# MICHELANGELO LUPONE: *"CORDA DI METALLO"* (1997)

*Walter Cianciusi*
Conservatorio "A. Casella"- L'Aquila (Italy)
Centro Ricerche Musicali - Roma (Italy)
E-mail: info@waltercianciusi.com

**ABSTRACT**

This work aims to describe the composing style and aesthetics of Michelangelo Lupone, a leading figure in the Italian electroacoustic musical scene of the last twenty years.
Starting from the description of choices made in writing *Corda di Metallo* (Metal String) for string quartet, synthesis and live electronics, the guidelines that accompanied the entire production by the composer born in Solopaca will be explained.
The search for "character" that the author of this article is determined to achieve was facilitated by the author's dealings with and understanding of the composer, Maestro Lupone, during a span of several years.
Another interesting element is the fact that, despite prestigious performances of *Corda di Metallo* (for example by the Kronos Quartet), the score has not yet been published: therefore, aspects of the drafts, that may not be included in the final edition, could be revealed.

## 1. INTRODUCTION

### 1.1. The Meeting

A Sunday evening in Rome, time: six pm.
I am in front of the main entrance to Centro Ricerche Musicali (CRM) waiting for Michelangelo to arrive. Lamarmora Street is located near Piazza Vittorio and is, in fact, the oriental quarter of the city. You hear so many different languages spoken you sometimes wonder where you are.
6.03 pm "I'm sorry I'm late", he mumbles this apology over my shoulders in his usual deep and sombre voice.
"No problem", I reply. "Perfect timing" (and I think: he's so used to being overloaded and late that he apologizes even when he doesn't have to).
Without adding anything further, he opens the door and leads the way up to the first floor.

### 1.2. The Materials

Once in his study, he says: "I looked in the files but all the things I found regarding *Corda di Metallo* had no definite form." Then he hands me two different scores (one including useful handwritten notes on how to realize the live electronics, the other without any details), the electroacoustic patch (a flying sheet), a compact disc with five tracks (the part of the magnetic tape), three DATs with fragments of rehearsals by the Kronos Quartet, a CD-ROM with software (C code) allowing for the creation of a physical model (all custom-made by Lorenzo Seno and Marco Palumbi), a CD-ROM with the spatialization program.

## 2. THE SCORE

### 2.1. Organic

This analysis considers the more complete score, the one with the handwritten notes on the rehearsals held by the Kronos Quartet in 1997.
Lupone is not satisfied with the description "string quartet, magnetic tape, live electronics" found on the first page. In the final draft he will probably change it to: "string quartet, synthesis based on physical models and spatialization device".

### 2.2. Symbols

The second and third pages of the score describe a series of symbols used in the work and, therefore, a series of techniques: some of which have been experimented in a contemporary context more than once, others are extremely original. Belonging to the first category:

- microtonal sliding;
- Bartók pizzicato;
- beating the bow and letting the wooden sound be heard;
- hammering.

Belonging to the second category are those techniques derived from Lupone's experiments on strings. Experiments originating from the study of the physical model *metal string*, from which the piece gets its name:

- a particular vibrato, slow/wide  or fast/very wide  ;
- a particular jeté  : a light but constant pressure and a slow movement of the bow produce grains of sound;
- a series of regular or irregular oscillations around a given range ;
- a sort of guitar bending  , clinging to the string to obtain a vibrato on the harmonic;
- the use of great pressure on the bow at the lowest possible speed.

But what is surprising is the almost continuous change of the bow setup. There are five possible solutions:

- bridge (P);
- centre-bridge (PC);
- centre (C);
- centre-fingerboard (TC);
- fingerboard (T).

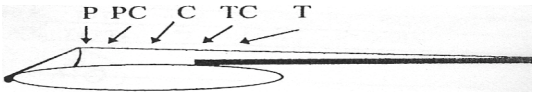


**Figure 1.** The bow positions

Often the transition from one position to another occurs by gradually moving backward or forward. On other occasions the bow must move in circles within the limits indicated (for example from fingerboard to bridge):  . Other times, the change is abrupt.
Also interesting is the prior arrangement of the bowings: it's possible, for example, that a group of five 16th notes is played up-down-up-down-up (using the bow as a saw!).
Finally, the accidentals: the quarter-tones are indicated traditionally.

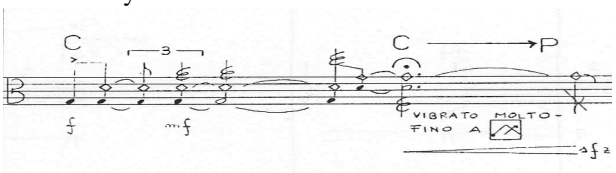


**Figure 2.** The start by the viola

## 3. ANALYSIS

Anyone who has attended Maestro Lupone's lessons at the Conservatory in L'Aquila knows what the following means: "I don't believe that scientific research alienates general cultural choices: sound research directed towards simplified musical instruments has produced limited instruments like the concepts to which it turns. Today, significant scientific research in acoustics and computer music has objectives that are conceptually aligned with the technical and communicative demands of contemporary music." Or taking this a step further: "Much of the music produced today scarcely utilizes the available means for expressing complex thought; the concepts of harmony, timbre and notes that place traditional music above the new means shows an uninformed musical background and the discrepancy between ideas and realization."
Lupone thinks that contemporary work can only enrich and extend its background when it manages to transform an idea by choosing the right instruments, making them necessary and making them bow to the original ideas that are to be expressed.
So this is why the starting point of *Corda di Metallo* is an experimentation on the physical model.
I remember Michael Nyman distinguishing between composers whose definition of experimental was a partial lack of control in the realization of live performance (take for example works by Cage or the Fluxus School), and composers for whom the experimental stage was before the composition and a guide in the choices (fixed forever) of the composition [1].
So, Michelangelo Lupone belongs to the second school of thought. Having taken care of the physical model experiment stage, he embarks on an hyperdeterminism and a structuralism that leave little to be experimented on performance.

### 3.1. The Physical Model

Research into the physical model of the string was initiated by Lupone in 1996 at the CRM in Rome. The staff consisted of a physics graduate (Lorenzo Seno), an engineer (Marco Palumbi) and others.
Instead of continuing to experiment with classic calculation models simulating strings (Waveguides method), attention was paid to the time variance of the descriptive equations of the physical parameters.
The hypothesis, in the early stages, was that of exploring the insides of string so as to discover the timbre characteristics of the materials it was made of, an uninterrupted spectral transformation from catgut to metal, a variation of the tension-density proportion and the independent variations of the speed, of the pressure and of the point of intervention of the bow.
In an original reading of the equation of the string, Seno and Palumbi momentarily suspended the term depending on the rigidity (the strings of a violin, of a viola or of a cello have a low rigidity) and introduced a term that represented the dissipation provoked by the viscose friction inside the string (this term gives the increasing rapidity of the dampening of partials to the increasing frequency).
In regard to the excitation they treated the string as

- pizzicato;
- hammered;
- tightened by the bow.

It introduced a non-linear term into the motion equation; this represents the real interaction that exists between the exciting system (bow) and the variables of the excited string.
After several experiments and comparative tests with real instruments, the researchers managed to improve the noise of the rubbing that was modelled adding to the function of excitation white noise of semi-dispersion, equal, at every point, to the value of the acceleration at that point: that made the intensity of the noise proportional to the pressure of the bow and introduced a chance component that through the bow is responsible for the micro-chaotic behaviour of the string [2].
After having implemented the model (C code), Lupone applied control functions to all of the terms of the equation with the two-fold aim of :

I. realizing a magnetic tape;
II. determining the emission modes used by traditional instruments to unleash, where possible,

the functioning of the instruments from the techniques in use.

*3.1.1. Magnetic Tape*

From experiments on the implemented model, Lupone chose the functions for the algorithm control that most interested him and divided them into four families.
Primitive Functions:

1. ramp;
2. step;
3. trapezoid;
4. square with variable duty cycle;
5. sinusoid;
6. cosinusoid.

Functions Derived from Primitives: substitute a zero for one of the two semiperiods of the preceding types.
Modulating Functions:

1. ramp (positive, centred on zero, negative);
2. sinusoid (positive, centred on zero, negative).

Modulated Functions: the primitive family types and their derivatives are modified through offset processes and modulated (amplitude and period) with the functions of the modulating family.
The entire system, represented by these functions, is applied to the following parameters of the physical model:

- string tension (length);
- internal dampening;
- dampening of the air;
- bow speed;
- bow pressure;
- position of the bow.

The synthesis produces what you can hear from the tape during a performance.
The tape for *Corda di Metallo* is composed of five brief fragments that collectively total about five minutes. These little gems are collocated in a more articulate discourse (the entire performance lasts approximately 18 minutes) and highlight the characteristics of various sections of the work.
In the current version of the score, only the beginning and end of the fragments are indicated[1] (and the duration of them). The details of the dynamics for the tape have been added in pen: they are somewhat provisional.

*3.1.2. Emission Modes*

The experimentation on the physical model was even more useful in extending the technical background and timbre of the strings than during the tape realization. And it is in this perspective that you can trace the fundamental optimism that characterizes all of Lupone's works: "le magnifiche sorti e progressive"[2] of a positive Enlightened vision. Michelangelo Lupone wrote a string quartet in 1997, convinced that he could, at least partially, renew the functions of such a chamber group. The renewal is made possible by importing into the instrumental world emission modes revealed by experimentation on the synthesis model. Electronics, or should I say meta-electronics, allow us to extend the "range" of an instrument.
From simulations on calculator comes the composition of a timbre glissando obtained through varying the pressure, the speed and the position of the bow. Furthermore, the creation of a sort of rhythm of intensities (obtained by varying the pressure of the bow) and a rhythm of timbre (obtained by varying the speed of the bow).
From the experimentation on real instruments come the creation of a circular movement of the bow that introduces chaotic functions on timbre and pitch, the modulation of the harmonic in a vibrato mode (a technique already experimented by Lupone in *Ciclo Astrale II* for violin, tape and live electronics) and other techniques.

**3.2. Spatialization**

One of the most known characteristics of Lupone's works is the particular attention dedicated to the sound spatialization. In recent years especially, with the creation of art sound installations such as *Guide d'Onda, Planofoni* and *Olofoni*, the appellative "space composer" has become evermore pertinent.
Even in *Corda di Metallo* the collocation and movement of sound represent a central problem.
The computational model, chosen and implemented by Lupone with the help of the engineer Marco Giordano, utilizes, apart from the consolidated techniques to control the amplitude of the signal on the speakers, an independent control of the delayed emission, a network of comb filters and a reverberator for each of the eight diffusion lines utilized in the work [3].
In *Corda di Metallo* the sounds are diffused through a system of eight speakers on which the spatialization process is carried out. There are four ways of intervening:

Localized source: is obtained by differentiating the emission characteristics on lateral and frontal speakers, highlighting stereophonic localization on the latter. The frontal ones, very far from one another and at extreme ends of the stage, were chosen with an opening angle of 80° on the horizontal plane and an elevated depth of field; this enabled the highlighting of, in a large spectator's area, the precedence effects, utilizing time differences (between 100 and 200 ms) during particular moments of the performance, when the articulation of the attacks propose transitions sufficiently ripid. The localization of signals required by the work led to a further intervention based on the principle of interaural differences: an independent control of intensity and a modest phase

[1] 0'10''- 0'42''; 3'05''- 3'44''; 4'54''- 5'51''; 9'10''- 10'25''; 16'06''- 17'25''.
[2] From "La Ginestra" by Giacomo Leopardi 1798-1837.

modulation on the six lines of the speakers placed around the audience, in this case fed by only two signals (left and right) and with decreasing intensity from the ones upfront to the ones at the very back.

Closing in and distancing source: in this case, the control functions of the crossfading between the speakers are critical. The type of curve, the offsets and the speed of the functions equally contribute to the crossed envelope placed on the four comb filters of every line. The modulation (varying in time) of the first reflections obtained through this technique and the use of a lowpass filter in the comb filters feedback, show a closing in and a distancing effect, even when the sources act upon the speakers placed alongside the audience.

Source in elevation: the source in elevation influenced the pitch range of the composition, the setup of the bandpass filters on the signals from the instruments (1.2 KHz/1Oct., 3.8 KHz/1Oct., 7.6 KHz/2Oct., Gain $\geq$ 12 dBOct.) and the spectral density of the magnetic tape. In *Corda di Metallo* there is a more complex control on the directional bands. To achieve this, two speakers were placed three meters high at the front and centre, far from the audience. Both with high efficiency and a narrow angle of radiation, were treated monophonically and filtered so as to release the band between 500 Hz and 8 KHz.

Chaotic motion of the sources: this characterizes the moment in which there is a transformation of the primary musical references. This type of spatialization underlines the instable phases when the musical references assume ambiguous characters in pitch, timbre, rhythm, and announce the entry into one of the four attraction basins (see 3.3.). The ambiguity expressed here through a continuous variation of the instrument performance parameters, is emphasized musically by the chaotic paths of the sources moving on horizontal planes, middle and frontal, with varied direction and speed. To achieve this chaotic movement, Lupone and Giordano utilize a generator of random numbers and a linear interpolator. The functions obtained are used to choose the couple of channels subjected to crossfading, and are also applied to the speed of the fading, to the relationship between direct and reverberated sound, to the range of the delayed signal (between 200 and 300 ms) and to the coefficients of the comb filters.

The entire spatial structure of the work is not dealt within the current writing of the score. However, there is a CD-ROM containing the spatialization software that, in real time, effects these transitions. To make this software the staff concentrated on the SMART prototype of the IRIS Centre, upon which Carlo Galletti and Felice Cerone created a powerful parameter manager, capable of simultaneously controlling sequences sent from external devices (Fly 30, MIDI and sound cards).

This software[3], called KRONOS so as to associate it with the quartet of the same name, makes parameter management easier while preparing a concert.

### 3.3. General Structure

The map of the work is ideally designed by four confluent basins of musical elements and each basin presents a maximum point of concentration within which the expressive forces of the sounds are attracted. The concentration point implodes the acoustic peculiarities of the sounding materials, giving the piece, at that moment, a definite and unique character. The expressive character of every basin falls within a perceptive parameter:

- reflective goes with a prevalence for timbre;
- chaotic goes with spatial perception;
- punctual goes with a perception of pitches and intervals;
- logic goes with rhythm and variations of it.

The attack supplied by the viola immediately puts us in the reflective basin that prefers timbre perceptions. Helped by the first of the five tape fragments, that intervenes at ten seconds from the start of the piece, the timbre mass of the quartet proliferates till it makes the instruments behind the sound unrecognizable. From there onwards the chaotic polyphony makes it hard to read the score in real time. The micro-variations of rhythm and pitches remind you of the orchestral writings of Xenakis.

The zone around every basin includes transformations, unions, overlappings and interactions of different perceptive parameters; in these areas the work highlights the paths of the four primary musical references that move in different directions and at different speeds.

The section from the thirteenth to the fifteenth minute (drafts pages 48-51) is unique. It seems, on a first reading of the score, like a static zone: a collection of simple chords with corona maintained simultaneously by all four players. But looking at the spatialization program, the apparent staticity is betrayed by a continuous movement between virtual sources. A circular movement of the cellist's bow, within precise limits (fingerboard-centre bridge-centre), joins the spatialization process. The centrifugal movement is accelerated progressively till the start of the next section.

## 4. REFERENCES

[1] Nyman M., "Experimental Music - Cage and Beyond", Cambridge University Press, 1974.

[2] Palumbi M., Seno L., "Physical modeling by directly solving wave PDE", ICMC Proceedings, 1999.

[3] Lupone M., "Spazio, Arco e Metallo", in *I Quaderni della Civica Scuola di Musica*, Comune di Milano, Anno XIV, N. 26, pp. 80 - 89, 1999.

[3] Written in C and Visual Basic code.