

## Music: a friendship between humans and time

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### Abstract

*Thousands of years of philosophical debate as well as our direct experience, seem to confirm that music in one of the fields of human expression that succeeds at managing time as a friendly platform. Human beings of all cultures have always experienced the sounds of music as pleasant ordering factors of many time-related aspects of their existence and activities. Yet, music seems to convey such a simplifying power while revealing its own complex, multi-layered structures that ramify across cognitive, psychological, physical and intellectual territories. The analysis and acquaintance with these simultaneously interacting layers of complexity, despite all possible applications of modern technologies, have not overcome an ultimate sense of mystery that remains within, about and around the phenomenon of musical time. It is a friendly mystery, though, that exceeds the accounting of its own components but still allows music to remain a trustworthy, healthy companion to each person's lifetime.*

*What is time? If no one asks me, I know what it is. If I wish to explain it, I do not know. Time implies an irreversible sequence of "before" and "after." My awareness of time is supported by the sensory experience of touching and hearing. (St. Augustine)*

*Space and time are the framework within which the mind is constrained to construct its experience of reality. (I. Kant)*

*Time is like an empty box inside which all events occur. (I. Newton)*

*Music celebrates a friendship between humans and time. (I. Stravinsky)*

### 1. Music: a friendship between humans and time

The famous quotes above challenge me to clarify my own relationship with time: this is a word that, as we see, seems to be loaded with very different existential implications at different ages, places and conditions of human history. As a musician, I feel particularly intrigued by the unexpected positive view of Stravinsky, who feels time not as a constraining limitation, but as friendly partner with whom human beings can dance at the sound of music.

Augustine's amazing inner photography of how we concretely experience each instant of Time is still very vivid in my daily perception, as well. I realize that also an approach to time in terms of theoretical challenge and Newton's architectural approach to time as a platform available to be planned by human agendas are both very present in our life nowadays. In the Italian language the word time (*tempo*) is charged with such a diversity of semantic references that is sometimes confusing and insidious to deal with it, even for musicians. We will therefore try to get acquainted with the many facets that identify some of the complex meanings of such a simple word.

Rather than unifying definitions, we should search for some experiential minimum common denominator of what "musical time" is. In order to do this, we must probably dig in our infant, pre-verbal memories [1].

We probably start experiencing musical time already in our early infancy, when our parents or siblings invite us to clap along some simple exciting song. The viral video of an Italian baby's joy<sup>1</sup> when listening to the sound of a rock song is a great example of that precise experience: his attention, focus, recognition of timbre-related changes and phonemes reaches a climax in the instinctive motion that allow him to beat his hands along with the attack of the bongos. It is certainly a fairly universal, neurological-based reaction that transcends culture, education and other contingent factors. We can say that our primordial approach to musical time has to do with the motoric, pre-verbal recognition and fine-tuning with a beat. In ancient Roman culture such a parameter was already familiar, and named *tactus*. The etymology of this word carries within itself the "tactile" implication mentioned by Augustine's quote: somehow the beat could be defined as an instant of musical time that arouses the physical impulse to touch the ground with a foot, or clap hands.

However, when a sequence of isochronous pulses proceeds with no difference of any sort among beats, our perception of time is almost annulled, frozen, rather than driven by the beat. Think for example of the monotonous tolling of a metronome<sup>2</sup>: only the stress put on certain beats can wake our attention up providing the beats sequence with the dignity of interesting sound events. It is not only the dynamic stress of a stronger sound that can cause this accentuated emphasis but also, for example, the longer duration of a sound, or its different range (higher/lower). These psychoacoustic phenomena have been empirically well known for centuries, but only recently studied in a systematic, scientific manner. Stressed beats, on their turn, tend to sort the other neighboring beats hierarchically: our brain perceives them as starters of the beats that follow.<sup>3</sup> As it is in life, every important event acquires the value of a new beginning. It is indeed thanks to the Gestalt Principles of Perception that our brain tends to search for patterns, and to group events accordingly. For example, think of a waltz

<sup>1</sup>Video available in this url: <https://www.youtube.com/watch?v=qaRmg77Ud48>.

<sup>2</sup>See <https://www.youtube.com/watch?v=Ihz1jZqz6uM> for an illustration of how a metronome works.

<sup>3</sup>It is the "Grouping Law" that is explained by Diana Deutsch in "The Psychology of Music". [quote properly]

and how we instinctively call “One” the beat that is stressed every other three. We always feel the stressed beat as the “first” of as many beats as it will take till the next accented one.

Every difference within a series of isochronous pulses creates a pattern. This is what we call rhythm: every rhythm is the combinatorial result of all above-mentioned factors; rhythms can be designed as repeatable but also infinitely variable patterns, like the images of a kaleidoscope.

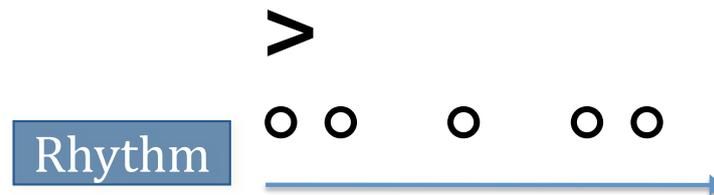


Figure 1: *Scheme of the concept of rhythm.*

When a rhythmic pattern keeps repeating itself, the regular distance between one stressed beat and the next ones provides these with a further hierarchic value: we perceive them as strong beats (the so-called downbeat), as a metric measurement unit<sup>4</sup>. Such unit then becomes the implicit, mental reference point for those who play, sing, conduct or merely read music.

As it is for language, also in music meter implies the conquest of an advanced, structured level of both morphology and syntax. In Western Music the predilection for a metrical approach became progressively important, in proportion to the need of synchronizing the co-existence of heterogeneous yet simultaneous events: that is why polyphonic music grew parallel to the subordination of rhythmic chant to a metric frame of mind. In that way, the rhythmic freedom of each voice could be “held together” to the rest thanks to a mental obedience to the metric background.

What we exposed so far is somehow the summary of the concepts that the vast majority of music theory manuals have been sharing as pivotal for about four hundred years. However, I believe that as soon as we distance ourselves from keeping pulse as our minimum common denominator, contradictions, ambiguity and arguments begin: between rhythm and duration, cyclic vs free accents, regularity vs irregularity, the triumph of metrics vs its complete elimination.

Long before Riemann’s studies around the beginning of the 20th century [2], perhaps already since the Platonic approach conflicted with the Pythagorean one in ancient Greece, all the way down to the post-serial standpoints, Western Music theorists have been debating as to whether rhythms and meters are quantitative phenomena rather than qualitative

<sup>4</sup>The musical measure or bar is nothing but this.

ones. Do they come from combinatorial calculations of durations, and as such they imply a predilection for a proportional/mathematical approach?<sup>5</sup> Do they rather relate to the physiological/neurological cycles of arsis/thesis, tension/relaxation; repetitive downbeat/upbeat gestures typical of swimmers, walkers, bowmen, craftsmen; the inhaling/exhaling process; the jumping/falling sequence, and so forth?

In my opinion I feel that this problem is unresolvable, like the dilemma of the chicken or the egg, as rhythm and meter generate each other in perfect reciprocity. Quality and quantity are two ever co-existing, yet apparently opposite faces of the same coin.

After all, even the problem of performance synchronization had been resolved since the ancient times, through both the metrical recitation of Greek tragic choirs or, on the other hand, the totally a-metric melisma of Christian Chants.<sup>6</sup> Plainchant simply held tight to the stressed syllables of each word in the sacred text to be sung.

Interlocked rhythmic patterns that are totally independent both from meters and lyrics create spectacular polyphonic textures also in certain extra-European traditions, as we see in the micro-fugato *yoddle* of the Baka Pygmies tribes.<sup>7</sup> They generate poly-rhythm and a feeling of “vertigo” even in the most educated western listener: such lack of stability is conveyed by the absence of a unifying meter. Meter, in western music has indeed the function of a solid ground for musical time to run and unfold, whereas the multiple simultaneous rhythms on which this music is based turn out to be perceived as a sort of sliding ground to opposite directions. Traditionally we can neither dance nor play together with others unless we mentally “count” the beats that subdivide bars.<sup>8</sup>

This is a very intriguing frontier for the contemporary composer. Even the simplest poly-rhythmic patterns bring such a variety of textures to life, that can stimulate and modify the psychological time of our music listening as our attention is captured by the identification of single patterns and their kaleidoscopic permutations.

Visual evidence comes at a glance if we look at the holes punched in the roll of a player piano: the example in Fig. 2 is one of the famous polyrhythmic studies by American composer Conlon Nancarrow.<sup>9</sup> No traditional music notation could have ever been adequate to represent such a complexity of time-curves, as it goes way beyond the organization of mere multiple/sub-multiple rhythmic values.

As we zoom out from miniature details, the research about our perception of musical time

<sup>5</sup>Abstract? Symbolic?

<sup>6</sup><https://www.youtube.com/watch?v=MdiADz1a8KI>

<sup>7</sup>[https://www.youtube.com/watch?v=cATZe\\_j1c9g](https://www.youtube.com/watch?v=cATZe_j1c9g)

<sup>8</sup>“Metric thinking” is such a rooted practice in European tradition that it has become normal even for jazz musicians. . . Measuring time must be that advantageous! . . .

<sup>9</sup><https://www.youtube.com/watch?v=f2gVhBxwRqg>

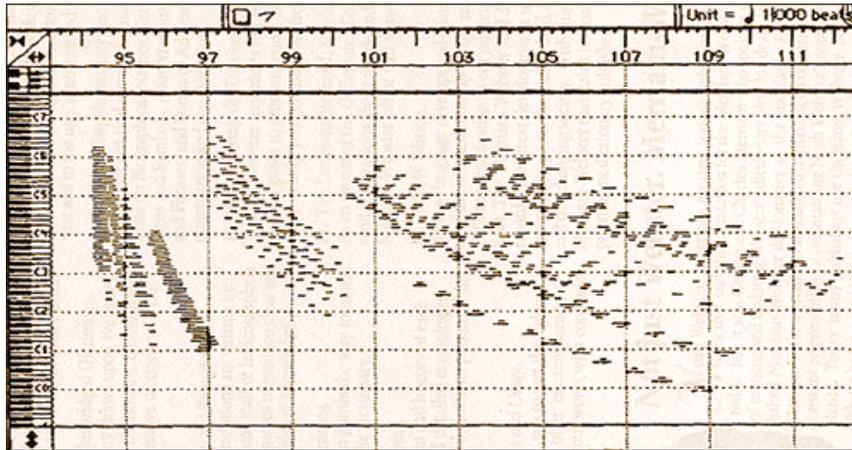


Figure 2: *Polyrhythmic studies* by American composer Conlon Nancarrow.

encounters broader levels and deeper, more complex structures. However, while the contours of our object progressively unveil and clarify, our dilemma remain intact. Time flows through music in the exact same ways we perceive it flowing through our life: it appears like a factor that we would like to tame and manage by measuring, chopping, organizing, saving, allocating, optimizing, controlling and planning it by all means. Can we rule musical time and make it “productive” thanks to organizational criteria similar to those adopted by modern businessmen, like we normally do with the electronic planners of our working time?<sup>10</sup> Otherwise, does it flow as an unpredictable wave, and all we can do is learn how to surf it safely, playfully, with more or less skills and dexterity?<sup>11</sup>

Continuing with the analogy of time as a flowing current, we encounter a further musical implication: it is expressed by *tempo*, an Italian word which means time, indeed.

The creative pioneers of Italian instrumental music since the beginning of the 17th Century realized how insufficient to clarify a musical thought it was to notate it merely as a map of variable proportions between different rhythmic values in reference to a fixed meter and an abstract pulse. Scores could have been interpreted too arbitrarily fast or slow: it was necessary to find a notational tool to suggest the right “pace” of the piece, and therefore the exact speed of its pulse. Since the most familiar cyclical pulse in the daily experience of human beings is indeed that of one’s own pace, they chose the human pace as a reference parameter: it was sufficiently subjective but also universally easy to relate to its changing speeds. Since then, a bunch of Italian words have merged the universal glossary of music theory as expressions of agogics<sup>12</sup>: they are a quick experiential reference for each performer or conductor, who will pick the “right speed”, mood, or conduct of a certain piece by comparison

<sup>10</sup>This seems to be the underlying mentality of contemporary structuralism in music as well as paradoxically that of commercial music.

<sup>11</sup>This might rather be a good metaphor for the jazz/rock improvisational approach.

<sup>12</sup>The Greek etymology of this word ( $\alpha\gamma\omega\gamma\eta$ ) means indeed “movement”.

with the suggested pace: ADAGIO, representing forcefully slow steps, as one would walk in a procession or a funeral; ANDANTE, representing one's own natural, average walking steps; ALLEGRETTO, for pretty quick steps; ALLEGRO, fast and hasty; PRESTO, for the speed of running steps, and many more colorful terms.

Musical time, therefore is not mere pulse, stress, rhythm, meter, but also flow: time, in our daily psychological perception of hours passing, can proceed along with a quick/slow imaginary pulse, or rather accelerating/slowing through infinitely diverse curves. It can even be *rubato*, an Italian word that means “stolen”: pulses stolen from the regularity of the set tempo and returned to the irregular beat twisting, pausing, breathing, sighing or holding as each performer may feel necessary in order to personalize the psychological feel of the music flow.

Music history, which unfolds according to the changing of cultures and mentalities, shows how the measurement parameters of music tempo moved gradually from being most connected to human physiology (human steps) to a progressively automatic control tools: first it was the invention of the metronome, all the way down to digital sequencers and software that allow musicians to create, control, correct music within the frame of milliseconds. Inevitably, digital music ended up sounding so unbearably non-human, that correcting plug-ins<sup>13</sup> had to be invented in order to ultimately randomize and humanize the digitally edited music tracks. I find it quite hilarious that one of the most recognizably human attributes of musical time is “imperfection”...

This said, it is important to add that the American philosopher Suzanne Langer underlines that [3]

*[...]our perception of musical speed is neither necessarily related to a fast agogic tempo, nor to the emphasis placed upon small rhythmic subdivisions, but to the frequency of changing events, instead*

For example, the frantic tempo changes in the music composed by Carl Stalling for the Warner Bros cartoons in the '40es and '50es<sup>14</sup> are directly driven by the previously edited images in the film. Along with them, they must operate continue, rapid changes of style, harmony, tempo, timbre, rhythm, dynamics and melody: such music actually sounds much “faster” than certain minimalist compositions based on frantic, repetitive pulse subdivisions, yet poor of relevant changes within the structures of music itself<sup>15</sup>. Current studies in psychoacoustics [4] confirm that a musical excerpt filled with non-repetitive events seems to run faster than an equally long excerpt rich of quick yet repetitive notes, as the former somehow keeps our brain more busy and alert, while repetition encourages either hypnotic or soothing annulments of the time-flow.

<sup>13</sup>[https://www.youtube.com/watch?v=\\_SA1jfVnc2Q](https://www.youtube.com/watch?v=_SA1jfVnc2Q)

<sup>14</sup><https://www.youtube.com/watch?v=kkQha4sKAVU&list=PL74AC8COA9B09E0B5>

<sup>15</sup><https://www.youtube.com/watch?v=8zAcUBZ2yvc>

If we compare these categories to the concept of musical time as it was in 17th, 18th and 19th Century, we find no track of the fragmented accelerations that we just described, and no track of repetitive loops, either. Western Classical music had rather found its own ideal in the structural logics of human language and its complex structures, unfolding as shown in Fig. 3:

<b>PHONOLOGY</b>	→	<b>MORPHOLOGY</b>	→	<b>SYNTAX</b>	→	<b>SEMANTICS</b>
↓		↓		↓		↓
<b>sound</b>		<b>word</b>		<b>sentence</b>		<b>meaning</b>
<b>sound</b>		<b>motive</b>		<b>phrase</b>		<b>meaning</b>
↑		↑		↑		↑
<b>PITCH</b>	→	<b>MELODY</b>	→	<b>HARMONY</b>	→	<b>FORM</b>

Figure 3: *Unfolding of structural logics of human language and its complex structures.*

Hence comes the more easily graspable “expressive” power of Baroque-Classical-Romantic music compared to the polyphonic complexity of the Renaissance or the post-tonal settings of the 20th Century, as the latter ones were both based on mathematical rather than linguistic structures.

A Romantic music theme seems to spell out the words of a sentence,<sup>16</sup> and phrases flow, cadence after cadence, with the flexibility of a spoken monologue or dialogue. Our listening time is comparable to the experience of reading a novel, or going to theater, and the emotional participation to the unfolding events often gets charged with dramatic power. For this reason, a consecutive repetition (more than twice) of the same statement is banned as a primitive, embarrassing, useless tool in classical western music; the same is true also for poetry, and for the spoken language, as well.

On the contrary, the beats, harmony and phrasing of most extra-European music, and commercial music in general,<sup>17</sup> are highly repetitive, and this places them in different realms: not those of language but those of mechanical work, dance, ritual and liturgy, instead. Here repetitiveness is accepted and even functional, as both music and time acquire the completely different purpose of raising our physical/spiritual participation to a certain collective event, whether it is the arousing power of a dancing party,<sup>18</sup> a stadium choir,<sup>19</sup> a litany prayer<sup>20</sup>, a sorrowful cantilena<sup>21</sup> accompanying the fatigue of alienating work, the hypnotic repetition of a lullaby<sup>22</sup> or the playful lightness of children games.<sup>23</sup> In these cases musical time does not require an intellectually active “listener”, but individuals who are driven into rituals and gestures along with other individuals. Is this perhaps what the African St. Augustine had

<sup>16</sup><http://www.youtube.com/watch?v=yrD1ZaNwdsU>  
<sup>17</sup><http://www.youtube.com/watch?v=mIQToVqDMb8>  
<sup>18</sup><http://www.youtube.com/watch?v=lgVGhyf8Ys0>  
<sup>19</sup><http://www.youtube.com/watch?v=78aS60eVVEU>  
<sup>20</sup><http://www.youtube.com/watch?v=jb23Z5X3uhA>  
<sup>21</sup><http://www.youtube.com/watch?v=65ewGQiN3SI>  
<sup>22</sup><http://www.youtube.com/watch?v=nuevFn9A9h4>  
<sup>23</sup><http://www.youtube.com/watch?v=mjFcrv6Lfx8>



in mind when he described the flow of time in terms of “tactile” experience, along with the dynamics of memory, expectation and surprise? To understand this we have to zoom out towards an even larger scale.

While listening to music, we can easily notice that our memory is indeed in charge of keeping a sort of real-time accounting of both the quantity and quality of musical events that occur. It does so by instantly processing some sort of instinctive, quick analysis, thanks to which our brain compares sound-events with the previously listened ones and sorts them according to logical categories (this melody is identical, this rhythm is similar, this range is different, this dynamics is quite the opposite, etc.). The focused listener’s memory can’t help but keeping track of the unfolding musical section, screening and searching for all possible existing relations, contrasts and reciprocities among them. This sort of memory-log of our listening experience is what Music Theory calls form<sup>24</sup>. The ongoing awareness of musical form enriches the excitement of our time spent with music: emotional reactions easily spring forth from each and every instant of music. This takes place as an uninterrupted dynamics of expectation vs surprise, sketched in Fig. 4; such dialectics conveys not merely the semantic level of musical experience, but the very pleasure of listening.<sup>25</sup>

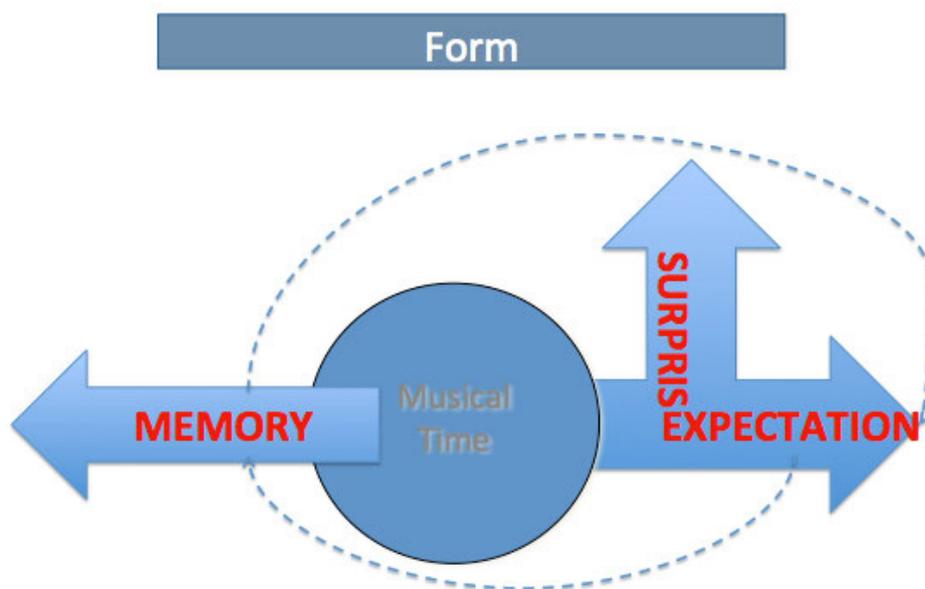


Figure 4: *Uninterrupted dynamics of expectation versus surprise in musical time.*

Composers have refined their own mastery through the centuries, designing highly effective and complex formal arches, ruling large excerpts of music and smaller sections as well, applying every sort of symmetry to musical time. Whether the secret structures are revealed or remain hidden, the listener does perceive a sort of mysterious solidity that can awake awe from many points of view and many different expectations. The underlying formal plans can be founded on certain mathematical rather than psychological, emotional or poetic forces. Many people ask me “how can we recognize such forces if we are untrained to undertake

<sup>24</sup>See St. Augustine’s quote at the beginning of this article.

<sup>25</sup>Is this the “friendship between music and time” that we have quoted from Stravinsky?

advanced musical analysis?" Honestly I believe that beauty, truth and strength are out there for us to grasp in all the arts, no matter what the level of our expertise is. One of the most evident cues is that masterpieces have already defeated time, indeed, as they are surviving beyond ages, styles, cultural fashions and individual expectations. The very fact of enduring above and beyond infinite trials is enough of an unmistakable sign of strength and value for any human artifact or natural phenomenon, as well.

The discovery of underlying structures in a simple theme by Richard Wagner could be a small yet precious example of what was stated above. In the diagram of Fig. 5, I translated this wide, uninterrupted orchestral breath into graphic symbols.<sup>26</sup> The circles represent the subsections that we hear in the music, from the smallest to the largest. Rectangles reveal the underlying secret of this small form. It is a structure mysteriously rising within the instrumental sections, then quickly decaying back to the point where it started: woodwinds first, then strings merging, then horns and the whole brass, with a timpani roll emphasizing the climax of the formal curve. Like a wave, the theme grows out of a process based on redundancy combined with change. A five-note motif is transposed one step lower and then transposed again while extended into a broader unit. Despite the apparent downward movement of all motives, the progressive summation of orchestral timbres turns the theme into the shape of a gigantic blooming spiral. The climax point reveals that indeed all of the mysteriously perfect elements described above actually spring forth from the spiral-generating mathematical Golden Mean proportion: this is true for pitch, orchestration and time, too.

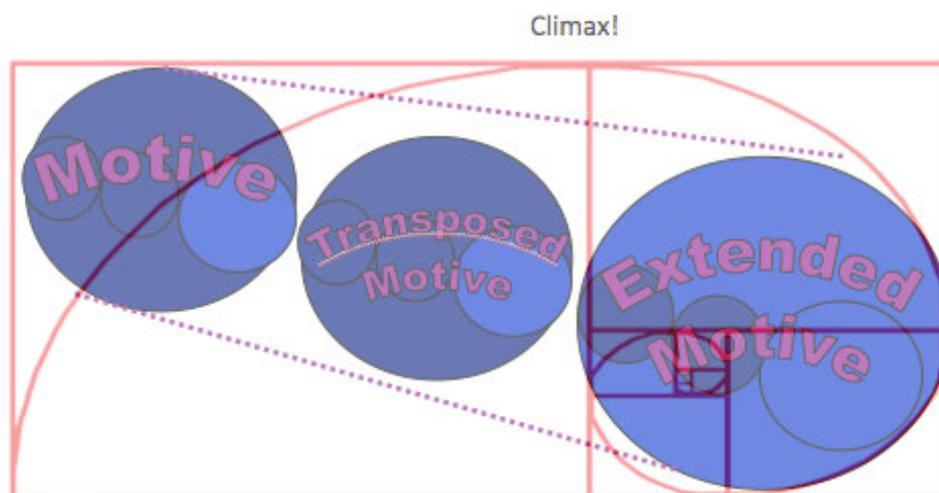


Figure 5: *Underlying structures in the Prelude to Act I (Theme of the Holy Grail) in Wagner's Parsifal, from 6'51" to the end.*

So far we have discovered how multi-faceted and complex are the implications of what we call musical time. All factors listed in this article coexist and add consistency to our central concept, not without surprises and ambiguity. It is mind blowing to think that in music all of these time-related factors not only coexist, but also interact with each other, thus

<sup>26</sup>This piece is available online at <http://www.youtube.com/watch?v=7w17MamPY7A&list=RDDwdYZWFrBBM>



exponentially multiplying the number and diversity of solutions: infinite ways to use time as the playground of music, infinite possibilities for the composer, infinite paths for the listener; very similar to, and therefore very friendly with the neural network of the human mind. It is quite a logical vertigo to think that the human mind is indeed the origin as well as the final port which ultimately creates, perceives, processes and enjoys the full palette of this musical kaleidoscope. Such a mysterious relational ramification of the factors that constitute the musical experience has somehow gained a growing respect and interest of poets, philosophers, artists and scientists for music.

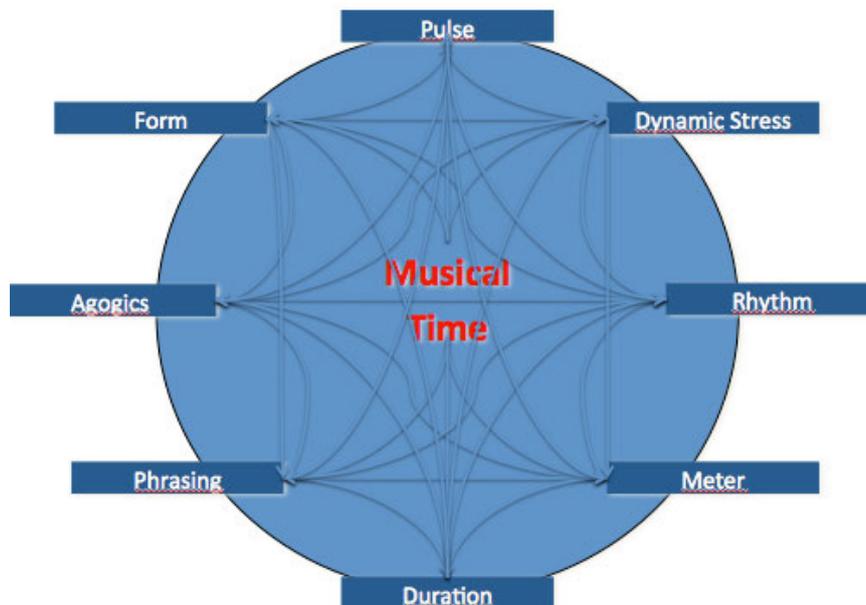


Figure 6: *Interrelation of concepts in musical time.*

It is interesting to notice that pulse, cycle, arsis, thesis, stress, rhythm, tempo, agogics are all concepts that imply movement. An old Italian music theory book defined music itself as movement of sounds in time [5]. In the 21st Century we seem to be still attracted by this unpredictable movement of sounds called music. We never have enough of chasing its dance and stretching its limits to paradoxical extents. Contemporary music explores the edges of musical time, trying the limits of its possible periodicity<sup>27</sup> and its opposite<sup>28</sup>. We swing from extreme simplicity<sup>29</sup> to extreme complexity<sup>30</sup>, order<sup>31</sup> and disorder<sup>32</sup>, hyper-determinism<sup>33</sup> and stochastic processes of chance<sup>34</sup>, primordial pulses<sup>35</sup> and high-tech design<sup>36</sup>, as attracted as we are by machines and by the conceptual vertigo of temporal paradoxes and parallel

<sup>27</sup>i.e.: Steve Reich, Desert Music, <http://www.youtube.com/watch?v=hHMBDoFwj0>

<sup>28</sup>i.e.: Gyorgy Ligeti, Lux Aeterna, <http://www.youtube.com/watch?v=-iVYu5lyX5M>

<sup>29</sup>i.e.: Terry Riley, In C, [http://www.youtube.com/watch?v=H\\_Hg9isDmqo](http://www.youtube.com/watch?v=H_Hg9isDmqo)

<sup>30</sup>i.e.: Brian Ferneyhough, Etudes Transcendentales, <http://www.youtube.com/watch?v=jFnu-1YsmeI>

<sup>31</sup>i.e.: Morton Feldman, Rothko Chapel, [http://www.youtube.com/watch?v=qxSt\\_w20DaQ](http://www.youtube.com/watch?v=qxSt_w20DaQ)

<sup>32</sup>i.e. Mauricio Kagel, Two-Man Orchestra, <http://www.youtube.com/watch?v=oM5SttMyu1E>

<sup>33</sup>i.e. Elliott Carter, Night Fantasies, <http://www.youtube.com/watch?v=tAzVIseDRfk>

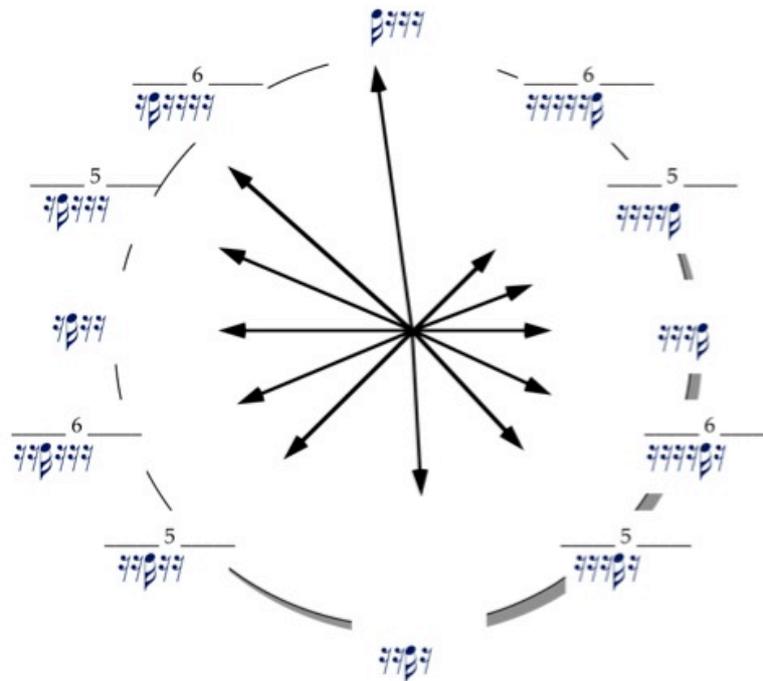
<sup>34</sup>John Cage, Chance Music, <http://www.youtube.com/watch?v=b0CDSSNdWNU>

<sup>35</sup><http://www.youtube.com/watch?v=6yMD7qJfigY>

<sup>36</sup>Il Suono della Guerra dei Suoni, Notte Futurista, BEA Award 2009, from a project by Roberto Andreoni, Agon, Castagna Ravelli.



universes. My own research as a composer is immersed in this kind of explorations, as one can grasp at a glance from the paradoxical structure of my “Little California” Suite for solo piano, in which a “rhythmic clock” rotates all the way around a fixed pulse. The latter continues to be metrically reinterpreted as a metaphor of cultural relativism.<sup>37</sup>



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Also my *Scendi un minuto!*<sup>38</sup> for piano is a 60” piece: 60 isochronic pulses represent as many steps of a staircase descending the 88 keys of a piano, from the highest to the lowest. Every 10” the musical landscape changes harmony, texture, rhythm, meter, dynamics, function and meaning of this six-floor descent. Only the ontological beat of the clock remains immutable.<sup>39</sup>

In conclusion, I want to paraphrase the formidable definition that Italian musicologist-pianist-philosopher Guido Salvetti once gave: Music is a wonderfully complex way to think and feel. More than that, I believe that we have reached enough evidence that music is indeed a wonderfully complex way to think, feel and to not waste time.

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<sup>37</sup>“Little California Suite”, for Piano, Ed. Suvini Zerboni, Milano.

<sup>38</sup>Copyright Suvini Zerboni, Milano.

<sup>39</sup>The podcast of this piece can be obtained as part of the Supporting Information of this paper in the Euresis Journal website.

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