interval of the octave consists of a fundamental tone and its first overtone; the interval of the fifth consists of a fundamental tone and its second overtone. Taken independently, consonants sound peaceful to our ears. Perhaps, presence of the communal strong overtones makes it easier for our brain to process the consonants, (thus, less effort pleases our brain on a subconscious level). Notes of the dissonant intervals, like the minor second and major seventh, do not have the strongest harmonics in common.

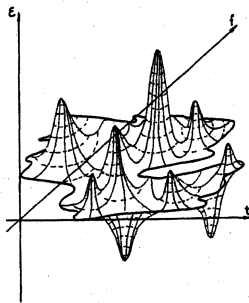
Tonality in music is system of tonal relations: a single musical sound does not create tonality, similar to how a single individual is not a society and thus cannot create societal structures. The tonal force field is made of a web of tonal relations generated by the “hidden dimension” of overtones. Intuitively, we perceive some tones as centers of stability and other tones as less stable. The unstable tones gravitate, with

various degrees of intensity, toward centers of stability. Leibniz wrote: "Music is a kind of counting performed by the mind without knowing that it is counting." [1] In other words, while listening to music, we are involved in unconscious calculation. By looping mentally between tones or clusters of tones, our brain works on registering and weighting their status in the tonal reference system. This magical source of tonal patterns—the tonal field—is a cultural gift that we acquire intuitively while growing. The tonal forces make us experience anticipation, tension and release. Like the terrestrial gravity, the tonal forces shape musical compositions and hold them together; without tonal gravity, there would be no musical structures.

Music's "material foundation" is a product of the natural selection in musical practice. From the Pythagorean perspective, we can say that music is the "Moving and Sounding Geometry"—while listening to music, we perceive the sounding proportions. In the art of music, everything is abstract and everything is a result of experimentation and intuition. The tonal field itself is not an invention, but a discovery.

As musical forms evolved in complexity, the elegant sonic clarity of the overtone-based musical scale (the so-called Just Intonation Scale) was lost. This naturally conditioned scale does not allow unrestricted transitions from one tonal center to another within the same musical composition. (Such transition in music is called modulation.) After centuries of experimentation, various tempered scales came to being. The Equal Temperament provided finally the ultimate universality of tones by equalizing relations between all 12 semitones of the Diatonic Scale. The precious tonal hierarchy was of cause protected. The new way of tuning possesses beauty of mathematical expression: in the equally tempered Diatonic Scale, all 12 semitones of the octave are divided evenly with the logarithmic relation of frequencies equal to 2 to the  $n/12$  power. Only one interval, the Octave, was left unaltered. In this interval, the upper note is the strongest overtone for a lower note.

We can present music in terms of geometry. Let us establish two coordinates: Frequency-coordinate and Time-coordinate. If a single note is a mathematical point, then its continuation along the T-coordinate will produce a line. By adding different notes, we create a musical surface.



When we add the coordinate of Emotions, the 3-D picture begins pulsating with our response to music. Let us discuss the coordinates. The F-coordinate possesses obvious certainty: a musical sound as an acoustical signal can be expressed numerically. However, when musical sound enters the tonal space of musical images, it breaks away from acoustics and becomes a tone in the community of other tones, in the realm of musical ideas. As for the T-coordinate, a musical composition can be measured in real time, yet time is abstract in music: it is psychological, qualitative time of feelings and not a quantitative time of science. When performing, an interpreter plays with sounding time by manipulating it; tempo and agogica (minute changes of tempo) are of tremendous importance.

The evolution of acoustical signal in music happens in a highly arbitrary situation of minute relations and within chain of events with a strong connection to a previous history. Consequently, we cannot divide the fabric of music into independent and equable quantities. We resonate physically with sounds in music, and we resonate spiritually with ideas expressed through organized sounds.

There are two powers in the cosmos of music: force field of tonality and structured time. I call the combination of these two powers the **tonal chronotop**. The tonal chronotop could be compared to a living being, where structured time is like a skeleton and tones are like flesh. In music, structured time and the tonal field are inter-twined and inter-dependent. Art of music transcends the deterministic worlds of acoustics similar to how human thought transcends the physiology of the brain. In the fine arts, artist's biological and mental energy becomes structured in accordance with rules of a particular medium. The skillfully arranged energy of the artist carries a spiritual message to other human beings, and communication with true art demands spiritual work from the perceiver. These messages travel through the thickness of time, coded in lines and colors on a piece of a cloth, an architectural arrangement of space, the musical symbols on a ruled paper, or other combination of materials. We recognize in them the thoughtful and caring friends who sent their ideas (and their immortality) by way of arranged relations and proportions.