Chrónos and Kairós in electroacoustic music

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Abstract

In this article we've analyzed some time concepts, applying them to a selection of electroacoustic pieces of different aesthetics.

Some differences are pointed out: between *hors-temps* and *en-temps* with specific application to the repertoire; the relationship between χρόνος *(Chrónos)* and καιρός *(Kairós)* and their influence on the compositional experience and on the approaches used to analyze electroacoustic pieces.

The fact that acousmatic music is characterized by a sufficient degree of abstraction with reference to the more traditional musical parameters, does not lead us to the conclusion that the management of time cannot be also considered at an analytical level.

We've cited the Obst's Crystal World cycle as an emblematic case. In this cycle, time and its management are important on a multidimensional scale: this leads us to make further considerations on analytical techniques, their limits and their possible developments.

Other references concern the musical repertoire by J. Adams; J. Alvarez; F. Bayle; F. Donatoni; J. Harrison; R. Minsburg; M. Rodrigue.

1. «Hors-Temps» and «En-temps»: the management of time

From the point of view of a composer, the time of a composition is never just the timing of a compositional work, but also the time that logically precedes its achievement.

With the term «*Hors-temps*», we define the time that precedes and regulates the development of a musical piece, influenced by the composer's vision. Opposed to this we have the work «*En-temps*», that is its sound incarnation, or rather its translation into performance, or fixing on tape. While talking about «hors-temps», E. Napoletano distinguishes: a) the «hyletic universe», which is the «material universe» and b) the «universe of forms», which are:

> *"The rules of composition, construction, musical architectures at all levels starting from micro to macrostructures (…). These systems can be considered as formal islands. The entities that deal with this universe are emancipated from their historical conditions of birth and time - since time itself can be treated in its temporal immobility"* (Napoletano, 2018, p. 294-297).

Eg.1 With *Quartetto III* (Avantaggiato, 2014, pp. 2-11), the Veronese composer Franco Donatoni wrote a piece that was largely influenced by Serialism. The composer started from

the definition of a «frequency scale» - «scala delle frequenze» in Italian - subdividing the octave in constant intervals of 14 frequencies. The initial «material universe», described by Donatoni as a qualified and well-characterized sound material, offers many other transformation possibilities, allowing the composer the "leavening" of the materic substrate.

Eg. 2 In *Crystal World*, German composer M. Obst[1] investigates into the complexity and dynamism of the sound spectra of the Asian instruments and the human voice. These sounds encourage the artist to open and relax them, to create a formal development in 4 panels.

Obst describes a journey that goes from sound to noise: he plans not only the set of frequencies he is going to use, but also the differences amongst them. With the fourth ratio (: $40\sqrt{2}$), Obst obtains sequences of sounds close to noise (Fig.1).

$5\sqrt{2}$ (1,14869)	$10\sqrt{2}$ (1,07178)	$20\sqrt{2}$ (1,03527)	$40\sqrt{2}$ (1,017548)
100 (hz)	100 (hz)	100 (hz)	100 (hz)
114	107	103,5	101,7
132	114	107	103,5
152	122	110,7	105,3
174	132	114	107
It divides the octave in 5 intervals	*It divides the octave in intervals which are slightly larger than a second; it provides the tritone.*	*It divides the octave in intervals almost a quarter of a tone.*	*It leads to sounds close to noise*

Figure 1: harmonic system in Crystal World I. Interview with the composer, 2020

Rotating Sound Plate (Java)	Octave-based spectra	Smooth attack; very long release; stable overtones	Very warm
Keysu (Japan)	Tritone based spectra; less bright spectra	Medium attack; medium release, the spectra softens during release	Warm
Rîn (Japan)	Tritone based spectra; bright spectra,	Medium attack; long delay with stable overtones	Bright, rather cold
Glissando Gong (China)	Metallic spectra	Medium attack; short release; glissando up and down	Cold, aggressive
Mokusho (Japan)	Wood, extremely bright Spectra	Hard Attack; very short release	Extremely aggressive

Figure 2: The «material universe» in Crystal World I: the list of percussions.
Interview with the composer, June 2020

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[1] We thank the German composer Michael Obst for the interview released in June 2020, without which this writing would not have been possible.

CRYSTAL WORLD I – FIRST SECTION (0'00''- 2'34'')					
	0'00''-0'31''	0'32'-0'48''	0'49''-1'32''	1'33''-2'17''	2'18''-2'34''
Instrument	Rîn, Keysu, Gong (intro)	Mokusho	Rîn, Keysu, Gong (Variation)	Rîn, Gong elec trasf.	Rotating soundplate
Character (Static/dynamic)	Static character; single gestures	Static character, rotating repetitions	Dynamic character, gesture with delay, accelerando, final development.	Static character -> dynamic character and final development.	Static Character -> dynamic character (Exclamation mark)
Gesture /Texture	Gesture+frame	Gesture+frame	Gesture+frame	«Monochrome»	«Monochrome»
Reverb	Room I (brighter)	Room II (bright)	Room I	Room III (less bright)	Room I

Figure 3: Crystal World I - Structure of the first movement.

2. «Chrónos» and «Kairós»

The time of a work enjoyed by the audience is based on a dichotomy: absolute vs perceived time or, alternatively, chronological vs cariological time.

In various ways these distinctions have been endorsed by composers and professionals of electronic music because the correlation between the perspectives of absolute time and psychological time, even if not always recognized, are crucial to their craft.

Schaeffer talks about duration as a psychological and perceptual experience of time; similarly, Olivier Messiaen distinguishes between chronometric or "measured time" and duration or "perceived time".

Cairological time, instead, tells us about time as an opportune moment, an instant of occasions, the mature time to perform an action or to make something happen, the inspirational moment in which you can dare and grab the divinity Kairós by the tuft, which is in front of his forehead.

Thaut refers to «Kairós», as:

> a temporal dimension of meaning, which informs about the correct understanding
> and interpretation of events, perceptions, actions and cognitions (Thaut, 2007, p.20).

Attempts to systematize the various time scales that refers to chronological time were presented by various authors (Roads, 2015; Pasoulas, 2020; Andean, 2015).

Unlike Curtis Roads, A. Pasoulas (Pasoulas, 2020, p.223) distinguishes between absolute time and psychologycal time to start a discourse around perception. Instead of talking about a number of time-scales, he talks about a psychological time continuum: at the exact center of the continuum there is balance, where actual and measured duration is supposed to be equal to psychological – perceived - duration.

Pasoulas distinguishes some factors that influence time perception which can be related to music or that originate outside music, such as the surrounding environment at the time of listening and the psychological state of the audience listener. These factors were considered in Par. 4/6 to make some consideration around time modulation and rhetoric in electroacoustic music.

Through a coordination of different approaches Andean, instead, coordinates theorists' and researchers' positions in a wide range of fields - from acousmatic to broader areas of musicology and further cognitive research - limiting the number of thresholds proposed by Roads from nine to four (infinitesimal/subsample; sound object/mesostructure; macro; supra/infinite).

3. Time modulation through techniques

Regardless of the number of time thresholds identified or identifiable, what is important for a composer is the possibility to modulate the perception of audience, the sense of time that passes and the overall qualitative listener's experience through some strategies that work at different levels: Micro-structural; Meso-structural; Macro-structural; rhythmical and so on:

Change of state: leaving the initial state and subsequent return to an initial state can be an indicator of time passing.

Eg.1 - In *Klang* by composer J. Harrison (2000), the listener can trace the development of the material from raw casserole sounds in the introduction (0'00''-3'04''), through more complex, highly transformed events in the four sections, back to the opening sound-world in the Coda (7'42''->end).

Eg.2 - *Klang* is similar to *Crystal World* for its programmatic and essayistic approach; however, these pieces are also similar for the common strategy to introduce the original materic substrate at the beginning of the work. In Crystal World I, Obst introduces the Asian instruments which are, later in the passage, the object of electroacoustic transformations (fig. 2-3).

Eg.3 - In *Cristaux Liquide*, Mario Rodrigue describes a sonic continuum inspired by two different physical states of water — the solid one, with its fixed, crystalline movements (5'58''-6'15'') and the liquid state (2'39''-3'26''; 5'35''-5'40''; 8'19''-8'53''), with its rich undulations, created in a counter-pointistic way, and the evocation of the avalanches of color characteristics of crystals (2'25''-2'55''; 3'45'-4'13'').

Alienation of chronological music structures: in acousmatic music the trend to alienate chronological time structures is quite common when the objective of the composer is to recall traditional popular music and try to reinterpret it: by doing so, the composer tries to avoid straight pulsation. In *Mambo à la Braque* (1991), J. Alvarez creates an electroacoustic collage of musical segments drawn from Cuban mambo *Caballo Negro* by D. Perez Prado. Original phrases are re-allocated to create new epileptic musical sequences: the original rhythmic structure of the mambo is variously deviated, and the dynamic contrast is increased.

De-phasing of rhythmical structure: The process of de-phasing is generally exploited in a more organic way inside minimalism boundaries, being very common in Steve Reich's production; it's also used by J. Adams in *Hoodoo Zephyr* and by M. McNabb in some episodes of *Invisible Cities*. Outside the boundaries of minimalism, this technique is used, for instance, in the *Entrèe* of the *Messe de Terre*:

> We hear a very elaborate musical composition, which is gradually polarized on two static elements: a monotonous psalmody of the act of confession and a rhythmic cell which is like the lung of this sequence. This is the sound obtained by the friction of the metal grid of a microphone on the rotating plates of a tape recorder. This squeaky sound, with its characteristic pedal, enters a close relationship with the pendulum

movement of the windscreen wiper: the distinct rhythmicity of these two mechanical and repetitive phenomena can meet, out of phase. (Chion, 2016, p. 50).

This example shows that some specific compositional strategies can help to modulate the perception of time, and this is specific but not exclusive of a certain genre.

Perceived Timbre, Pitch, Duration, Amplitude, Space work as articulators of rhythms [Christensen, 1996, pp. 100] **and perceived time**.

Perceived timbre, for example, can help in horizontal organization, influencing the perception of time passing (Hirst, 2003, p. 2) : changes in timbre can affect the integration of a horizontal sequence: repeated and/or rapid changes in timbre can fragment a sequence; less rapid shifts in timbre can be used to delineate larger horizontal units or phrases.

Variations in Intensity: if we concentrate on the perception side, Christensen gives some important advices with regards to working on – what he calls - the micro-temporal dimensions - Space, Intensity, and Timber - and macro-temporal dimensions - Movement, Intensity, Pulse. In particular:

> Variations in intensity can be used to provoke arousal of the listener's attention; the timbre allows to identify a sound; by altering some of its characteristics, and with some technical retractions, it allows to hide the original sound, making it more difficult to recognize (Christensen, 1996, p.12-16). In general, movement allows to increase the awareness of time passing and therefore to make it emerge; the pulsation allows to increase the awareness of regularity (Christensen, 1996, pp.49-50).

Motivic Contrast: in *Fábrica* (Obst,1997) the composer uses the motivic contrast as a tool to build the piece together with the following: increase of density or frequency of sound elements over time; general change in sound, through sound selection and extraction; its arrangement in clusters or to create poly-rhythms (Obst, 1997, pp. 155-159).

Duration and Sustained Sound: in cases where long sustained sounds are involved and there is little or no indication of long-term evolution, the listener becomes less aware of time passing. However, if there are no cues or clues in the sound itself to make us aware of its approximate physical duration, the sound in question appears seemingly endless, or even static (Pasoulas, 2020, p. 222).

Use of Dynamic Contrast amongst panels: as a tool to determine a formal development of a piece. Eg.: *Studien II* by K.H. Stockhausen; *Fábrica* by Obst; *Mambo à la Braque* by J. Alvarez.

Change of density or of frequency of sound elements over time; **increasing of the complexity of the structures:** a) Working on the relationships among order and disorder, an aspect which is very similar to traditional harmony; b) Working on horizontal relationships amongst objects: layering, like traditional counterpoint (Emmerson; Landy, 2012, p.4).

The use of different psychoacoustic effects (Reverb; Delay; Filters…): reverbs allow the composer to simulate different ambiences/scenes that give an idea of contrasting temporal and spacing coordination. These techniques were used in pieces from the past, such as in Ligeti's *Glissandi*, to present times (Fig. 3);

The generation of time: In *Tilt* by composer Mario Rodrigue, a Francis Dhomont pupil,

> the possibilities of envelope control and the creation of liquid or cloud-like musical morphologies suggest a view of rhythm as a continuously flowing, undulating, and

> malleable temporal substrate upon which events can be scattered, sprinkled, sprayed, or stirred at will. In this composition it is not a matter or filling or dividing time, but rather or generating it (Roads, 2015, p. 59-60).

Other important strategies can influence the qualitative perception responses of a listener:

Emergence of a symbolic and rhetoric substrate, not limiting this to the categories clearly labelled as rhetoric by some analytical theories: Roy's Relation and Rupture Categories (Roy, 2003); Temporal Semiotic Units and Spatio-Temporal Semiotic Units (M.I.M.,1996).

Activating synesthetic relationships, acting on some characteristics of the sound, such as rugosity (cfr. our work *Atlas of Uncertainty*, 1'31''-1'47''; 1'53''-2'02'').

Working on predictability of events: in the work «Sweet Anticipation: Music and the Psychology of waitation» the author highlights the predictability of events in time (Huron, 2006, p. 35). He provides the foundation of our perception of rhythm and meter and suggests several sources for this predictability: periodic metric structure; rhythmic motifs; the regularity of musical phrases or the regularity of non-periodic sequences. He demonstrates - through experimental methods – that events occurring at predictable points in time are more quickly and easily processed by listeners.

Creating a sense of time abolition: in «*Techniques d'écriture sur support*», in the paragraph «Transformations» the author describes how composers can create a sense of time abolition: suspended time («le temps sustendu») or the frozen time (« temps gelè ») is obtained by creating a hypnotic phenomenon as in Asian Music (Vande Gorne, 2018). The idea of suspended time seems to recall what Christenesen expresses talking about the «time of being»:

> The «time of being» is the time experienced in nature when we are not expecting something to happen, and we are not impatient for a change to occur (Christensen, 1996, pp.49-50).

Another way to create a sense of time abolition consists of playing on contrasts, alternating sequences where time is compressed, accelerated, rich in events and sequences where there is a sound - a very small loop – that creates the cinematic effect of «shutdown on image».

Sculpting sonic material into gestures or phrases, which are the middle layers of musical structures:

> We remember discrete entities more easily than continuous or unclearly demarcated ones, at least for the memory of structures. This does not mean that continuous variation is not important in the appreciation of musical form. It is certainly vital for expressive variation of musical gesture (Bregman; McAdams; 1979, p. 24)*.

The use of pause/silence as a formal signal: in *Fábrica* and *Quartetto III* a pause divides the work into two equal halves. This is a clear formal message, that allows to give breath to composition. In *Quartetto III*, after the central pause, the original series is exposed. In this way, original material does not appear at the beginning of the piece like in *Klang* by J. Harrison and *Crystal World* by Obst; but it starts exactly in the middle of the piece.

Sectioning of a lengthy piece: composers have found a solution to presenting excessive macro durations to audiences by dividing their lengthy pieces. This is the case of *Messe de Terre* by M. Chion (duration 152:30) divided into 16 conceptual blocks.

4. Acousmatic music and its multidimentional rethoric

The question of the presence of a precise musical rhetoric within the acousmatic genre *stricto sensu*, is a bit set aside or even avoided, even for the complexity that a discussion on this topic would entail. Even if many good reasons exist to discuss sound and music from the angle of a rhetoric and composition, we don't do this very often. That is probably because analysing acousmatic music from a rhetorical perspective means embracing many uncertainties:

> It means diving into the weird ways that music is and it is not like language, with its syntactic articulation, the ways it does and does not guide our emotions, and the subsequent conclusion that much of musical meaning is wrapped up in the associations we bring to it as listeners (Stedman, 2012, p. 46).

Therefore, the existence of a rhetoric cannot be denied, being highlighted by various theorists. It operates at different levels and it has the power to lead the audience's listening; it allows to give a directionality to music, from sound objects[2] to space organization (Fig.4):

Temporal associations of sounds, carried through their semantic meanings	Typo-morphology (Schaeffer, 1977; Thoresen. 2007,129-141) Functional Grid (Roy, 2003, pp. 358-365); T.S.U. (M.I.M., 1996)
Temporal associations of sounds, carried through their spectro-morphological characteristics	Spectro-Morphology[3] (Smalley, 1986, pp.61–93)
Temporal and metaphoric relationship between audio and other media (such as Video; Poetry/Text), or more synthetically, multimedia or inter-medial relationships	(Rees M., 2018), Cook (1998); Chion (2016); Carterette E., Kendall R. (1990, pp. 129-164); Lakoff /Johnson (1980)
Temporal associations of sounds during space segmentation and during spatialization processes; treatment of space and spatial movements	Spatio-Temporal Semiotic Units by (M.I.M, 1996); Spatiomorphology (Emmersion; Landy, 2012, p. 3); Figure d'éspace (A. Vande Gorne, 2002, pp.9-11)
Relationship between reality and imagination	Lakoff /Johnson (1980)
Emotional responses of the listener to music stimuli	Network of relations in the interpretation of acousmatic music (Hirst, 2003, p. 4); Social, Emotional and Meaning-related aspects (Emmerson; Landy,2012, p. 1)

Figure 4: Rhetoric in acousmatic music. Adaptation (Pasoulas, 2020).

With regards to listener's emotional responses we should observe that:

a) music rhetoric embraces the confluence of emotion and meaning;

b) beyond being kairotic and culturally rooted and situated, musical meaning is "associative", latched necessarily onto the imagination and interpretation of listeners;

c) the comprehension and enjoyment of a given audience has often much to do with audience members' familiarity with the genre;

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[2] Recorded sound is historically expressed as "sound object" which is a term coined by Pierre Schaeffer in his *Traité des objets musicaux*, Paris, Éditions du Seuil, 1966; 2nd ed., 1977.

[3] Spectro-morphology is s term coined by Denis Smalley (1997) for describing sound shapes, based on an interaction between the sound spectra and the ways it changes through time.

d) every change in a sound will change the meaning and the perception of a sound; of a phrase or of a sequence, etc;

e) to a large extent, the meaning of a work cannot be controlled, regardless of the intention of composer and how much the sound is tinkered with.

With regards to temporal association the M.I.M. researchers[4] have suggested introducing meaning in the description of sound objects. They defined some temporal semiotic units, that allow us to indicate phenomena of repetition; stagnation, chaotic effects (Invariant T.S.U.s) or otherwise variant T.S.U.s with uniform development, with thwarted development or disrupted balance etc.. The balancing between Variant and Invariant T.S.U.s is a good index of how the composer can work on the continuity or on the variation of music.

The term rhetoric is explicitly used by S. Roy (Roy, 2003, p. 358), in his Functional Grid, a model in which the author talks about two archetypes of rhetoric:

1) Réthorique relationelle: Appel->Réponse; Annonce ->Rappel->Thème et variation; Anticipation /Affirmation; Reiteration/Imitation etc
2) Rèthorique de rupture: Dèviation; Parènthese; Indice: Articulation; Rètention; Rupture; Spatialization etc

In Minsburg *A tu memoria,* the first section of the piece from 0'00'' to 2'22'' is built around a system of rethoric replies: Appel->Réponse, the first of whom is situated at (0'01''->0'07''); the answers in the continuation are gradually enriched through undulations that create a halo around the principal replying sound (0'19"; 0'29"; 0'37"; 0'44"; 0'52").

Analytical Techniques such as Stephan Roy's approach and Temporal Semiotic Unit by M.I.M., seem to re-appreciate the temporal dimension of meaning and interpretation (Thaut, 2007, p. 20).

In A.V. Gorne's «Figure d'Espace», the author focuses on different spatial figures that correspond to as many rhetorical «canons» as a framework to explore how composers articulate the spatial horizons. It goes without saying that some archetypes identified by one technique are then actually reported in others or may have a very close relationship with them: «imitation», listed by Roy's model in the category «rèthorique relationelle», can be put in close relation to the «fondu enchainè » (Vande Gorne, 2002, p. 25).

Technically speaking, Roy (Roy, 2003, p. 358) explains that "Imitation" is an immediate replication of identical or slightly varied components in terms of timbre: this is an immediate referral function because the components are contiguous and sometimes become a «fondu enchainè».

5. Audiovisual works: time passing and trans-sensorial processes

In audiovisual works, chronological time and senses of time passing can be apprehended also by eyes and by ears, through a trans-sensorial process (Chion, 2013, pp. 137).

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[4] *Temporal Semiotic Units* were developed at Music and Informatics Laboratory of Marseille/France (M.I.M.) in 1992, by a group of composers, researchers and artists led by François Delalande.

Sounds can influence temporality in different ways, that is to say through:
- «temporal animation»: sound can change the spectator's perception, transforming it from static to moving and vice-versa. «Temporal animation» plays an important role in increasing or decreasing the perception of time by the listener;
- «temporal linearization»: music gives a comprehensible logic to - apparently - disordered images and disrupted actions, provoking a stabilization/normalization of time awareness;
- «directional properties»: the audio section has the property of leading towards a predefined objective, a plausible or comprehensible end. «Directional properties», in particular, can be used to mark the starting point and the end of sections within the piece.

In considering all these three aspects, it is clear that chronological organization and time management of events are only two part of the same coin profile (Avantaggiato, 2018, pp.4-5).

6. One piece, different temporalities

In our research, between the extremes of «electronic music*» and «electronica*» (Ramsey, 2014), we have experienced a great variety of situations, ranging from pieces with their simple "grid-like" structure to pieces in which the composer experiences time in multiform ways.

In M. Obst's *Crystal World I-IV*, for example, musical time moves at different rates and the succession of episodes shows diverse profiles: circular, flat, accelerating or decelerating in stages, each one opens up to different temporalities and perceptual dimensions.

The special attention to different temporal domains creates a kaleidoscopic variety of perceptive plans, that become a strong point of the cycle:

- the temporal profile of attack, sustain and releases of oriental percussive instruments;
- the use of scales of frequencies. The harmonic system on which *Crystal World I* (Fig. 1) and *Quartetto III* are based, demonstrates that some authors do not merely compose the sounds, but also use the "temporal" differences that separate them and act on them;
- the organization of musical discourse in textures and gestures at an intermediate level;
- the use of different psychoacoustic effects such as reverbs that allow the composer to simulate different ambiences and scenes that give an idea of contrasting temporal and spacing coordination;
- the simultaneous presence of regular distributions in the form that are accompanied by accelerating and decelerating gestures in stages (Fig.5-6);
- the coexistence of different arrangements of sounds over time: from granulation to motivic movement; from drifting and fractional polyrhythm (0'11''-2'20'': *Interméde*) to regular or stochastic intermittencies (0'54'' to 2'13''; 8'21 to 8'51'': second movement *Chorale*); from constant slowing down to constant speeding up (0'00'' to 0'11'': 2'21 to 2'34''; 3'08'' to 3'21'': third movement); from simple to complicated repeating patterns (1'49''to 2'21''; 2'34'' to 5'06'': first movement).

The appreciation of different temporal dimensions in this musical cycle, allow us to make some considerations:

- multi-temporality allows to increase the sense of variation and musical interest for such a long work;

- the analytical techniques developed in the field of acousmatic music are not sufficient to accurately describe the complexity of pieces like *Crystal World*, which is a concentrate of different rhythmic opposites (Curtis Roads, 2015, p. 184).
  The piece, being rich of accelerations and decelerations with different shapes – concave, convex, logarithmic (Fig.5-6) , seems to recall those profiles described by G. Grisey in his «continuum of rhythm» (Grisey, 1987, p. 239–275);
- temporalities and rhythmic dimension are the most neglected by analytic theories: in this context, we consider «rhythmic oppositions» by Roads and Grisey's «continuum of rhythm», as an important starting point for further analytical development.
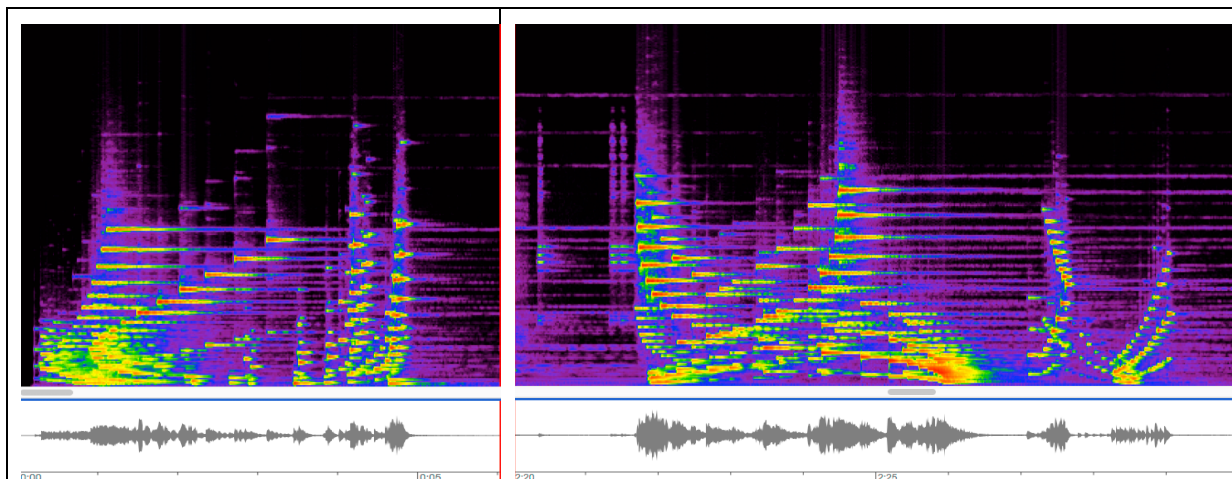

Figure 5-6: sonograms of the initial and central section of the Interméde by M. Obst. We can remark the existence of a crescendo at the beginning (0'00" - 0'10"), in the center (2'20" - 2'25") and at the end of the piece (4'58''-5'05'').

7. Multiplicity of forms: some hints

Durations that make sense in music start from the threshold of timbre perception (Bregman; McAdams, 1979, p.12) and go up to the macro timescale, which is commonly connected with musical form. Composers sometimes employ timescales that exceed those limits:

> Durations less than the micro timescale are musically usable only as mass events; durations that last more than the threshold of human body fatigue can be experienced only in part and not as a whole (Pasoulas, 2020, p. 221).

At level of macro timescale, the shape of an experimental electronic music piece varies from «emerging» to a rigorous controlled one. The rigorous control of the form of a piece is typical of Structuralist period, even if not exclusive of that season.

In F. Donatoni's *Quartetto III*, a piece largely influenced by Structuralism, the sonographic shape is imagined «a-priori» by the composer. The image of an inverted hourglass accidentally recalls the concept of irreversibility by Ilya Prigogine (Prigogine, 1988, pp. 9-13), a Nobel laureate famous for his work on dissipative structures, complex systems, and precisely, irreversibility. In *Quartetto III*, the arrangement of the elements is specular with respect to time and sound matter. After the pause the original series of frequencies is exposed, activating an idea of circularity of the piece and of irreversibility of time passing.

At an intermediate formal level, Donatoni, instead, creates temporal shapes starting from single phrases by expansion; by contraction; by selection, strategies widely described in the volume «The Musical Timespace» (Christensen, 1996, p. 92).
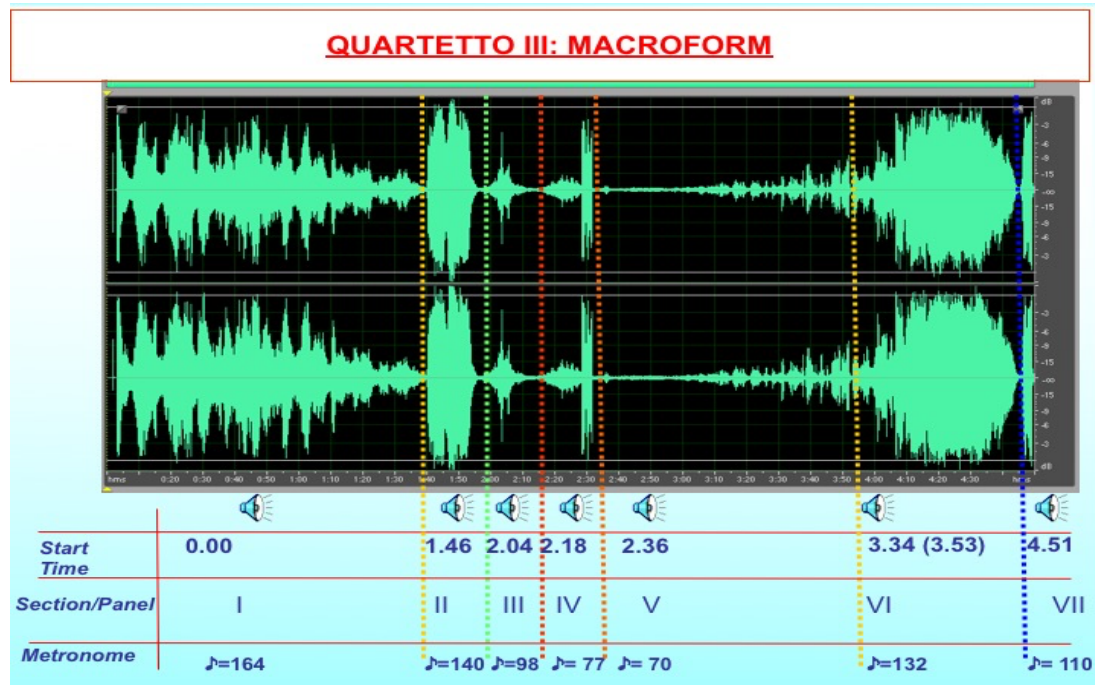

Figure 7: *Quartetto* III - overall form (Avantaggiato, 2014, pp.10).

In J. Alvarez's cycle *Cactus Géométries* a natural perspective influences the shape of the piece: the composer chooses some of his favorite «cacti» as musical metaphors for some possible new sonic topologies.

In Spectralism, composers describe, instead, the sound object as a complex formation that can be dilated to create a formal process. Spectralists often start from the natural space - a natural, delimited «microphonic space» - to come to an «imaginary» screen, where the composition is artificially projected. Artifice and nature interact: the form reflects the depth of sound on the imaginative plane and the image acts, implicitly, from connective with which something switches from one to the other. The presuppositions of this musical problematic are the practices of optical-acoustic conversion of sound by Emile Leipp, derived from sonographic analysis, and the philosophical conceptions by Deleuze's and Bergson's (Manfrin, 2003, pp. 1-32).

In Landscape music, the composer sticks to an immediate description of the surrounding world: the aesthetic shadow of the world seems to prevail over the composer's subjective interpretations. The landscape composition is also a particular genre in which, the already cited experience of the «time of being» (par. 3) becomes a central factor of time awareness.

Mathematical models have been highly influential on F. Bayle's works (Thom, 1985), as reported in the volume «Techniques d'écriture sur support» in the paragraph «G. Montage par variations catastrophe» (Vande Gorne, 2018). Amongst the shapes described by Thom, we can mention: le pli (the fold), la fronce (the frown), la queue d'aronde (the dove tail), le papillon (the butterfly).

8. Conclusion

In this article we have described how management of time is something more complex than the sheer chronological organization of events and their dislocation by recurrence, quality and quantity. Time affects different domains with various degrees and compositional strategies may help to modulate the perception of time (Par. 3).

In Par. (4-6) we have described that the compositional activity is influenced by a multidimensional rhetoric: metaphoric relationships are operative at different levels.

We've pointed out the importance of understanding musical rhetoric as an act based on sound and time that guides meanings at different levels, from sound objects to spatialization; the influence of rhetoric becomes more complex in the wider context of multimedia.

In Par. (6) we have reported the case of Crystal World, a cycle composed of 4 different movements, in which the coexistence of different temporalities allow us to point out how temporal and rhythmic aspects are covered by consolidated analytical techniques in a quite incomplete way. We have cited «rhythmic oppositions» by Roads and Grisey's «continuum of rhythm», as an important starting point for further analytical development.

Different and personal conceptions of time also reflect on the form of a work (Par. 7). References here concern the musical repertoire by J. Alvarez; F. Bayle; F. Donatoni; M. Obst; M. Rodrigue.

The several musical examples in this article show that authors should demonstrate to have an important ability: to work with sound and time, then, is to be present and to draw audience's attention to the present.

9. References

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