GENERAL PROCESS IN THE CREATION OF ESTRUENDOS AND PRINCIPAL STRUCTURAL ELEMENTS OF THE COMPOSITION

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Cuellar Camargo, Lucio Edilberto. General Process in the Creation of Estruendos and Principal Structural Elements of the Composition. Doctor of Musical Arts (Composition), May 2002, 47 musical examples, 5 illustrations, references, 35 titles.

My composition, Estruendos, is a work for large symphonic orchestra, guitar and computer-generated and processed sounds on CD. The work lasts 23 minutes and 45 seconds.

My dissertation is composed of two parts: Part One comprises the analysis and Part Two comprises the score. Part One gives a brief background of my compositional dialect and aesthetics. It also includes a discussion of the compositional process and general overview of Estruendos. In addition, it illustrates the primary role the placement of sonic events in time and timbral structure play in the pathos of Estruendos.
ACKNOWLEDGEMENTS

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## ACKNOWLEDGMENTS

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PART ONE

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CHAPTER I
INTRODUCTION

The purpose of this paper is to serve as an analysis of my composition *Estruendos*. If in the future someone wants to perform the work, he or she will have available documentation concerning the major issues of *Estruendos* such as its aesthetics and the essential musical components in its structure, style and musical language. The issues discussed in this document will give a view that goes beyond the written score. Therefore, this document is not a microscopic analysis of every musical element in *Estruendos*. Instead, it provides information essential to understand various musical components of *Estruendos*. These components are of primary importance in defining the pathos of *Estruendos*.

*Estruendos* was written between 2000 and 2001. It is an electroacoustic piece for guitar, large symphonic orchestra, computer-generated sounds and natural sounds processed by computer music applications on tape.
The work lasts twenty-three minutes and forty-five seconds and is a one-movement work with several contrasting sections within a traditional overall form in which a recapitulation and cyclic elements are present. *Estruendos* is a work in which the computer generated tape, guitar and orchestra interact with each other as soloists at times and as accompanists other times. With the realization of *Estruendos*, I was able to expand my musical vocabulary as a composer and to deepen my exploration of the electroacoustic musical field and its relationship with acoustic music.

Aesthetically, *Estruendos* contains influences from the late Baroque, Classical and French impressionist eras. Most significantly, it exhibits aesthetic influences from the latter part of the 20th century. From the Baroque era, one finds traces of passages using the concept of tutti and solo in the work. The overall form of the work is derived from the Classical era. From the impressionists there are influences in the function of harmony as timbre\(^1\) and the conceptual approach to time in the music. From the 20th century, the work includes new concepts and aesthetics about time, the use aleatoric elements, new concepts about micro-

\(^{1}\) For example, *La mer* utilizes dominant chord seventh harmonies as timbral coloration of melodic passages rather than as functional harmonies.
structural organization, and the use of electronic concepts developed in the short history of the field.

There are several musical aesthetics, as well as techniques fully developed in Estruendos, and they have become a part of my compositional style. Thus, Estruendos is a representative work of my personal musical style as a composer. These aesthetics and techniques can be traced in earlier compositions of mine such as A Armero for Tape and Alto Sax and a Suite for Flute, Trumpet, Piano, Cello and Computer Generated sounds on Tape in four movements.

A Armero (1995) exhibits several instances of improvisation and aleatoric techniques developed further in Estruendos. For example, at six minutes and eighteen seconds into the score one finds a musical object inside a box extended by a line with an arrowhead indicating the duration of the event (See Example 1.1).

Example 1.1. Lucio Edilberto Cuellar Camargo, A Armero: use of an aleatoric musical object in the Alto Saxophone at six minutes and eighteen seconds.
In the same work, there are also a few instances where the saxophonist improvises with the pitches inside the box for the duration indicated on the top of the box. Such a case occurs at three minutes and six seconds (See Example 1.2).

Example 1.2. Lucio Edilberto Cuellar Camargo, *A Armero*: Alto Saxophone improvising for twenty-one seconds at three minutes and six seconds.

A *Armero* is the first work in which I used sound synthesis processes in the tape portion and explored the use of microtones in acoustic instruments. An instance of use of microtones occurs at six minute and forty-six seconds in the saxophone part (See Example 1.3: Armero).

Before completing this work, I wrote a few works for solo tape and one tape with instruments piece using MIDI and pre-programmed sounds using samplers and synthesizers. Therefore, in listening to A Armero I find several instances where my techniques of handling tape materials are somewhat rudimentary. In A Armero, I began to use the conceptual approach of conceiving the electronic and acoustic part as independent entities. I further explore this concept in Suite for Flute, Trumpet, Piano, Cello and Computer Generated Sounds on Tape and Estruendos.

Suite for Flute, Trumpet, Piano, Cello and Computer Generated Sounds on Tape (1998) is my second work for tape and various instruments. My sound synthesis techniques in this work have developed more in comparison with my previous works. I began to incorporate more sound resynthesis processing techniques using recorded sound samples in the tape realization. I also began to explore the concept of sound spatialization in the tape. The concept of sound object mobiles is present in the acoustic portion of this work as well. An instance of such an occurrence takes place in the first movement at rehearsal mark five (See Example 1.4).

(This section is approx. 18")

Flute

Marimba

Percussion I

Vibraphone

Percussion II

Piano

Inside piano

Cello
Suite for Flute, Trumpet, Piano, Cello and Computer

Generated Sounds on Tape and A Armero were pivotal in the development of my compositional style. All the aesthetic and musical elements mentioned above are further developed in Estruendos.

The electroacoustic part and the acoustic part in Estruendos function for the most part as two independent entities; therefore, each part uses its own set of parameters of form, compositional process, musical elements and evolution in time. The acoustic part contains traditional western musical elements of pitch, rhythm and harmony as well as non-western elements such as percussion instruments of South American origin and that is timbre explored through improvisation. New aesthetic concepts about music and composition techniques introduced by Edgard Varèse, Karlheinz Stockhausen, John Cage, Earl Brown, Iannis Xenakis and Krzysztof Penderecki have influenced my work in general. Their influences are also prevalent in Estruendos. The electroacoustic part explores digital sound processing, timbre transformation, soundscapes, texture and sound spatialization. My approach to compositions involving acoustic and electroacoustic media has been influenced by the approach Karlheinz Stockhausen used in Kontakte, an electronic work realized between 1958-60. The work has two
performance versions. One is for tape alone and the other for tape and piano and percussion instruments. He generated first the tape portion and later he added the acoustic instruments\(^2\). In my work for mixed media, so far, I have used the same approach sometimes using the same order Stockhausen use in *Kontakte*, which is the case in *A Armero*. In recent works such as *Estruendos*, I wrote the acoustic part first and added the tape later.

Compositional aspects discussed in this paper include the treatment and the relationship between acoustic and electroacoustic elements as well as the similarities and differences of approach in the process of composing both parts (acoustic and electroacoustic). Other topics presented in this paper include the compositional techniques used in the creation of *Estruendos* and the work’s aesthetic influences.

CHAPTER II

GENERAL COMPOSITIONAL PROCESS AND FORMAL OVERVIEW OF

ESTRUENDOS

In the previous chapter, I talk about my aesthetic and musical influences and discuss the diverse approaches I used to compose other pieces. In this chapter, I change the focus in order to talk about the conception of Estruendos. Therefore, I will begin by explaining the general compositional process and overall formal design of Estruendos, highlighting the different creative layers and structure of the work.

**Compositional Process**

The general compositional process of Estruendos unfolded in six stages. In the first stage, I selected the main musical forces, musical aesthetics and general overall design of the work. In the second stage of the composition of Estruendos, I conceived the main musical objects in the acoustic part and the selected one of the main sound sources for the tape portion. Next, I created and notated the acoustic component. After the completion of the acoustic portion of the score, I generated the tape and
created the symbols to notate the sonic events of the tape. Once I had completed the sonic events in the acoustic and electroacoustic components of the work, I worked out their synchronization. I worked out each part separately only considering general issues about synchronization, structure and musical parameters. I achieved the final synchronization of Estruendos by adjusting temporal relationships that gave more unity to the two parts and have meaning artistically. In the conception of each part, I was more concerned with the development of independent ideas with no regard to sharing these independent ideas in both the acoustic and electroacoustic parts. After the integration of the acoustic and electroacoustic parts, I began the postproduction of the tape in one of the CEMI electronic studios at the University of North Texas.

I would like to mention that these compositional stages are based on the logical steps I followed in the composition of Estruendos and not necessarily in the chronological order I followed in the composition of the work. For instance, there were times when I was working on some material from the third stage and an idea for the tape came along, prompting me to pause and work out the idea for the tape.
Since the first sketches in the initial planning of \textit{Estruendos}, I wanted to write a work that had traits of my cultural roots yet was experimental and exhibited traditional elements of Western music. Therefore, I chose to write a piece in which the guitar is one of the main musical forces. Although the guitar is of Spanish origin, in Latin American countries the guitar gradually has evolved over the past four hundred years to represent their national musical heritages. Other musical sources from my roots are sampled guitar and rhythmic motives used on the tape. The other two main musical forces of \textit{Estruendos} are the symphonic orchestra and the computer manipulated and generated sounds on tape. The symphonic orchestra is a product of the European musical tradition while the electroacoustic part represents a more recent development in Western music. Therefore, I give the tape more experimental treatment than the other two major components of \textit{Estruendos}.

Once I established the major musical forces and general aesthetic ideas of the composition, I decided to model the overall form of \textit{Estruendos} using the concerto form from the European Classical era. I decided to pick the concerto form for several musical reasons. For instance, this form can feature the major musical forces of
Estruendos (guitar, tape, and orchestra) with the use of ritornellos, tutti and solo passages. In addition, the instrumentation seemed to fit the prototype of the traditional concerto form. It also allowed me to explore ideas about timbre and it gave an element of unity and structure to the overall form of the piece. However, deviations from the original formal model took place as Estruendos unfolded. In fact, once the piece was finished, the overall design of Estruendos did not closely resemble the original model. I made these deviations to develop musical ideas and aesthetic concepts I wanted to explore. These deviations help to give Estruendos a unique essence.

Having defined the major components and first stages of the macro structural design of Estruendos, I developed the main unifying musical elements of the tape and the germinal cells for the acoustic parts. First, I decided to use a sound file that I have used in previous compositions for the tape portion. This sound file contains rhythmic patterns of Caribbean origin tapped on the resonant body of the guitar. These Caribbean rhythms are the congas’ rhythmic pattern used in the merengue and the two-three rhythmic pattern of the Claves in salsa music. I superimposed these two Caribbean rhythms simultaneously to create the components of the sound file (See Example 2.1).
Example 2.1. Two Caribbean rhythmic patterns tapped simultaneously on the resonant body of the guitar.

Merengue 2-3 clave

Other components of the tape part include the recorded samples of acoustic guitar. These samples are sounds produced on the guitar using 20th-century techniques of playing. Besides these samples, the tape also includes a sound file containing a spoken sentence in Spanish by a tenor voice, and several recorded samples of oboe and synthetic sounds generated by the computer.

Next, I created the main musical object of the acoustic part. This musical object has three music cells. The first one is a two-part dialogue consisting of a contrapuntal part that stands as the foreground musical idea of the musical object. The melodic content of these two melodic lines is contrasting. One uses repeated notes in a span of two octaves and a half using intervals of major and minor thirds, major and minor seconds perfect fourths and tritones. The other melodic line has smaller
interval content using tritones, perfect fourths, major and minor seconds, and it spans one octave (See Example 2.2).

Example 2.2. First music cell: two-voice dialogue of first musical object.

The second cell is a melody, which is less active than the two-voice part, and it stands as middle-ground musical material of the object.
The intervals used in this melody are the perfect fourth, major second and tritone (See Example 2.3).

Example 2.3. Second music cell: countermelody to two-voice dialogue.

The third cell is a chord progression that serves as a musical background material of the musical object (See Example 2.4). This composite musical object is the most complex rhythmically since it contains three rhythmic layers. One layer moves in quintuplet sixteenths and thirty-seconds. The second layer uses mostly eighth and quarter note values. The third layer moves in long rhythmic values of whole and half notes. This musical object is also the most complex of all the musical objects of this composition. The three musical cells of the object are contrasting in character. I later orchestrated this musical object and reorganized the presentation of the various musical cells. This musical object is not only the
seed of several orchestral passages but also provides the main musical theme of the guitar.

Example 2.4. Piano reduction of third music cell: a chord progression that serves as background of first object.

After designing this first musical object, I conceived another important musical object that is pivotal in the construction of the orchestra part. It contrasts with the musical object just mentioned in that it has static
sonorities with a wide range covering lower, middle and upper registers. It includes a long melodic line stated in the middle register that functions as the foreground of the musical object. This melody is stated twice. The second begins and ends with new melodic material. It includes a transposition from the original tonal center as well as rhythmic displacement (See Example 2.5).

Example 2.5. Melodic line stated in the middle register that functions as the foreground of second musical object.

In addition, florid ascending arpeggios function as middle-ground material in this object. Example 2.6 illustrates the cell of the arpeggiated lines in this musical object (See Example 2.6).
Example 2.6. Piano reduction of a Cell of arpeggiated lines in the second musical object.

These arpeggiated lines arrive on various pitches that hold to build the static sonorities that intermingle with others. These become the background of the musical object (See Example 2.7).

Example 2.7. Two piano reduction: background of second musical object.
Like the previous musical object, this one has a multidimensional rhythmic structure containing three rhythmic layers. One layer moves using thirty-second note values. The second layer incorporates mostly eighth and sixteenth note values while the third layer moves in long rhythmic values of whole and half notes. I created this musical object having an orchestration in mind. Therefore, it differs from the first, third and fourth musical objects in this respect. The third musical object has three components. The first component is a long melody in the middle and upper registers, which functions as the foreground of the musical object (See Example 2.8).

Example 2.8. First component of the third musical object.
It evolves at a medium pace and repeats with some variations in the rhythm and harmonization. The second idea is a chord progression accompanying this melody (See Example 2.9). The progression covers a wide range beginning in the lower registers and expanding into the upper registers. This progression serves as a background for the musical object. The voicing in the lower register is open while the voicing in the upper register is closed. This chord progression moves in half notes creating a second rhythmic layer.

Example 2.9. Piano reduction of second idea of the second music object a chord progression.

The third musical idea is a slow melodic line in the extreme upper register. It is a fragment of the second
cell of the first musical object and it is an octave higher (See Example 2.10). It also serves as a countermelody to the primary melody and functions as the middle ground of the musical object. This musical object shares some similarities and musical ideas with the first musical object despite its dissimilar character. Melodically both begin the same; however, the ending of the third music idea of the third music object is a descending line in step-wide motion covering an interval of a third. This third cell uses the longest rhythmic values of the musical object and provides a third rhythmic layer of the musical object.

Example 2.10. Third music idea of the third music object fragment of the second cell of the first music object an octave higher.

The fourth object conceived is the most static and simple of all five. It contrasts the other four in that it consists of one musical idea; a narrow chromatic cluster covering the interval of a minor third in an upper register (See Example 2.11).
This musical object evolves into several orchestral passages where timbre exploration is the main musical focus.

Example 2.11. Four music object a chromatic cluster covering the interval of a minor third in an upper register.

The fifth and last musical object comprises the first minute of the piece. This section is the introductory part of the acoustic portion. This last musical object is a composite one. It contains three musical cells. The first cell consists of tutti chords played by the orchestra (See Example 2.12).
Example 2.12. First cell of the fifth music object. The orchestral score in the example is non-transposed except piccolo, guitar and contrabass.

Conductor chooses one of the two chords at will. Using a mixture of the following rhythmic values of \( \frac{1}{4}, \frac{1}{8}, \frac{1}{16} \) as the duration indicated on the top of the box.
The second cell is the solo guitar melodic motives (See Example 2.13).

Example 2.13 second Cell, guitar melodic motives. The guitarist chooses at will any of the three boxes in between the orchestra chords.

The third cell is the last chord formed by the staggered entrances of all the instruments of the orchestra (See Example 2.14). The conception of this musical object is linear. Therefore, the three cells are in the foreground with each cell stated successively; they are never stated simultaneously. Rhythmically this musical object contains metric random elements and non-metric random elements.

* Stagger entrances. After tape starts, diminuendo and stagger releases
This last musical object is important in that it introduces aleatoric musical concepts and random elements into the piece. In addition, this musical object is important because it introduces subjective timbre exploration in Estruendos. It also introduces an important portion of the musical language utilized in the work. I used proportional graphic notation to notate this musical object. I decided that this type of notation was the most adequate to represent the musical ideas in this musical object after consulting the book Music Notation in the Twentieth Century by Kurt Stone and studying several scores by composers active in the later part of the 20th-century.

Once I established these musical macro parameters of the acoustic and electroacoustic parts of composition, I began to compose the acoustic part. The five musical objects just described above are the seeds of the acoustic portion of the piece. They serve as pillars of the construction of the orchestral and guitar parts. There are orchestral sections where no surface relation seems to exist with these musical objects. However, the aesthetic

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concepts of these musical objects carry over in these sections.

Once I had composed the main cells of the acoustic portion, the creation of the acoustic part of Estruendos proceeded in a linear fashion. The construction of the acoustic portion of Estruendos is organic in nature. To achieve my goals musically and to express myself, I developed the ideas within the five musical objects described above using several traditional techniques. Among these techniques, I used imitation, transposition, elongation, retrogression, augmentation, diminution and several forms of inversion. In addition, I employed methods where the principle of variation takes place using additive and subtractive (decomposition) procedures. Moreover, one can find pitch sets derived from the main cells. Among the variation techniques used in these pitch sets are the combination of elements from different pitch sets to create a new set, pitch rotation, pitch subtraction and pitch replacement.

As mention before, the overall form of the acoustic part began with the concerto as a model. However, the result shares more similarities with sonata form than with concerto form. The only characteristic that carries over from the concerto form in Estruendos is the tutti and solo
passages featuring orchestra and soloists (tape and guitar and instruments from the orchestra). The piece has the structure of a sonata containing an exposition, development and recapitulation (See figure 2.1).

Figure 2.1. Overall form of Estruendos.

The harmonic language of Estruendos is free and does not fit the traditional prototypes of functional harmony. The harmonic language of Estruendos contains clusters mixed
with quartal harmony as well as incidental thirds and microtones. These sonorities primarily use open voicing and cover a large range using several octaves. On the surface, the work might look atonal and certainly there are passages of the work where harmonic principles are not present. However, it is quite clear that the work does have certain sonorities that function as main harmonic centers and return often during the duration of the work. *Estruendos* also has sections in which the harmonic content dissolves into dense timbral clouds of chromatic and microtonal clusters.

After having finished the acoustic part, I started to develop the tape portion. The aesthetics and approach I use in the tape are different from the approach I use in the acoustic portion. The tape portion contains a variety of sound sources that are different when compared with the acoustic instruments. For instance, there are sounds such as a jet engine, glass breaking, speaking voice and synthetic sounds using several sound synthesis techniques. Therefore the traditional musical parameters of melody and harmony are incidental in the tape while sound transformation, color and texture are the main musical parameters dictating formal structure and artistic meaning in the tape. Although, a few melodic lines play an
important role in certain portions of the overall structure of the tape, the tape primarily explores subtle variations of color and creates diverse moods and atmospheres to paint a sonic picture.

Rhythmically, the tape explores a large range of approaches. They include non-metric patterns avoiding repetition and accentuation as well as metric repetitive accentuated patterns. It also contains textures with long sonorities lasting up to 15 seconds. All these approaches to rhythm provide contrasting textures within the tape. At the microlevel, granular rhythmic patterns form not only random clouds but also predictable clouds with a constantly increasing or decreasing speed of grains.

I began producing the tape by recording sounds from two types of sources: environmental sounds such as speaking voices and doors closing; the other one being the instrumental sounds from a guitar and an oboe. After recording these sounds, I produced the computer generated synthetic sounds using Csound and Max-msp. After I finished collecting sounds, I began the signal-processing phase. For the sampled sounds, I removed unwanted artifacts such as clicks. I also shaped the sampled sounds by imposing envelopes. After cleaning the sampled sounds, I applied several techniques of signal processing using
applications such as Csound, Max-msp, SoundHack, GrainMaker, cloud generator, SoundEdit 16 and Peak. For the computer generated synthetic sounds using Csound, the process was different in that I started with the creation of orchestras and scores. Once these files were designed, I compiled them to generate sound files. I changed parameters in orchestras and scores in Csound until I achieved desirable sounds. I applied some of the same signal processing techniques and sound applications for both the sampled and synthetic sounds.

After I had created several sound files, I began to build the structure of the tape using Protools to mix these sound files. Besides, the sound file containing the rhythmic patterns of merengue and salsa (See Example 2.1), I used synthetic sounds and guitar samples to create a framework for the structure of the tape. These sounds function as unifying musical elements in the structure of the tape. They reappear throughout the tape in their original form or with some type of variation.

After I finished putting together the sound events of the tape, I notated these sonic events using time-space notation based on symbols to write traditional and aleatoric music. I also used written instructions to clarify desired sonic characteristics. I tried to be
consistent in the use of each symbol by using the same symbol for the same sonic event. I believe this type of notation is the most accessible for orchestral conductors who in general are accustomed to reading traditional musical notation. I used seconds to define and measure the position and duration of sonic events in the tape as well as to facilitate the coordination of the acoustic and electroacoustic sonic elements.

After generating and notating the tape, I combined the tape with the acoustic portion of the work. I conceived each part independently using different musical approaches and musical aesthetics. Therefore, the process of combining the acoustic and electronic elements of the composition was necessary. I achieved this process by evaluating the complementation properties of both elements and making compositional decisions regarding their temporal placement, for instance; when the musical character of the acoustic part was agitated. I chose to contrast this musical character by providing a texture containing sustained relaxed sonorities with little rhythmic activity in the tape. This is the case at five minutes and twenty-five seconds (See Example 2.15).
Example 2.15. Contrasting simultaneous textures between tape and acoustic part.

In this case, the acoustic and electroacoustic parts work against each other to create a complex sonic picture with contrasting textures. On the other hand, there are passages such as the one at ten minutes and twenty seconds where the tape displays the same type of musical gestures present in the acoustic portion. Consequently, this combination creates a musical picture in which the textures
of acoustic and electronic parts blend with each other through their similarity (See Example 2.16).

Example 2.16. Simultaneous Texture complementation by similarity between tape and acoustic portion.

In sections in which the tape and the acoustic part share great similarity, special consideration must be given to issues of synchronization. The tape is very precise and always the same, while the acoustic performance is more flexible, less precise and prone to different interpretations with each performance. Therefore, I decided that at the micro-level, the synchronization between the electronic part and the acoustic portion is not precise and I allow a certain margin of flexibility.
However, at the macro-level these two entities do have points of exact synchronization. This approach to the synchronization of acoustic and electroacoustic sonic events is a trait that carries over from previous compositions of mine. For instance, Armero (1995) for tape and saxophone, Entre realidades (1997) an interactive piece for guitar and live electronics and Suite for Flute, Trumpet, Cello, Piano, 2 Percussionists and Tape (1998) are pieces that explore this particular approach to synchronization of diverse media.

I worked on the postproduction of the tape last for several musical reasons. First, I needed to be sure that the sonic events of the tape were completed to my satisfaction. Second, I needed to refine further the synchronization between acoustic and electroacoustic parts in order to emphasize or de-emphasize to certain parameters in segments of the electroacoustic part. Finally, I wanted to finish everything else in the piece before I started thinking about the sound spatialization of sonic events and the reverberation levels in the tape. These parameters add another musical dimension to the composition. Therefore, these parameters redefine the character of the tape and the role the tape plays in the structure of the composition and
at the same time, they redefine the shape of the entire composition.

The conception of Estruendos was not linear and in that sense, its conception breaks from the traditional approach to composition. This can be seen as a trend first exhibited at the beginning of the 20th century. Another departure from a more recent tradition already established is the independent conception of the electroacoustic and acoustic parts. In this respect, the conception of Estruendos is multilinear.
CHAPTER III
THE AESTHETICS AND ROLE OF SONIC EVENTS THROUGH TIME IN THE STRUCTURE OF ESTRUENDOS

_Estruendos_ explores recent aesthetics and approaches to sound placement in time. In that sense, within a traditional structure _Estruendos_ explores current trends concerning time in music. At the same time, it contains an unusual approach to the interaction between acoustic and electroacoustic sonic events in time.

The approach I used to place sonic events in time within the electroacoustic and acoustic parts is unusual. Although I used basic raw sonic materials for the tape, I worked out the placement in sonic events in the acoustic part first. Afterwards, I worked out the placement of micro sonic events of the tape part. At the macro structural level, the tape loosely follows the framework established by the acoustic part. The study of composers like Earl Brown, John Cage, Krzysztof Penderecki, Edgard Varèse, Karlheinz Stockhausen and Iannis Xenakis influenced
my aesthetic preferences concerning the treatment of these sonic events in time. This is reflected in Estruendos. My experience dealing with these two media in previous works (see Chapter II) was also an influential factor in the approach I used to place sonic events through time in Estruendos. With respect to practical concerns, I considered the limitations inherent in acoustic and electroacoustic music. In the acoustic part, the human factor at times becomes a limitation while in the electroacoustic part the machine/technology available imposes limitations. On the other hand, both offer infinite possibilities to explore new sonic universes of different natures. Therefore, the challenge for me in this composition was to allow these two media to interact and integrate as a whole while still enabling each component to be an independent sonic universe coexisting in parallel with the others.

In the acoustic part, I mainly used metered sections to place events through time. In some other sections, I avoided meter constraints. As a result, placement of musical events in these sections is more free, and is notated using graphic proportional notation. In a few sections, I used diverse combinations of these two approaches to rhythm to create a bridge between the metered
and unmetered passages of the work. The unmetered sections serve to create textures with characteristics similar to the tape in order to meld the orchestra’s sonorities with the tape sonorities. This enhances the characteristics of the electronic sound. The unmetered sections in the orchestra also generate contrasts in musical character and texture to the metered textures in the orchestral portion. The metered sections have a linear organization to present temporal elements, and temporal elements have direction toward a goal.

On the other hand, the placement of events through time in the tape is free; it is not constrained by meter. However, its pacing is mostly regular and placement of temporal events is exact to the millisecond. I use graphic proportional notation to notate sonic events in the tape, indicating only prominent temporal events that are relevant to the synchronization of the tape with the acoustic part. The approach to the tape is non-linear. In the tape, I went back and forth between the different sections, and I was constantly adding new musical elements even when I thought certain sections were finished. I was able to use this approach in the tape because I could hear the results almost immediately with as many repetitions as I desired. Therefore, when I brought new material in at a later
section of the tape, I realized that this same material would enhance a previous section of the tape. It was a trial-and-error kind of approach involving the development of conceptual ideas. In the acoustic part, this type of approach was not possible for obvious reasons, including the availability of a symphonic orchestra to regularly and repeatedly perform score excerpts. Composing the electroacoustic part also made it possible to create simultaneous complex layers of sonic events without concern for the limitations of performer coordination. By contrast, logistics concerns regarding the coordination of performers necessarily influenced acoustic compositional choices.

Splicing is another electroacoustic technique that can create discontinuities of temporal events. There are many instances where I splice sound files to introduce new sound ambiences. A good example is the treatment of the sound file containing the simultaneous combination of rhythmic patterns of the Claves in salsa music and the rhythmic pattern of Merengue (See Example 2.1 in chapter II). I splice this sound file in many different ways to create different interactions of this sound source with others. The splicing of this sound file allows new sonic scenarios by breaking the continuity of events of this sound file and
immediately presenting unrelated sound events from
different sources. At the micro level, the organization of
sonic events in the tape is achieved by the use of
ostinato, sequence of events creating recognizable
patterns, variation of these patterns and combination of
different patterns. In addition, the practical aspects of
performance of each instrument in the acoustic part such as
range, rhythmic agility, breathing and dynamic ranges were
influential factors in the placement of sonic events in
time.

Acoustic and electroacoustic sonic events in
Estruendos share the same unit of measurement of time,
namely one second. Therefore, all musical events in
Estruendos share this common ground and spring from this
unit of measurement at the micro or macro level. Although
it might appear on the surface that there are no temporal
relations between acoustic and electroacoustic parts,
closer evaluation demonstrates that all temporal elements
in Estruendos are multiples of a second. For instance, the
passage between twelve minutes and fifteen seconds and
thirteen minutes in the acoustic part there are several
simultaneous or not simultaneous tempo-markings (depending
on the conductor’s choice). In this section, the conductor
chooses at will the order of entrances and cut offs for
each box. The hearing of a predominant beat in this section is almost impossible, therefore I am trying to create a chaotic psychological effect. Underneath the temporal experience; however, every instrument’s tempo marking is a multiple of a second. The tempo in the French horns, trumpets and piano is sixty-quarter notes per minute. The tempo in the trombones is ninety-quarter notes per minute and the tempo in the percussion section is a hundred and twenty-quarter notes per minute. The other instruments in this section are free of tempo. They only have to play the notes indicated in the page in relation to the other players. The only unit of measurement is the duration of the section, which is forty-five seconds. Using sound, I am also trying to create the illusion of flying objects in space. The flying objects are represented by the various musical objects inside the boxes, while space is represented by the sustained sonorities in the woodwinds and strings. This passage is subject to various interpretations according to the conductor’s choice. (See Example 3.1)
Example 3.1. Use of several tempi trying to create a chaotic effect.

In contrast with the previous example, there is an unmeasured passage at eleven minutes and twenty-eight seconds creating an illusion of suspension of sound in time.
achieved by static bands of sound in the acoustic part (See Musical Example 3.2).

Example 3.2. Sustained sonorities provide an illusion of suspension of sound in time.

In this section, the articulation of every sonic event takes place in reference to the previous event without a precise measurement of time. This all occurs within a defined period of time (seventeen seconds) at the macro level. Therefore, this section will sound different every
time it is performed or rehearsed but will always achieve the same psychological effect on the listener. These two sections, although different in approach and psychological effect, share at the macro level the same unit of measurement of time and fix duration in time despite their different lengths.

The placement of sonic events through time defines the musical character of the different sections of Estruendos. For example, the first minute of the acoustic introduction of Estruendos contains a pseudo-random process that determines the temporal placement of sonic events, giving the music a character that is agitated and somewhat unpredictable in the introduction. In contrast, the section between two minutes, forty-five seconds and four minutes, five seconds has a more lyrical musical character due to its slow pacing and metric rhythmic patterns (See Example 3.3).
Example 3.3. Slow pacing and metric rhythmic patterns in the acoustic part provide a lyrical musical character.

The unfolding of sonic events over time in Estruendos embraces various aesthetic principles and techniques, among them, metric linear patterns with defined goals such as the main musical cell of the guitar (See Musical 2.2 on chapter II). This linear approach in composition has predominated Western music from the beginning to the present and reflects Western modes of thought. Other types of aesthetic thought present in Estruendos involve nonlinear
treatment of passages in which sonic events occur with no precedent or development. They create suspended textures in time giving the sensation of infinity or ecstasy (See Example 3.4).

Example 3.4. Suspended textures give the sensation of infinity and ecstasy.
Although there are several examples of nonlinearity present in Western music prior to the 20th century, the aesthetic thought of nonlinearity in music began to be explored fully by Debussy and Stravinsky⁴. Moreover, this development was due primarily to the exposure of Europeans to other musical cultures, as was the case with Debussy whose music was influenced by the Javanese gamelan orchestra. This new concept gained momentum, and throughout the twentieth century, composers like Olivier Messiaen, Karlheinz Stockhausen, John Cage, Ianis Xenakis and Earle Brown continued exploring its possibilities⁵.

Another aesthetic approach to sound in time not explored anywhere else in Estruendos takes place in a section containing unusual temporal events (See Example 3.5).

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⁵ Ibid., 44-49.
This section presents an interruption in the temporal linear process of Estruendos and explores yet another aesthetic concept first introduced by Iannis Xenakis. In my composition, this process consists of short rhythmic values in the orchestra and short granular sonic events in the tape to create a sound cloud. Although the cell of the
section comes from material previously present in the work, the behavior of a group of pitches and their interaction becomes more important than the individual pitch. Therefore, the individual pitch is only one member of a collection of complexly interacting notes, each with little weight or importance of its own, a process described by Robert P. Morgan in his book *Twentieth Century Music*. In other words, the whole is more important than its components, although it all begin with one individual gesture. Iannis Xenakis provides a nice analogy explaining his concept in his book *Formalized Music*. He said that his idea could be demonstrated in many natural forms such as in protests in city streets. One heard that an individual starting to shout a slogan then a few individuals joined moments later. Moments later still others follow. Eventually the whole crowd was repeating the same slogan forming a sound cloud. This sound cloud changed its shape in many ways. Sometimes it was loud and sometimes it was soft. Other times one heard more people shouting slogans in high registers and other times one heard more people shouting slogans in the low registers. At times, the sound cloud was uniform and sometimes it was not. Sometimes one

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heard a new slogan gaining momentum while the other one was fading out. In the orchestral portion of *Estruendos*, this sort of textural change creates temporal interruptions. My main purpose is to create a sound cloud rather than develop thematically the original material in order to continue the process established previously. This section begins in the tape at thirteen minutes and thirty-three seconds followed by the xylophone and the tom-toms in the orchestra at thirteen minutes and thirty-seven seconds (See Example 3.6).

Example 3.6. The sound cloud begins with the tape followed by the xylophone and tom-toms: additive process at work.

Additive processes continually thicken the sound cloud over the span of several octaves (refer to musical example 3.5).

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After achieving this sonority, the cloud begins to move from the orchestra to the tape with the addition of short granular sonic events (refer to Example 3.5). Finally, the cloud reaches its end with the granular sonic events of the tape sounding with the oboes and clarinets (See Example 3.7).

Example 3.7. The cloud dissolves in the tape.

In the orchestra, the small particles of sound occur at a constant rate, and their duration is the same. In the tape, the grains tend to be more disperse than in the acoustic, and they tend to be more unpredictable than in the acoustic part. Although I do not use the mathematical
formulae that Ianis Xenakis used to generate his compositions, I share the same conceptual thought in the behavior of sound over time in this section.

Aleatoric treatment of sonic elements is a major component in the orchestral part. There are several passages in the orchestra that explore and expand the aleatoric procedures established in the orchestral introduction. For instance, there are sections combining sustained sonorities to create the sensation of suspension. These sustained sonorities are combined with improvised melodies in different instruments of the orchestra to create a multi-texture in the acoustic part. A passage illustrating this approach begins at ten minutes and thirty-two seconds and it ends at ten minutes and forty-seven seconds (See Example 3.8).
Example 3.8. Multi-texture in the orchestra: Sustained sonorities combined with improvised melodies in different instruments of the orchestra.

These improvisations are not only melodic but also rhythmic. Therefore, the performer is free to build a melody with any of the notes inside the box in the register in which he or she feels comfortable, while communicating the expression indicated in the score. There are other passages having musical objects that can be played in any order according to the conductor’s choice. These musical objects are enclosed inside boxes that are labeled with
numbers that provide the conductor with the means to communicate to the players. These sound objects blend with sustaining sonorities giving the illusion of temporal stasis. Thus, I want to communicate the sensation of moving objects in space with unpredictable trajectories every time the work is played. This passage provides an example in which the orchestra’s unmeasured sonic events and measured random events containing different tempi serve to dissolve a sense of time (Refer to Example 3.1). In these aleatoric sections, I was trying to achieve flexibility of performance within a given range of possibilities as Morton Feldman has done in his early works like *Intersection No. 1* 8 (1951-53) 9. These works are influenced by Feldman’s interest in the work of abstract expressionist painters in New York. In these compositions, Feldman was interested in finding performance flexibility within a given range of possibilities. Earl Brown’s aesthetics and early works such as *Available Forms I* also influenced the realization of the aleatoric processes in *Estruendos*. The mobiles of Alexander Calder and the “action” paintings of Jackson Pollock inspired Brown to

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create graphic music possibilities to allow changes in spatial perception from one performance to the next\textsuperscript{10}.

Yet another approach to the temporal sonic events in Estruendos combines aleatoric elements with traditional rhythmic elements of the work to complement and extend sonic events in the tape. For instance, the passage beginning at ten minutes and four seconds and ending at ten minutes and thirty-one seconds illustrates this approach. It contains the sixteenth quintuplet rhythmic pattern encountered in the guitar’s main theme in the percussion section combined with sustain aleatoric sonorities played freely by the high instruments of the woodwind section. The instrumentalist chooses when to articulate and approximates the duration of each sound, taking into consideration the instruments that play before he or she plays (See Example 3.9).

\textsuperscript{10} Ibid., 480-83.
Example 3.9. A passage illustrating an introduction of new material combined with music previously heard.

This section illustrates an introduction of new material combined with music previously heard to create a bridge to section to follow.

My innate sense of time is strongly influenced by my Latin American heritage. This sense of time is different from the European sense of time. According to the hypothesis posited by Gerardo Gandini in his lessons at the Centro Latinoamericano de Altos Estudios Musicales, Instituto T. Di Tella, Buenos Aires 25 years ago,
psychological time for Latin-American composers is shorter and more concentrated than that of the average European composer. In addition, Latin-American composers use the reiteration of sound cells enriched by ostinato elements. This musical idiom is common to American Indian cultures as well as the Aguisimbians from Africa whose cultures combine and are both present throughout the process of mestization in Latin America. The tape portion of Estruendos contains several instances where these characteristics are present. One such example includes the sound file containing the rhythmic patterns of both salsa and merengue (See Example 1 in Chapter II). This sound file recurs with subtle timbral changes throughout the tape giving unity and the structure to the tape.

By considering this, the live performer’s precision in the measurement of sonic events in time need not be exact and rigid. Exact coordination with the tape is not required. I composed an acoustic part to be flexible and responsive to the sonic events of the tape. I used this approach in the acoustic part to enable greater musicality and interpretative license than would be possible if exact coordination with the tape was required. Every performance

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of *Estruendos* will show that the acoustic part will deviate from previous performances due to the use of these diverse approaches to the placement of temporal events in time. In contrast, the tape part will always be the same.

The sole purpose of using these various approaches to the placement of temporal events through time in *Estruendos* is artistic. In this work, I am exploring new paths to expand my personal vocabulary as a composer. For the first time, I have used new aesthetic approaches that emphasize placement of temporal sonic events in time. This concern is of primary importance in defining the pathos of *Estruendos*.

12 Ibid., 4.
CHAPTER IV

THE AESTHETICS AND ROLE OF TIMBRE IN THE STRUCTURE OF ESTRUENDOS

Although sonic placement in time plays a primary role in the design of Estruendos, timbral transformation plays an almost equally significant role in this composition. In some instances, it is impossible to talk about timbre without taking into consideration the importance of rhythmic placement in shaping the different timbral colors in the orchestral part of Estruendos. In these cases, I will discuss rhythmic placement as it relates to the morphology of sound color.

In addition to identifying the different timbral transformations of timbre in Estruendos, I examine the role these changes of timbre play in the structure of the work. I will also discuss the divergent timbral combinations made possible with both acoustic and electronic sound sources. Within Estruendos, timbre serves as a unifying element between the acoustic and the electroacoustic parts,
generating aural relationships that fuse both individual sounds and larger sections.

My interest in timbral explorations provided a primary impetus for composing a work for orchestra, guitar and electronic sounds on tape. I strove to create a work in which timbral exploration is a main component of the work. These forces provide sources for a large variety of tone colors of dissimilar nature that present many possibilities for unexplored timbral colors.

Taking into consideration the general distinction between the acoustic and electronic sounds, I continued to create divisions based on similar timbral characteristics within these two major sources. In the case of the tape materials, there are four categories of sound based on their origin and sound treatment. Natural sounds from our environment such as the sound of a speaking voice of a tenor, the sound of a jet engine and the sound of glass breaking form the first category. The recorded samples of guitar, piano and oboe constitute the second category of natural sounds. Computer-generated synthetic sounds provide a third category. My fourth category includes hybrid sounds that result from the processing of natural sounds (sampled sounds of guitar, oboe, and piano and environmental sounds). Within the third and fourth
categories, I further group sounds according to the sound processing techniques. These subgroups embrace a large variety of timbral colors ranging from timbres that are similar to natural sources to timbres that are unrecognizable from the original source. Some of the sound processing techniques I used include additive synthesis, subtractive synthesis, non-linear synthesis (i.e. FM, AM, Ring Modulation, Wave shaping), physical modeling using the Karplus-Strong algorithm for plucked strings, phase vocoding, and granular synthesis.

Using FM and AM techniques, I generated synthetic sounds with color characteristics similar to high strings to blend sounds in the tape with acoustic instruments. The first time this sound occurs is after one minute and twenty-nine seconds (See Example 4.1).

Example 4.1. The first entrance of an FM sound occurs in the tape after one minute and twenty-nine seconds.
I generated a low drone sound using additive techniques in Csound and transposed the synthetic sound to a low register using soundHack’s\textsuperscript{13} phase vocoder. This drone creates an extension to the lower register of the orchestral instruments. An instance of this drone extending the lower range of the acoustic part occurs at five minutes and twenty-six seconds (See Musical Example 4.2).

Example 4.2. Low drone occurs in the tape after five minute and twenty-six seconds.

I generate melodic fragments with a high bell color using additive synthesis in Csound\textsuperscript{14}. These melodic fragments add contrast to the tape. The first use of this sound occurs

\textsuperscript{13} Tom Erbe’s application (free download, accessed 18 October 2001); available from http://www.soundhack.com/; Internet.

\textsuperscript{14} Richard Boulanger’s application (free download, accessed 18 October 2001); available from http://mitpress2.mit.edu/e-books/csound/fpage/getCs/getCs.html; Internet.
at three minutes and thirty-three seconds (See Example 4.3).

Example 4.3. Melodic fragments with a high bell color using additive synthesis in Csound add contrast to the tape.

In addition, I created other melodic fragments that are similar in color to a guitar with metallic strings using
the plucked instrument based on the Karplus-Strong algorithm in Csound. These melodic fragments, although not related to melodic material of the orchestra, will blend well with timbre of the acoustic guitar to create a sonic extension of the guitar. An example of this mixture occurs at fourteen minutes and three seconds (See Example 4.4).

Example 4.4. Melodic fragments with similar timbral characteristics to the acoustic guitar create a sonic extension of the acoustic guitar.

The resultant sounds from these sound processes create a subgroup in which the timbral characteristics are similar to the acoustic instruments giving an extension of range at times and color at others.
I also process sounds using granular techniques found in GrainMaker\textsuperscript{15}, Csound and cloud generator\textsuperscript{16}. With this technique, I process an important sound file in the structure of the tape that serves as a unifying element. Specifically this file contains the rhythmic patterns of the Claves in Salsa music and the rhythmic pattern of the Merengue tapped on the resonant body of the guitar (See Example 2.1 in chapter II). Following granulation, this sound file often has the characteristic percussive sound of a membrane instrument in the lower register. At other times, the granulated sound creates a hybrid between a cluster in the middle range of a string instrument and a wood-like percussive instrument in the low register. The first entrance of this file occurs at one minute and it serves to dovetail between the orchestra and the beginning of the tape (See Example 4.5).


\textsuperscript{16} Curtis Roads and John Alexander’s application (free download, accessed 18 October 2001); available from \url{http://www.create.ucsb.edu/htmls/code.html}, Internet.
Example 4.5. First entrance of the file contains the rhythmic patterns of the Claves in Salsa music and the rhythmic pattern of the Merengue in the tape. It is labeled Proc. Guitar/Tumbao.

Another type of granular synthesis resulted in a sound with ascending and descending popping sounds in the upper registers. Adding reverberation reshapes the color of these sounds. Sometimes one hears this dry popping sound and at others, one hears the same sound transformed when added reverberation produces a sound similar to a frying pan sizzling. The synthetic nature of these particular sounds makes them very distinguishable from the other sounds in the tape. The color of these sounds shares similar characteristics with the granulation of the sound file containing the breaking glass. An occurrence of this file takes place at ten minutes and fifty-five seconds (See Example 4.6).
Example 4.6. The passage at ten minutes an fifty-six seconds presents a granular sound of a sample of breaking glass.

The resultant granular sounds from these two sound sources share similar micro structural characteristics in morphology in which one hears these diminutive particles of sounds moving. However, they are distinguishable from one another in that the sounds derived from the breaking glass source contain more inharmonic partials, giving a much brighter characteristic than the sounds derived from a sinusoidal wave. The sounds generated with granular synthesis give the tape a dynamic change in pacing and color since I use this technique to break the constant sound into small particles.

I used several computer applications to generate these sound synthesis processes, among them, Sound Hack, Peak, Max-MSP, GrainMaker, cloud generator and Csound. Csound is the application with which I am most familiar.
Consequently, most of the sound synthesis processes used in Estruendos come from Csound. I feel that at a subconscious level the style of the tape was influenced by many years working within the environment of this musical language which has its origins in the early 60’s. Figure 4.1 illustrates a family tree of sound synthesis languages related to Csound.

Figure 4.1. Family tree of sound synthesis languages related to Csound.

```
Bell Laboratories (Early 1960's)
  |  
  |  MUSIC 1
  |  MUSIC 2
  |  MUSIC 3 (Max Mathews)
  |  Stanford
    |  MUSIC 4
    |  MUSIC 5
    |  Princeton (Godfrey Winham & Hubert S. Howe)
    |  MUSIC 6
    |  MUSIC 10
    |  MUSIC 4B
    |  MUSIC 4BF
    |  Queens College
    |  MUSIC 360 (Barry L. Verecoe)
    MIT
    |  MUSIC 11 (Barry L. Verecoe)
    |  (PB 11 Family of Minicomputers)
```

"This language has evolved since the early experiments of Max V. Mathews who created MUSIC 3 the first general-purpose program for sound synthesis at the Bell Telephone Laboratories. The center of the tree in figure 1 shows the programs developed by Mathews and his group at
Bell Telephone Laboratories. The branch of the right shows variants of MUSIC 4 that Godfrey Winham and Hubert S. Howe produced at the university of Princeton and the subsequent developments of that program: MUSIC 360 and MUSIC 11 by Barry L. Vercoe and MUSIC 7 by Howe. The branch of the left shows the music compilers MUSIC 6 and MUSIC 10 produced at Stanford” (See Figure 1)\(^\text{17}\).

Csound is a sound synthesis language written in C by Barry Vercoe\(^\text{18}\). There are three basic steps to generate a sound in Csound. The first step consists of creating an orchestra file. The second step is the creation of a score file. The third step is the compiling these two files to generate a sound. The Orchestra file contains a default header as follows:

```
"sr     = 44100
kr     = 4410
ksmps  = 10
nchnls = 1
```

The code in this header assigns the sample rate (sr) to 44.1k (44100), the control rate (kr) to 4410 and ksmplts to 10 (ksmps = sr/kr). The header also indicates that this orchestra should render a mono sound file by setting the number of channels (nchnls) to 1. After the header, the orchestra file contains the instrument section. In Csound the instruments are defined (and thus designed) by interconnecting modules or opcodes that either generate or modify signals. These signals are represented by symbols, labels or variable names that can be patched from one opcode to another. Individual instruments are given a unique instrument number and are delimited by the `instr` and `endin` statement.


\(^{18}\) Boulanger, *THE CSOUND BOOK*, xxxi.
Csound syntax of a simple orchestra file represented in a block diagram in figure 2 (a simple fixed frequency and amplitude table-lookup oscillator opcode, oscil) is as follows:

Instr 1

(Opcode, Amp, Freq., table #)

a1 oscil 1000, 440, 1
out a1
endin

Figure 4.2. Block diagram of a simple fixed frequency and amplitude table-lookup oscillator

<table>
<thead>
<tr>
<th>Amplitude</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>440</td>
</tr>
</tbody>
</table>

Now lets look at the Csound score file that performs this orchestra file. Like the orchestra file, the score file has two parts: tables and notes. In the first part, we use Csound’s function-drawing subroutines (GENS) to generate function-tables (f-tables) and/or fill them by reading in soundfiles from the hard-disk. In the second part, we type in the note statements. These note-events perform the instruments and pass them performance parameters such as frequency-settings, amplitude-levels, vibrato-rates and attack-times. Here is a syntax of a score file:

(f. # loadtime table-size GEN routine P1 P...)

f 1 16 10 1
; (comment) A SINEWAVE
In all note-statements, the meaning of the first three p-fields (or columns) is reserved for the instrument number, the start-time and the duration.

<table>
<thead>
<tr>
<th>p1</th>
<th>p2</th>
<th>p3</th>
</tr>
</thead>
<tbody>
<tr>
<td>instrument #</td>
<td>start-time</td>
<td>duration</td>
</tr>
</tbody>
</table>

The sound designer determines the function of other fields. R. Boulanger PP. 8-14"

To close the score file an “e” is necessary at the end of the file. The following Csound orchestra and score represent one of the many I used to generate sonic material for the tape in Estruendos (See Figure 4.3).

(Figure 4.3. Csound code for orchestra and score files used to generate one of the main sounds in the tape of Estruendos).

---

Orchestra File

sr=44100
kr=4410
ksmps=10
nchnls=2

instr 1
kenv linseg 0,.2,0,.3,1,p3-.5,1
kamp lin len p4,.015,p3,.015
kamp1 lin len p4,.05,p3,.05
kamp2 lin len p4,.0125,p3,.0125
kamp3 lin len p4,.0225,p3,.0325
a1 oscil kamp1+p3, p5/22, 1
a2 oscil p4+kenv,a1*.75, 2
a3 oscil kamp2+a1+p4, (p5+a2*.666)/21, 3
a4 oscil kamp1+a2+p4, (p5+a3*.5), 4
a5 oscil kamp+a3+p4,(p5+a4*.333), 5
a6 oscil kamp3+a4+p4,(p5+a5*.25), 6
a7 oscil kamp2+a5+p4,(p5+a6*.125), 7
a8 oscil kamp+a6+p4,(p5+a7*.06725), 8

19 Ibid., 8-14.
These orchestra and score files generate a synthetic sound based on nonlinear and additive sound synthesis techniques. The particular sound generated by this routine is a sound of importance in the structure of the tape portion. An example of this sound occurs at four minutes and one second (See Example 4.7).

Example 4.7. A synthetic sound based on nonlinear and additive sound synthesis techniques using Csound occurs at four minutes and one second in the upper registers.
Another musical application I used to do sound synthesis is MSP-MAX. MSP-MAX, an object-oriented graphical music program, was created by a team of researchers headed by the American Miller Puckette at IRCAM (Institut de Reserche et de Coördination Acustique/Musique) in 1986 at Paris France. Originally not a graphical programming language, MAX controlled IRCAM’s 4X synthetizer but later it was implemented as a graphical environment for MIDI on the Macintosh. In 1997, David Zacarelli developed the MSP (Musical Signal Processing) portion of MAX for Macintosh. It was based on a program developed by Miller Puckette. The patch illustrated in Figure 4 applies wave shaping, a non-linear technique, to recorded sound samples used in Estruendos (See Figure 4.4). The original patch is in the MSP manual written by Christopher Dobrian in 1998. However, I added a couple of processes to the original patch. I added the processes of reading a sound file and I added the processes of recording the result of the sound synthesis process into another aiff sound file.
An example of a sound process by this patch occurs in the passage beginning at nineteen minutes and six seconds and ending at nineteen minutes and eighteen seconds (See Example 4.8).
Example 4.8. Waveshaping sound produced by MAX-MSP patch in figure 4.4.

The acoustic part also offers great timbral variety that contrasts the synthetic, environmental and hybrid sounds in the tape. According to their basic color, there are four groups in the standard symphonic orchestra. These include the woodwinds, brass, percussion and strings with the addition of the piano and the guitar in Estruendos. Of all four groups in the orchestra, the percussion provides what is perhaps the greatest timbral variety. In addition to using some of standard percussion instruments in the orchestra, I make use of non-standard percussion instruments such as the rain stick, Claves, maracas and Guiro. All these instruments are of Latin American or Afro-American origin. Certain combinations of these instruments create timbral and textural characteristics similar to those present in the tape. Therefore, they
function at times as one of the timbral unifying elements between the acoustic and the electroacoustic portions of *Estruendos*. A passage illustrating this type of color and texture occurs at thirteen minutes and one second (See Example 4.9).

Example 4.9. Latin Percussion instruments present similar timbral and textural characteristics to those present in the tape.

Example 4.9 illustrates the similarities between the Claves and the processed oboe sound presented in the tape at that particular moment. At the same time, the maracas and Guiro make short sounds that are analogous to the granular sounds of the breaking glass in the tape.
Another instance in which the percussion section serves as a unifying element between the acoustic part and the tape occurs at eight minutes and forty-four seconds (See Example 4.10).

Example 4.10. Percussion section serves as a unifying element between the acoustic part and the tape.

In this passage, the gong provides a sustained metallic sound composed of inharmonic partials while the tape projects a synthetic sustained sound in the upper registers achieved by using additive synthesis in which the partials are inharmonic. The result of this sound is similar to the sound of a string instrument with a touch of a metallic color. Simultaneously, the wind chimes make a sound with a color reminiscent of the breaking glass sound present in other moments on the tape. In the same place, the rain
stick produces a sound composed of very short particles similar to the synthesized granular sound present in the tape at that moment. This passage illustrates that at times there are multiple instances of timbral association between the acoustic and electronic components.

Other instruments that are not categorized within the percussion family can also produce percussive acoustic sounds such as the guitar. On the other hand, percussion instruments that are typically used as melodic and harmonic instruments such as the piano are used as percussive instruments. For instance, at seven minutes and forty-eight seconds, the strings inside the piano are hit with a soft mallet, while the guitar is hit on the bridge with the palm of the hand (See Example 4.11). These percussive tonal techniques link acoustic timbres with electronic timbres in the tape by emulating electronic sonorities. These techniques provide another unifying element in the timbral context of Estruendos.
Example 4.11. Use of percussive extended techniques
Link acoustic timbres with electronic timbres.

In other instances, percussion instruments are used for melodic and harmonic purposes. For example, at nine minutes and nineteen seconds the timpani state a melodic fragment of the main theme of the guitar (See Example 4.12).

Example 4.12. Percussion instrument plays a fragment of main theme of the guitar.

An example of a percussion instrument playing chords occurs at five minutes and fifty-three seconds in the marimba (See Example 4.13).
Example 4.13. Marimba plays harmonic background material.

Ca. 5':54"

The acoustic portion also presents instances where extended techniques altering the original timbre of instruments are explored. One example of this timbral technique occurs in the first minute of the orchestral introduction when the pianist uses a guitar pick on the piano strings to produce glissandi (Refer to Example 4.5). This use of an extended piano technique at the onset of this composition serves to introduce this technique and foreshadows sounds present in the tape, thus providing another timbral unifying element.

Extended techniques also occur in the first entrance of the guitar at minute two. In this case, the guitar is producing multiphonics called bitones in order to enhance the color of the tape and blend with sonic material of the tape, thus disguising the acoustic nature of the guitar (See Example 4.14).
Example 4.14. Use of extended techniques in the guitar serves as a link of acoustic instruments with sounds in the tape.

Ca. 2':00"

Another instance of the use of extended guitar technique occurs at eleven minutes and sixteen seconds. In this section, the guitar performs ascending and descending glissandi using a bottleneck against the strings to create an aerie timbre which blends well with the tape material (See Example 4.15).

Example 4.15. Guitar performs ascending and descending glissandi which blends well with the tape material.
As in the previous example, the function of timbral change in the guitar provides timbral unity between the acoustic and electroacoustic parts.

One general approach to generate a complex timbral sound canvas was my decision to use timbre as a main musical source to create the structure of the tape. I gave more importance to the timbral development than pitch relations and development. This strategy creates an independent sonic language capable of communicating meaning with timbre that can not be expressed adequately using traditional elements of structure like pitch in the tape. Therefore, the importance given to timbral, textural and spatial organization of sound objects reflects a non-linear musical progression creating a somewhat static nature in the pitch structure. At the same time, this approach gives the tape a surrealistic sonic ambience not achievable otherwise. Repetition of specific sound files throughout the piece with small timbral and rhythmic variations, use of loops as well as repetitions and variations of sonic landscapes give unity and structural organization in the tape. For instance, the sound file containing the rhythmic patterns of salsa and Merengue reoccurs with timbral variations throughout the tape creating an ostinato mixing with other sounds containing different timbral color each
time it appears. These different combinations of timbral color create a variety of sound landscapes with a common sonic element. On the other hand, The orchestral part contains a structure based on several parameters. Pitch sets and their relations are one of the parameters. In the first nine minutes of the work, pitch sets and their relations are a predominant element of the structure of the work. They generate harmonic and melodic materials. Example 16 gives a skeleton of the harmonic language used in the first nine minutes of the work (See Example 4.16). After this point, individual pitch importance become less meaningful and timbre and texture become more significant in the definition of the structure of Estruendos.
Example 4.16. A skeleton of harmony used in the first nine minutes and twenty-seven seconds of Estruendos.
Throughout *Estruendos*, the work exits this interchange of roles between individual pitch, timbre, and texture. Every time there is a timbral transformation defining a new section, there is also a texture change. They go hand in hand in *Estruendos*. Instances of these changes occur at two minutes and forty-five seconds, five minutes and twenty-five seconds, seven minutes and sixteen seconds and ten minutes and one second to name a few (refer to pages 8, 19, 26 and 37 in the score). At the same time, there are several sections where color transformation serves as one form of thematic development. One example of this use of color is found in the section that begins at ten minutes and one second and ends at twelve minutes and fourteen seconds. During the duration of this passage, the process of addition of color begins at the entrance of the guitar with a tremolo in the highest possible note at ten minutes and four seconds. A narrow sound band in the upper register of the piccolo and flute follows the guitar sixteen seconds later (See Example 4.17). This process continues until the end of the passage.
Example 4.17. Guitar’s tremolo begins additive process to develop timbral transformation.

In addition, there are other sections in which color and texture define their main characteristics, relegating the melody and harmony to a secondary plane. For instance, the section beginning at eleven minutes and twenty-eight seconds and ending at eleven minutes and forty-four seconds has no individual pitch relationships within. Instead it is a collection of sound bands in the upper and lower registers, as well as clusters with no defined pitches combined with glissandi and non-pitched percussion instruments (See Example 4.18).
This chapter summarizes and gives examples showing the significant role timbre plays in the construction and structure of *Estruendos* not only in the tape but also in the acoustic part. The construction of the tape is based on timbral relationships while the construction of the acoustic part is a mixture of timbral treatment, sonic
elements in time and pitch relationships. This chapter also demonstrates that there is a multidimensional treatment of timbre in Estruendos.
V CONCLUSION

After finishing the composition of Estruendos and its companion paper, I concluded that in the process of the composition, I have further developed my skills and added new ones to my personal language as a composer. The time I spent in the elaboration of the tape was an aural learning experience dealing with live sounds and transforming them via technological means. This experience differs from the conception of the acoustic part since I avoid, as much as is possible, the use of an instrument such as the piano to help me with the composition of musical material. I chose to generate my ideas conceptually rather than to rely on aural feedback.

The paper demonstrates that the process I employed in the composition of Estruendos aided me in achieving the final goal that is the pathos of the work. It also demonstrates that sonic placement in time, timbral development, and textural changes hold the most crucial importance in the structure of Estruendos, leaving harmonic and melodic parameters to a second plane.
In the process of the composition, I used aleatoric approaches that shape form at the micro-level and that will provide material in my future compositions. I do expect to expand these approaches to shape form at the macro-level as well. In addition, the transcription of sonic events in the tape to the written page was an aural experience sparking my imagination to generate sonorities of similar characteristics in acoustic instruments. This could also prove to be an interesting path to pursue in the future. 

*Estruendos* is a work that aesthetically and musically reflects the times in which we live at the turn of the twenty-first century. The work achieves its purpose at various levels.

Emotionally, *Estruendos* embraces a variety of psychological stages between extreme chaotic moments and moments of extreme serenity. These psychological stages are all present in our society.

The concept of time and events in space are other levels in which *Estruendos* portrays a mixture of linear and non-linear thinking. This reflects a typical approach to time in Western society in the latter part of the twentieth century.
At another level, *Estruendos* incorporates non-Western elements such as non-linear thinking originally attributed to Eastern culture. Moreover, it incorporates non-Western musical elements such as the file using Caribbean rhythmic patterns and instruments such as the rain stick, the maracas and guiro. In that respect, *Estruendos* is a musical metaphor about globalization.

At the subconscious level, a central theme of *Estruendos* is the clashing of humanism against technology. The acoustic instruments portray humanity and the computer generated synthetic sounds portray technology. *Estruendos* reaches a solution where the two trends of thought reach a common ground in which one cannot exist without the other.

*Estruendos* represents my personal style. My style is influenced by my cultural upbringing containing aesthetic influences from Composers such as Blas Emilio Atehortúa, Edgard Varèse, John Cage, Earl Brown, Krzysztof Penderecki, Karlheinz Stockhausen, Pierre Schaeffer, Iannis Xenakis and Jean-Claude Risset. Their influences are tools of inspiration that provide techniques to express my own artistic thoughts.
The experience of composing *Estruendos* allowed me to develop as a composer. Through the process, I was able to recognize various cultural influences on my work as well as define and exercise my own aesthetic values.
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PART TWO

COMPOSITION

ESTRUENDOS

For Large Symphonic Orchestra, Amplified Acoustic Guitar and Tape

by

Lucio Edilberto Cuellar Camargo

(Copyright 2002)
Instrumentation

1 Piccolo
2 Flutes
2 Oboes
1 English Horn
2 Bb Clarinets
1 Bass Clarinet
2 Alto Saxophones
2 Bassons
4 French Horns
3 Bb Trumpets
3 Trombones
1 Tuba
5 Timpani
1 Snare Drum
1 Bass Drum
Cabaza
Claves
Maracas
Guiro
Rain Stick
Anvil
Wind Chimes
Marimba
Xylophone
Amplified Acoustic Guitar
Piano
Tape
Violin 1
Viola
Cello
Contra Bass
Tom-Toms
Cymbal
Suspended Cymbal
Gong
Flexatone
Violin 2
Gliss. inside piano with guitar pick
No. 2 bars
On the keys
On the keys
Rain Stick
On the keys
On the keys
On the keys
Non.
Low String
On the keys
Vln. 1
Vln. 2
Vla.
Vlc.
Cb.
Pno
Tp.
Proc. Guitar/Tumbao

* Stagger entrances. After tape chart, diminuendo and stagger releases
Ca. 5:44'
Hit a low string inside piano with soft mallet

Tambora on the bridge

Jete
Sul Ponticello
Sul Ponticello
Sul Ponticello
Sul Ponticello
Improvise rhythm and melody with these pitches
(D-D -D -E-E -F-F -F -G)

Tambora

Gliss. inside piano

Tuba

Solo

Improviser

Tuba

With these pitches should be some what melancholic

Vibes

Vln. 1

Vln. 2

Vla.

Vlc.

Cb.

Pno

Tp.
Instruments inside boxes are measured and have suggested tempi.
The conductor selects randomly which box to play.

Timpani

41°
Ca. 13:01''

**Obs. 1-2**

- Procedural Oboe

**Fls. 1-2**

- Broken Glass

**Pic.**

- Measured 1-2

**E. Hn.**

- Improv: short, melodic lines

- Shaking a dialogue for 34''

-C-C -C -D -D -D -D -E -E -E -F

42

**Bb Cls. 1-2**

**B.Cl.**

**Bsn.**

**Hns. 1-3**

**Hns. 2-4**

**Bb Tpt. 1**

**Bb Tpts. 2-3**

**Sax. 1 - 2**

**Tbn. 1-2**

**Tbn. 3**

**Tba.**

**Perc. 1.**

**Perc. 2**

**Perc. 3**

**Gtr.**

**Vln. 1**

**Vln. 2**

**Vla.**

**Vlc.**

**Cb.**

**Pno**

**Tp.**

Ca. 13:09''

**Proc. Guitar**

**Tap**

**Shake**

*Cont. until 13:19''*

**Broken Glass**

**Shake**

(C-C -C -D -D -D -D -E -E -E -F  )

42
Pic.
Fls. 1-2
Obs. 1-2
E. Hn.
Bb Cls. 1-2
B.Cl.
Bsn.
Hns. 1-3
Hns. 2-4
Bb Tpt. 1
Bb Tpts. 2-3
Sax. 1 - 2
Tbns. 1-2
Tbn. 3
Tba.
Perc. 1.
Perc. 2
Perc. 3
Gtr.
Vln. 1
Vln. 2
Vla.
Vlc.
Cb.
Pno
Tp.

Ca. 13:25"

Timpani
Gong

Ca. 13:33"

Broken Glass
Bubbles
Proc. Oboe
Proc. Guitar/Tumbao

Strikel with a soft mallet inside piano on a low string

On the keys
Ca. 14:45
Conductor and guitarist follow the same performance instructions of the beginning.

Ca. 17:05"

Ca. 17:20"
Perc. 1
Perc. 2
Perc. 3
Gtr.
Tp.
Ca. 19:10''
Claves
Maracas
Ca. 19:18''
Xylophone
Calabashes
Ca. 19:26''
Wind chimes
Ca. 19:34''
Proc. Guitar
Proc. Guitar
Proc. Guitar
Ca. 18:58''
Proc. Guitar
Proc. Guitar
Proc. Guitar
Ca. 20:22"