"In our present work we have to show whether this, the first stereophonically conceived work in total structure, will lead to a new, active art form of musical composition and listening.

By regulating the positions of the sources of sound it will be possible for the first time to appreciate aesthetically the universal realization of our integral serial technique". Karlheinz Stockhausen (Eimert, 1955, p.51).

The Attribute of Space in Music: Three Examples

by

Nicolás Alejandro Mariano Arnáez

A thesis submitted in partial fulfillment of the requirements for the degree of

Master of Music

in

Composition

Department of Music
University of Alberta

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Abstract

Sound and space are physically inseparable; all sounds have a defined spatial location. Our ears receive the energy generated by sound sources traveling in the air and inform us about location, motion, and in many cases also the velocity of movement of that source.

Since the 1950s, technology has allowed music composers to investigate the possibility of locating and moving sounds through space. These spatial principles of acoustics have become new artistic parameters in musical composition.

Because all sounds we interact with have spatial content, it is crucial to study and understand how they behave in our everyday situations, how we perceive them, and how they affect us psychologically. This will allow us to create musical pieces with a natural and organic ability of motion.

This thesis presents three musical compositions that deal with this new parameter, using different approaches.

Preface

The goal of this research was to compose music where the spacialization of the sounds involved had an essential role in the piece's structure and its expressive content.

During my undergraduate studies in Argentina, I researched and analyzed acoustic and electroacoustic pieces that used space as a musical parameter. By doing this I was able to extract common characteristics regarding the way composers dealt with this parameter, and I could also categorize spacialization sound systems and methods of encoding and decoding audio signals commonly used in electroacoustic music.

During my Master's Degree at the University of Alberta, I applied this knowledge to the creation of musical pieces; three of them are presented in this thesis. Each one faces the same challenge from diverse angles.

This work is dedicated to my wife, center of inspiration,

to my family, center of patience and understanding,

and to my professors, center of knowledge.

Acknowledgements

The result of this thesis has been possible thanks to the excellent supervision of Dr. Scott Smallwood, who always showed me the right tools to realize my ideas, and gave me the needed advice for success.

I am also very grateful for having worked with Dr. Mark Hannesson, who incessantly encouraged and invited me to try the newest technology, which was crucial to the completion of this work.

Dr. Howard Bashaw and Dr. Mary Ingraham provided me not only with the theory to support my ideas, but also the inspiration to come up with them in the first place.

There are other people who were present in the development of this important work, such as Dr. Andriy Talpash, who organized and conducted the concerts where these three pieces were premiered, and Twilla McLeod, who always solved many administrative issues that allowed me to keep focusing on my work.

Finally, I want to thank the entire Department of Music of the University of Alberta for having accepted me into this program, and also for financing my studies through Teaching and Research Assistantships chosen in relation to my experience as composer.

Table of Contents

External Supplementary Files

- *Nicolás_Arnáez_Ecos Boreales_Max_patch.zip* contains the Max patch and sound files created to perform the piece.

- *Nicolás_Arnáez_Sobre_como_pintar_en_el_tiempo_Max_patch.zip* contains the Max patch created to perform the piece.

Introduction

One way of understanding the construction of musical pieces is by analyzing the interaction between different musical parameters (such as rhythm, melody, form) in order to evaluate how the development of one in particular leads to the unfolding of the rest. For example, in the music of the Renaissance, text was the principal element that defined rhythm and form. Other examples can be seen in the Classical period, where melody and harmony defined form, orchestration, and texture.

The second half of the 20th century witnessed the introduction of a new and revolutionary parameter: space. Advances in technology offered tools to create the sensation of sound moving through space by the variation of loudness of the source in different speakers arranged in different locations. The pioneers of using this technology were composers such as Karlheinz Stockhausen and Pierre Boulez who played a role in the 1950s to make space a parameter in musical pieces (Arnáez, 2009).

Advances in technology have created standardized sound systems of reproduction such as monoaural, stereophonic, quadraphonic, octophonic, 5.1, and others. Also, there have been new encoding and decoding methods for sound spatialization such as binaural encoding and transaural reproduction, ambisonic, VBAP, etc. These systems have been used by composers like Jean-Claude Risset, John Chowning, Roger Reynolds, Juan Pampin and Pablo Cetta for the creation of musical pieces that use space as a principal parameter (Arnáez, 2009).

Sound spacialization is still a relatively new musical parameter, which provides means of expression like the others. The importance of developing it is unavoidable for 21st century composers (personally, I still believe it has

many possibilities of innovation and experimentation). Composing using space as a primary factor can enrich immensely the musical art: it will generate new discussions, new theoretical constructs and could even change our beliefs in what music is. In addition, it will contribute to the enjoyment of a new manner of experiencing music

That is why the three pieces presented here can be understood as my contribution to this art, and at the same time three new visions of music to experience and debate.

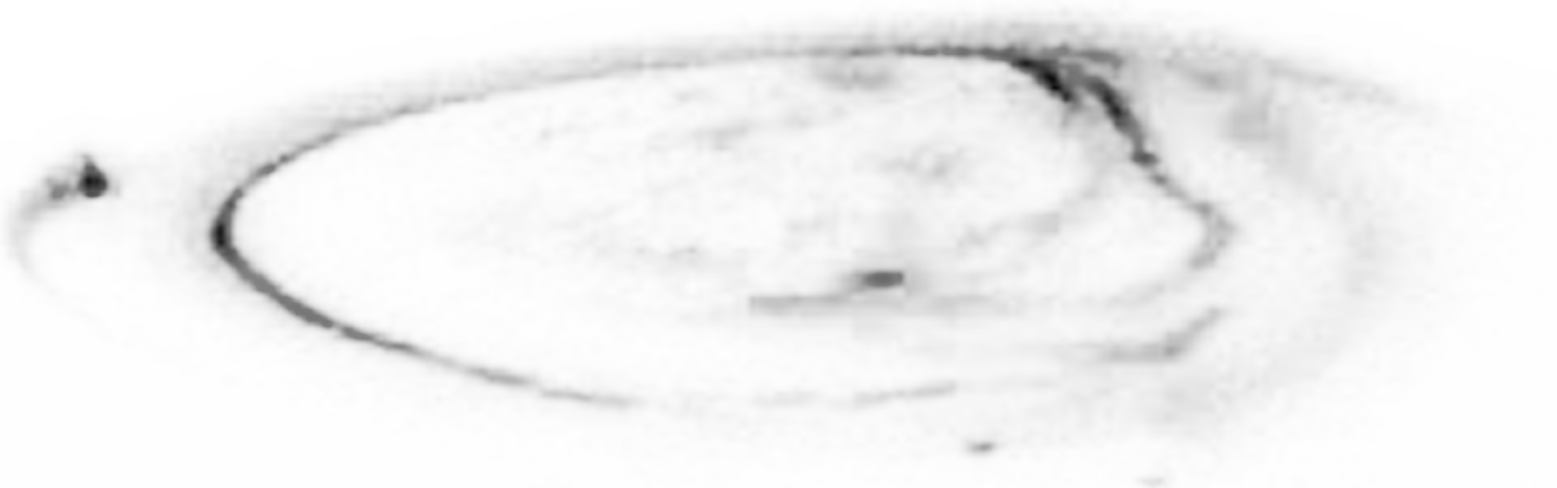
CHAPTER 1

Ecos Boreales

Ecos Boreales [Boreal Echoes]

Ecos Boreales (2012) is a piece written for saxophone quartet, octophonic sound system and real-time processing. The real-time aspect is mostly focused on movement through space of the saxophones' musical phrases in permanent repetition. My intention is to elaborate the spacialization in its horizontal axis (also known as *azimuth*). This was the primary reason for choosing an octophonic circular sound system and Vector Based Amplitude Panning, also known as the VBAP sound decoding method (Pulkki, 2001).

Ecos is a Spanish word which means echoes. This word in the title is an analogy which describes what happens in the piece: In each of its sections, the musical material is reduced to one kind of sound production (just air through the saxophones' tube, key clicks, multiphonics). The performers play some musical phrases, which are recorded. As soon as the phrase ends, a sound projectionist, managing the task of recording and playing, replays it on the computer with a specific spatial movement on the azimuth axis, with each reproduction following a distinct sound movement. This continues such that the space sounds like an echo. The result is an enriched texture in continuous and perpetual movement resembling sonically the visual effects caused by the aurora borealis (in Spanish: *Boreales)*.



Ecos boreales

ARNÁEZ, Nicolás

Ecos boreales
[Boreal Echoes]

For saxophone quartet and electronics
Duration: c. 11 minutes

© 2012 Arnáez Nicolás

PROGRAM NOTES

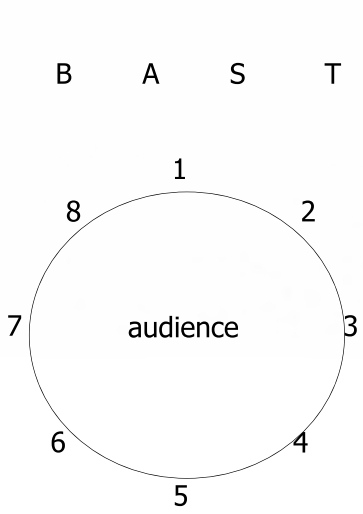
Perpetual memories of the recent past fill up the space, and invite listeners to experience the sensation of being surrounded and immersed in a constant elaboration of continuous echoes.

INTRODUCTION

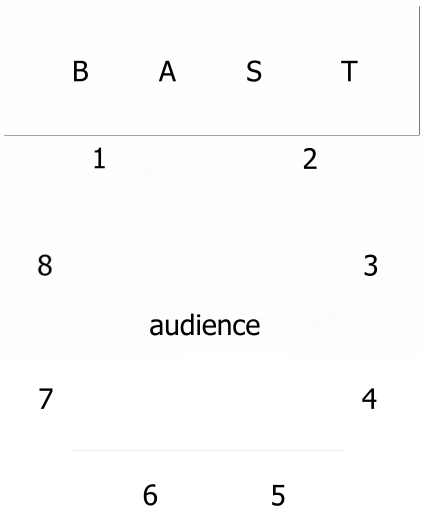
This composition was made between September and December 2012, during my Master's in Music Composition at the University of Alberta, under Dr. Scott Smallwood's supervision.

It has been written to be performed by an amplified saxophone quartet (Soprano, Alto, Tenor and Baritone) with live electronics (real-time processing). A Max patch features the electronic part, for which an additional performer is required.

The Max patch records different parts of the saxophones' lines and reproduces them, looped, in an 8 channel sound system. That is why each saxophone must have a microphone (4 in total, condenser mics are preferred). The 8 speakers should be surrounding the audience in a circular configuration if possible. Another option would be to put them in a square (see diagram below). The saxophonists will go on the stage in the order (left to right): Baritone, Alto, Soprano, Tenor.



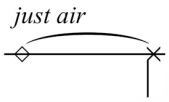
Preferred



Square

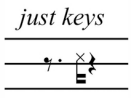
1, 2, 3, 4, 5, 6, 7, 8, are the numbers and locations of the channels that must be mapped to the Max patch's outputs

NOTATION

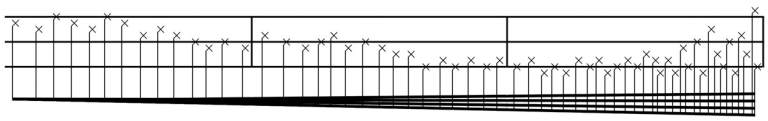


Blow through the mouthpiece without producing any note.

The three line measures refers to the three registers of the saxophone: low, middle high. A note on the top line (or above) means that the performer can play any note in the high register. A note between the first and second line means that the performer can play any note between high and middle register. A note on the second line means that the performer can play any note in the middle register. A note between the second and third line refers to any note between middle and low register, and the note on the third line (or below) at the bottom refers to the low register.

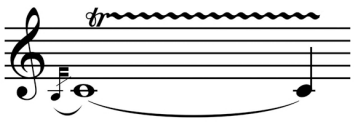


The x notehead indicates that a note is played without blowing (key clicks). In this case, a note close to the middle range.



This beaming indicates accelerando. This example shows key clicks with an accelerando, starting in the high register, moving to the middle, then low and finally opening to all registers.

Five beats tremolo.



Trill played starting from the slashed grace note.

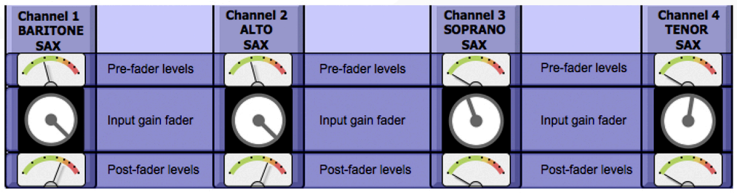
During the long duration notes, circular breathing is preferred. If the performer is not able to do it, he/she should breathe when this mark appears. It is recommended, however that the performer avoid as many of them as possible.

ABOUT THE MAX PATCH

To perform Ecos Boreales, you will need to have access to a computer with the program Max 6 or Max Runtime. This computer must have an audio interface that is able to control 4 analog inputs and 8 analog outputs .
This patch allows the Max performer to connect a Behringer BCF3000 MIDI Controller to control volume faders, record and play buttons. If this device is used, the Max performer will use the first 6 faders and buttons (the other 2 are not used). If the performer does not have this controller, he/she can use the mouse, or the computer keyboard for the performance.

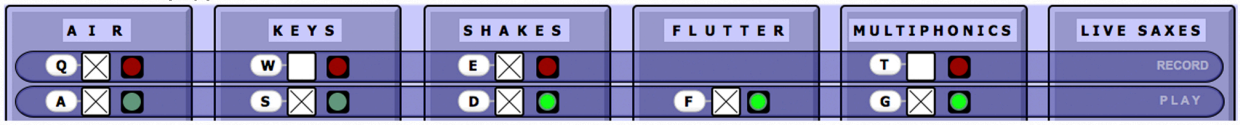
Here are some considerations about the patch attached.

INPUT AREA



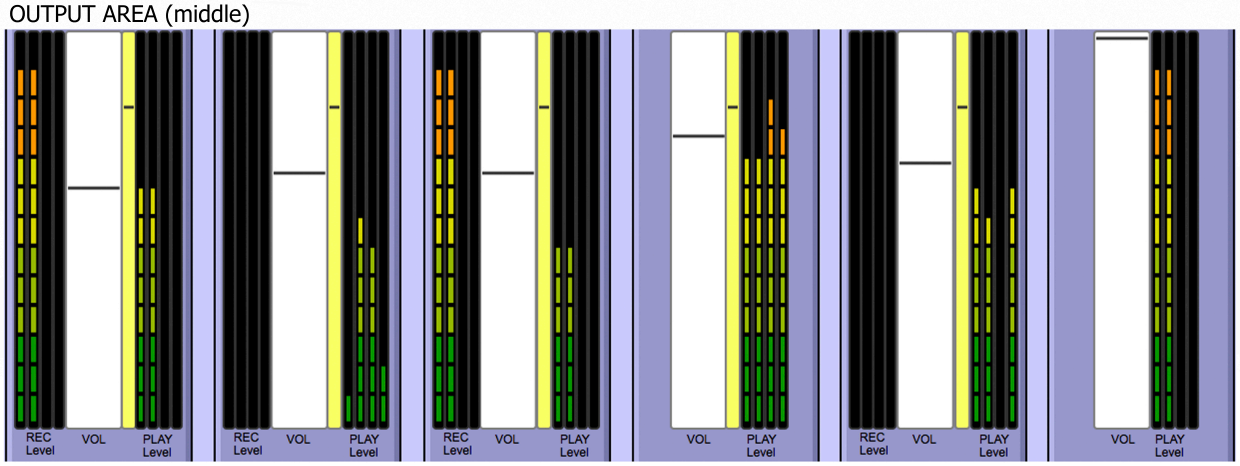
In this area, the Max performer will control the microphones' gain. Each one of the microphones must be connected as shown (channel 1: baritone sax, channel 2: alto sax, channel 3: soprano sax, channel 4: tenor sax). One pre and one post fader level meter is provided per channel for having better control over the incoming signals. The knob in between the level meters functions as trim control.

OUTPUT AREA (top)



From the left to the right are presented 5 slots where saxes will be recorded and played with their respective names. The last one (live saxes), controls the saxophones microphones.
The line marked as "record" shows the control for turning on and off the recordings requested in the score. It can be controlled by clicking with the mouse in the box, by pressing the key indicated or by using the MIDI controller. Same applies for the "play" line.
NOTE: The "flutter" slot has no recording button because this sample has been previously recorded and loaded.

OUTPUT AREA (middle)

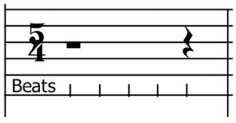


"REC Level" shows the signal that is being recorded. "VOL" is the fader to control the volume of the indicated slot. "PLAY Level" shows the signal that is being played. The yellow slider shows the automatized fade-in/fade-out that is included in all the slots while recording.

OUTPUT AREA (bottom)

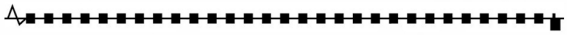
If there are any problems during the performance or during the recording, the Max performer can load a pre-recorded buffer to keep going by clicking the white button in the correspondending slot.

MAX PATCH NOTATION LEGENDS



The Max patch 6 lines staff shows (top to bottom): AIR, KEYS, SHAKES, FLUTTER and MULTIPHONCS record/play activity. The last line shows beat divisions.

Letter to be pressed on the computer keyboard and action realized by pressing it.
In this example, when you press Q, the computer will record the sound of air. This action can also be done by clicking with the mouse on the patch or by using the corresponding button on the MIDI controller.



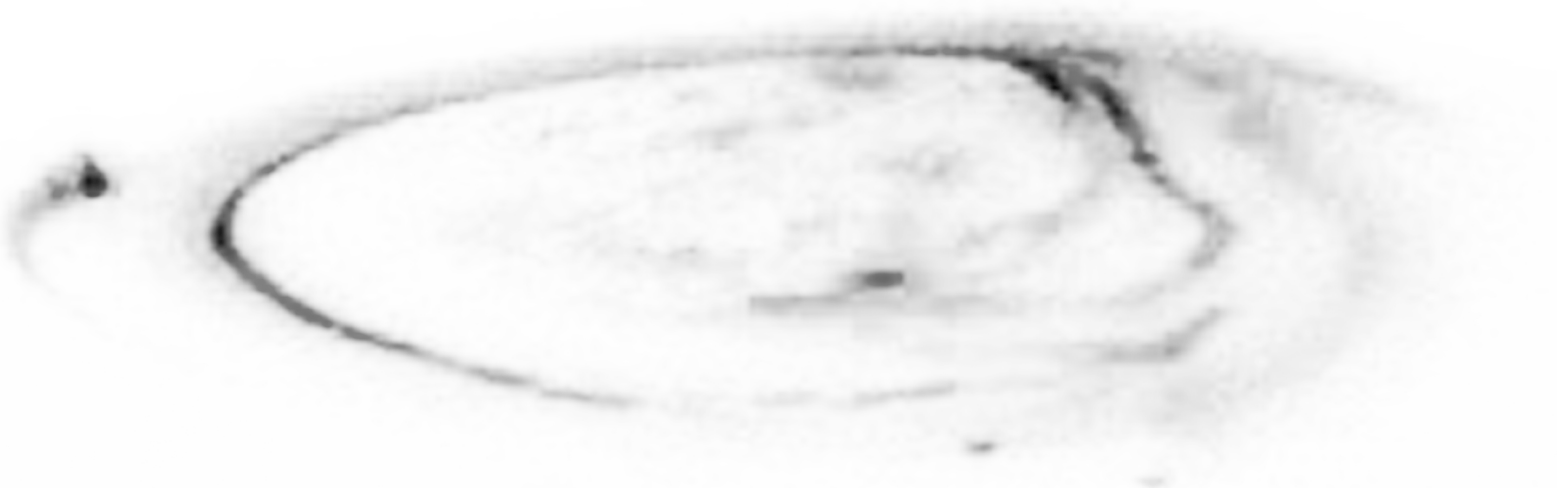
Dotted line shows recording activity.

Straight line shows playing activity.

Dynamics are indicated to be performed with the faders. The performer must ALWAYS avoid playing the buffers too loud. Live sound MUST be always on the top.

Buffer is still playing but fader is positioned in 0dB

NOTE: This piece contains a very important spacialization parameters. It is automated and synchronized with the letter pressed. It is important to avoid pressing the letters more than indicated.



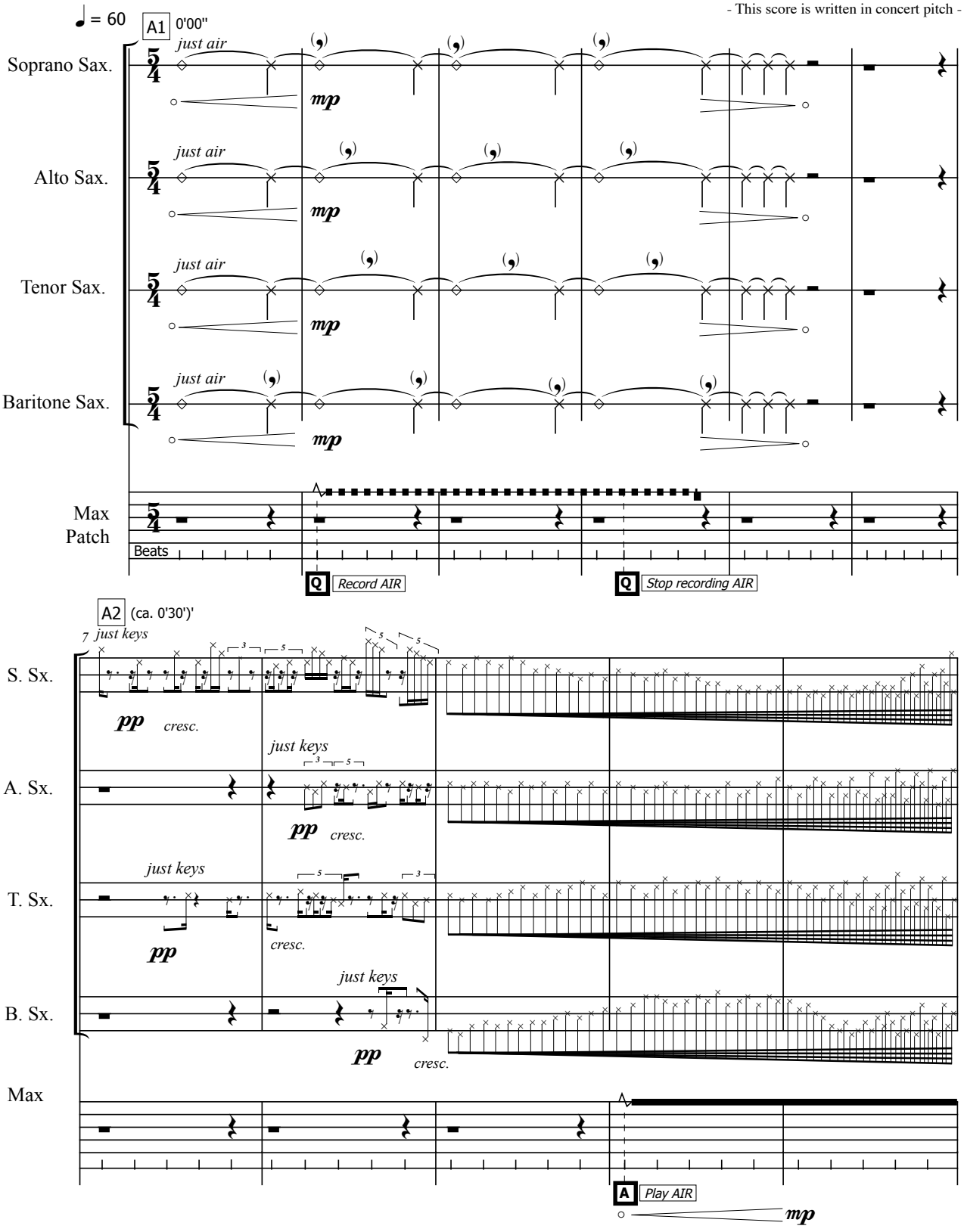
Ecos boreales

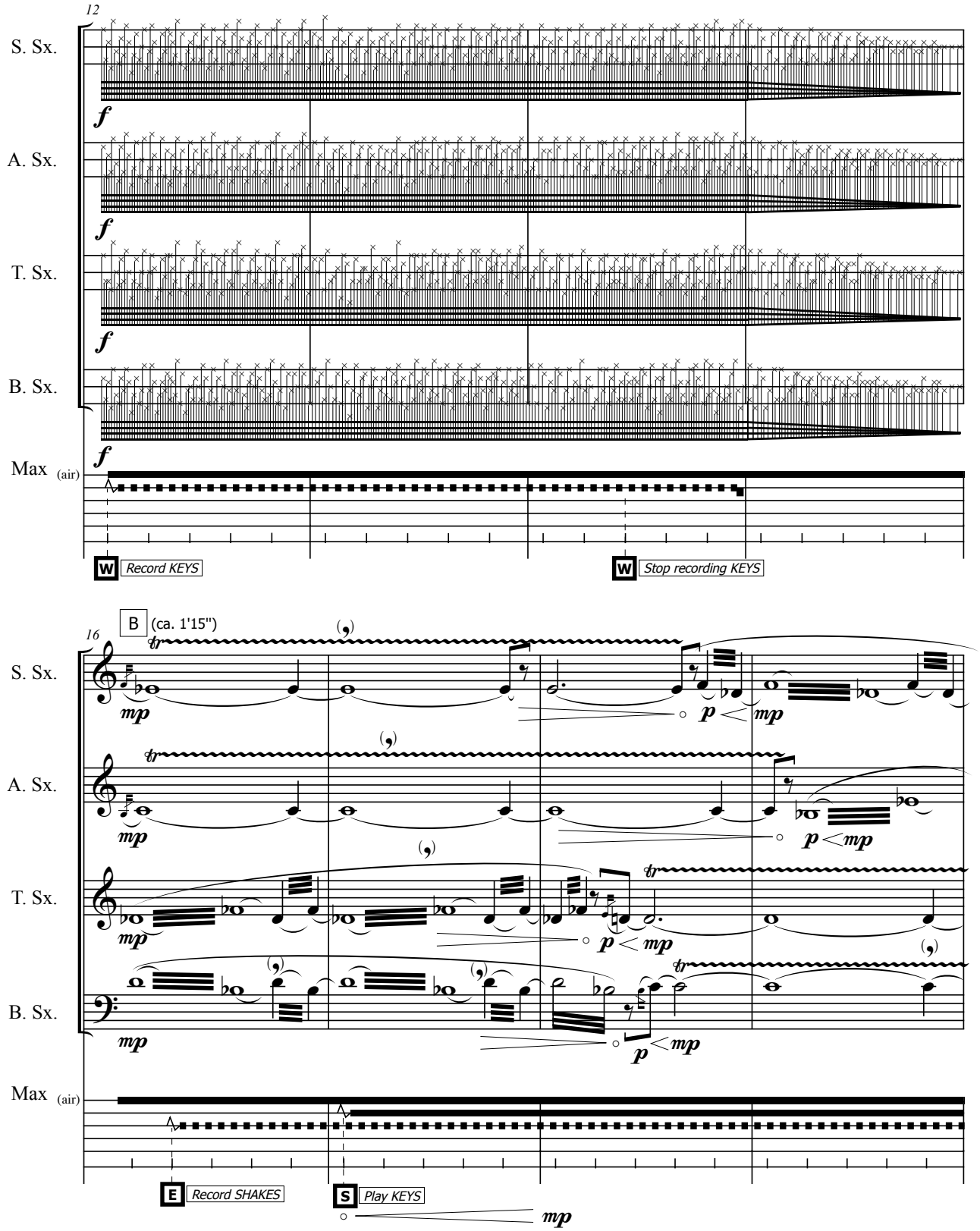
ARNÁEZ, Nicolás

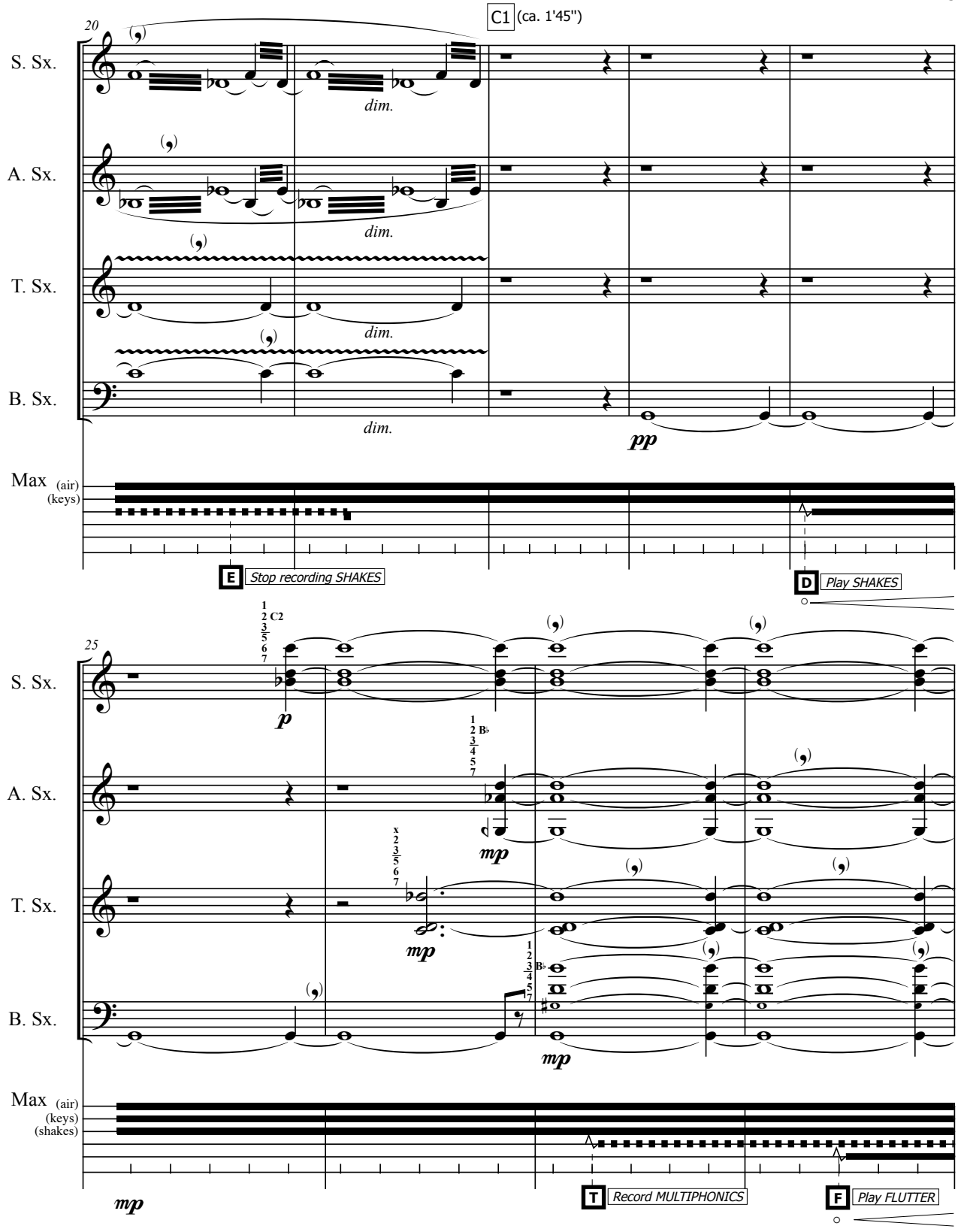
Ecos boreales

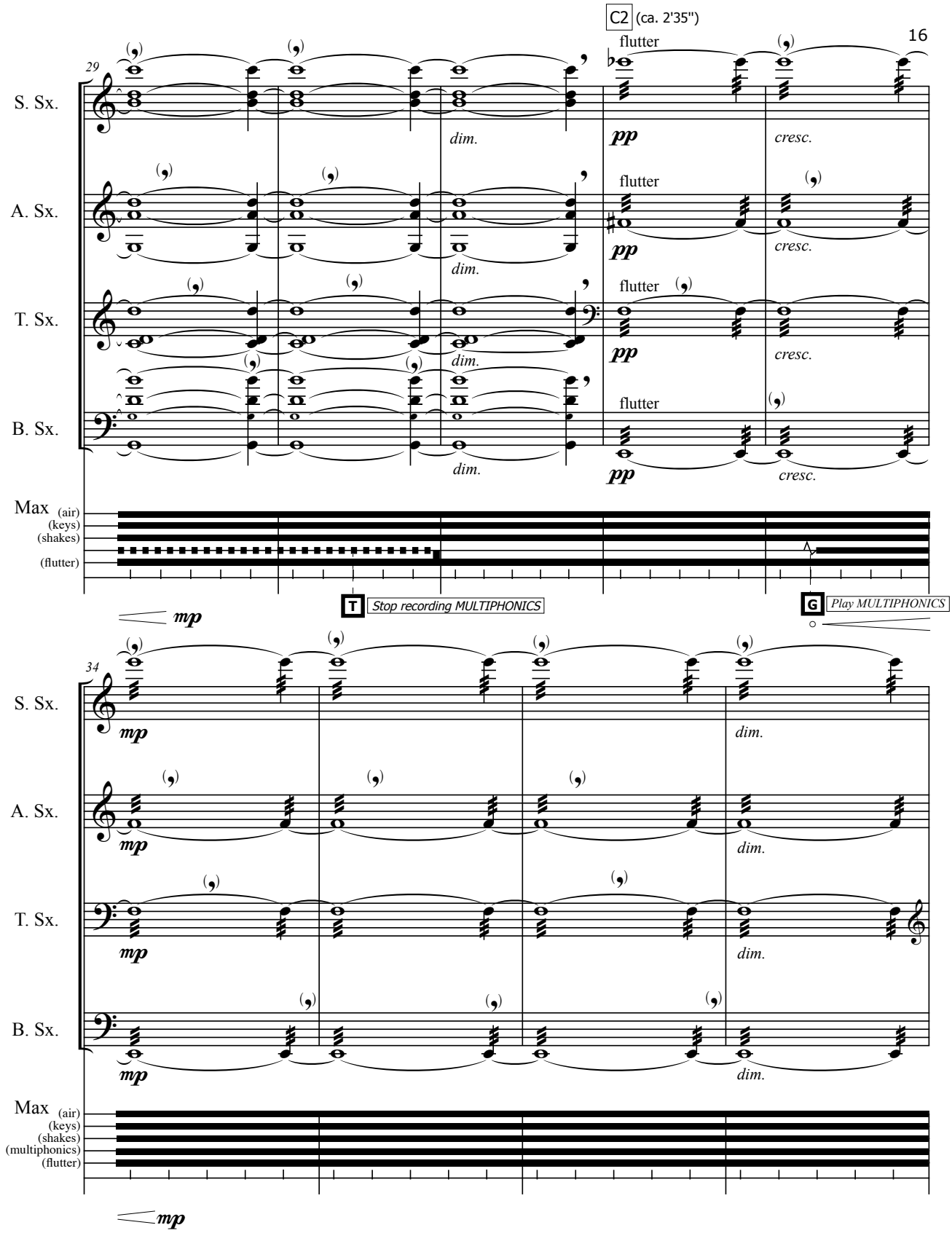
ARNÁEZ, Nicolás

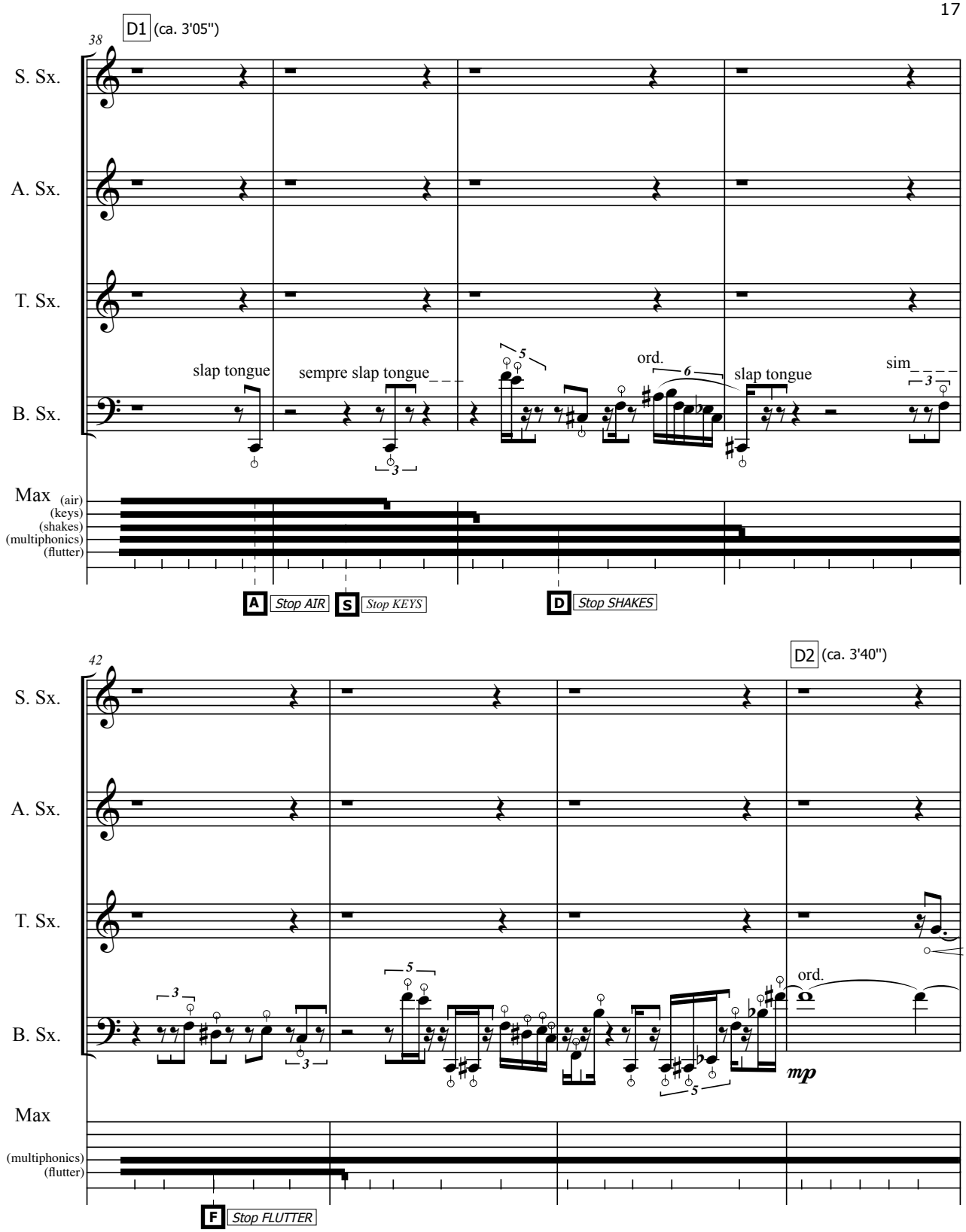
- This score is written in concert pitch -

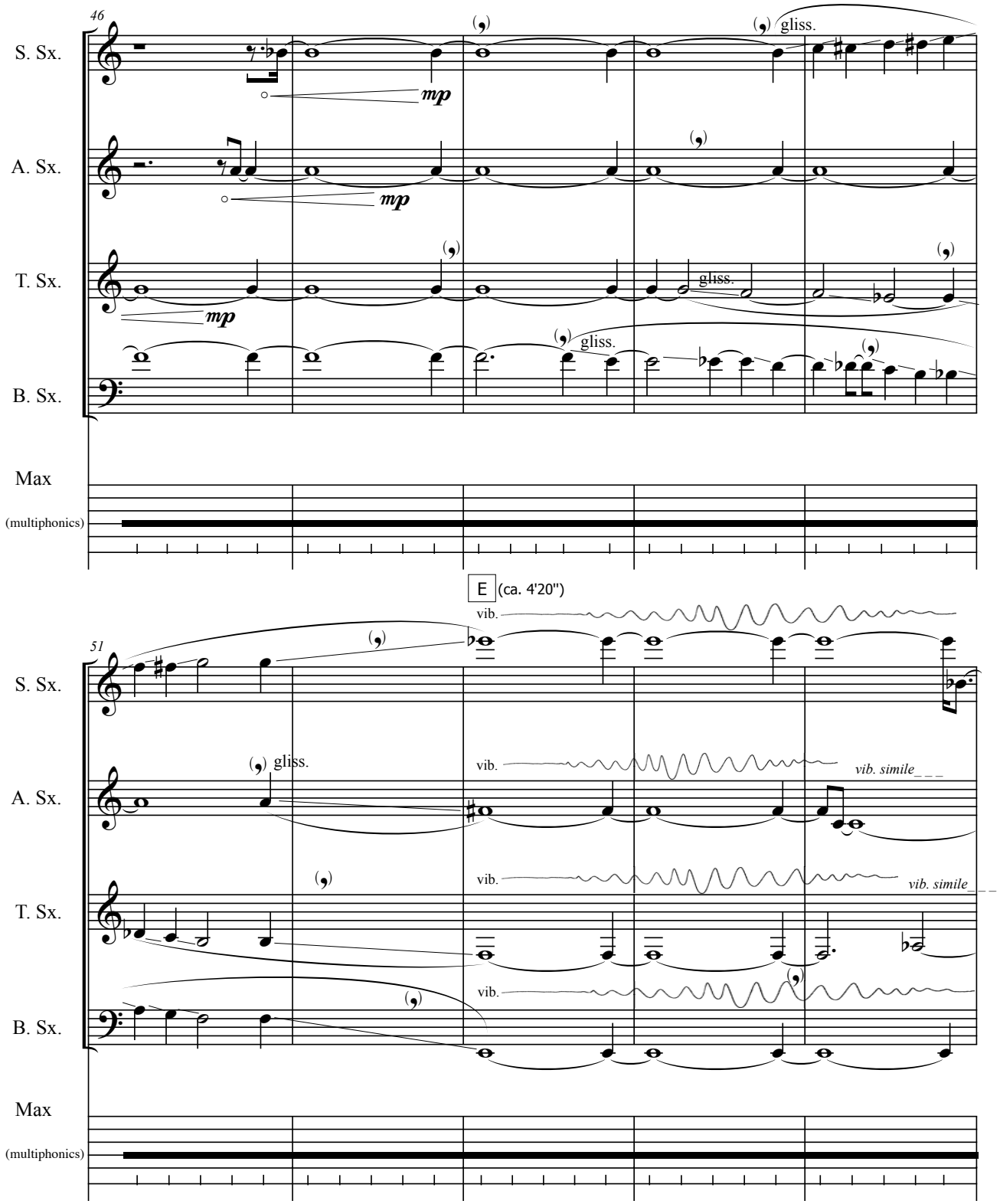


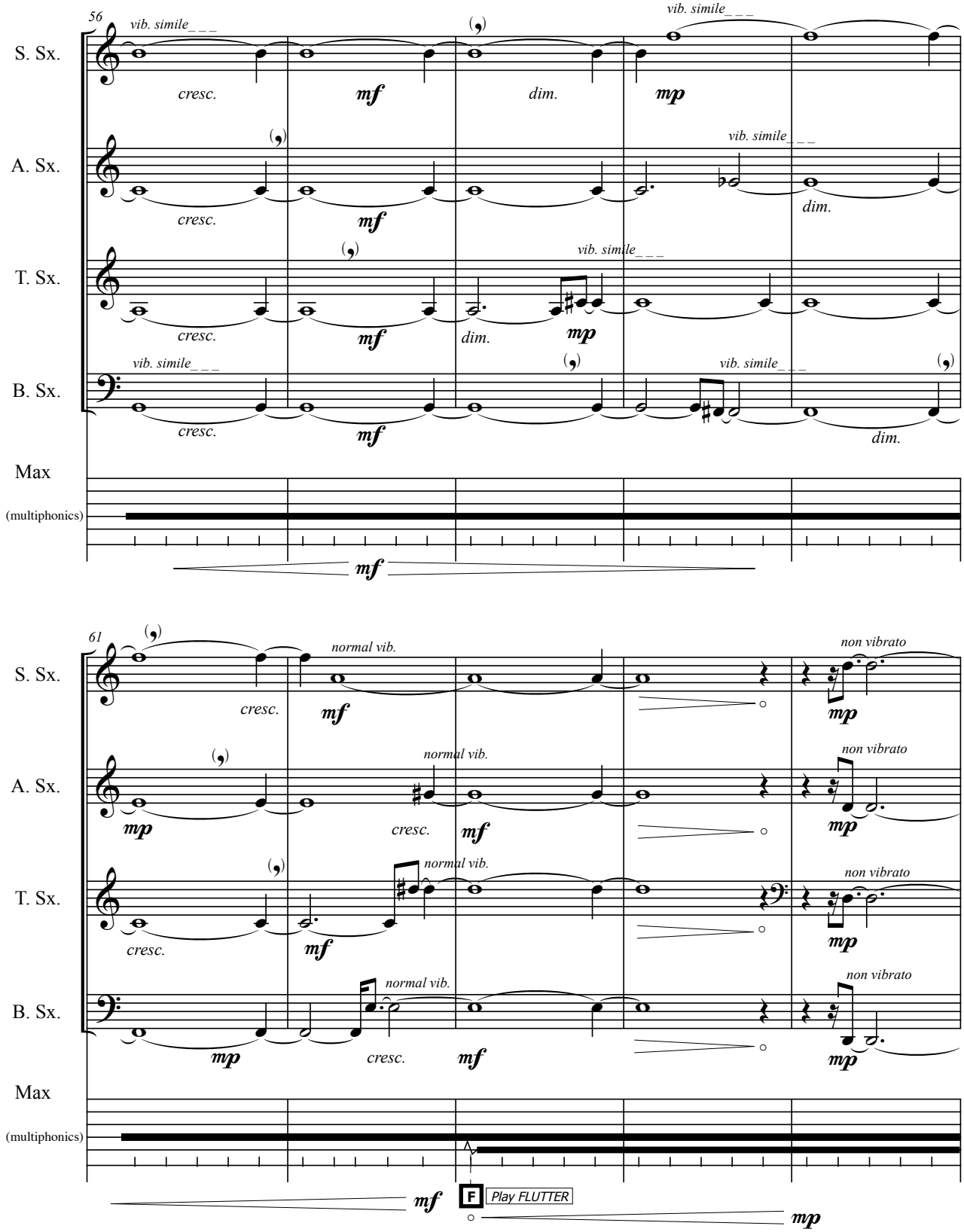

12
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max (air)
f
W Record KEYS
W Stop recording KEYS
B (ca. 1'15")
16
tr
mp
p
E Record SHAKES
S Play KEYS

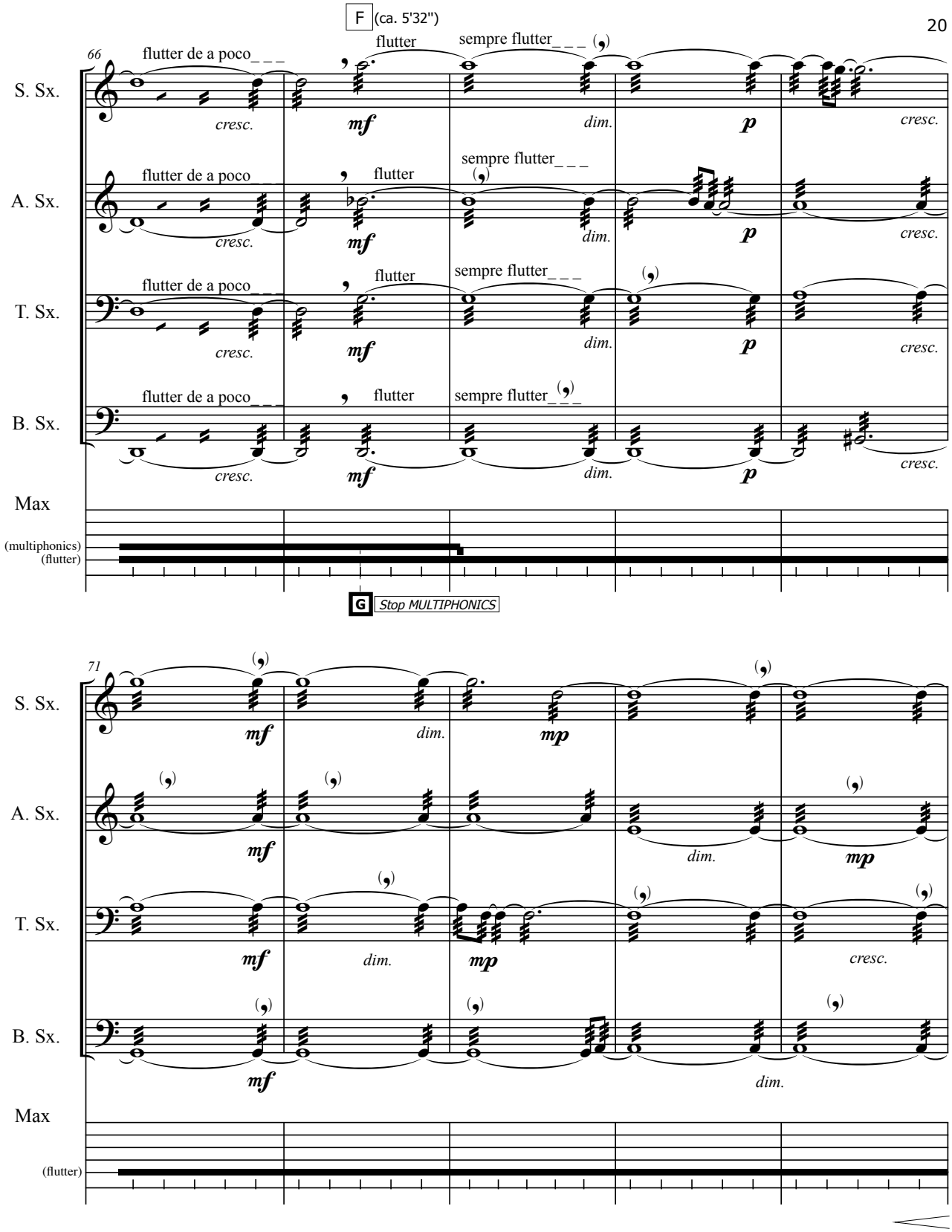

C1 (ca. 1'45")
20
S. Sx.
A. Sx.
T. Sx.
B. Sx.
dim.
pp
Max (air) (keys)
E Stop recording SHAKES
D Play SHAKES
C2
25
p
mp
Max (air) (keys) (shakes)
T Record MULTIPHONICS
F Play FLUTTER

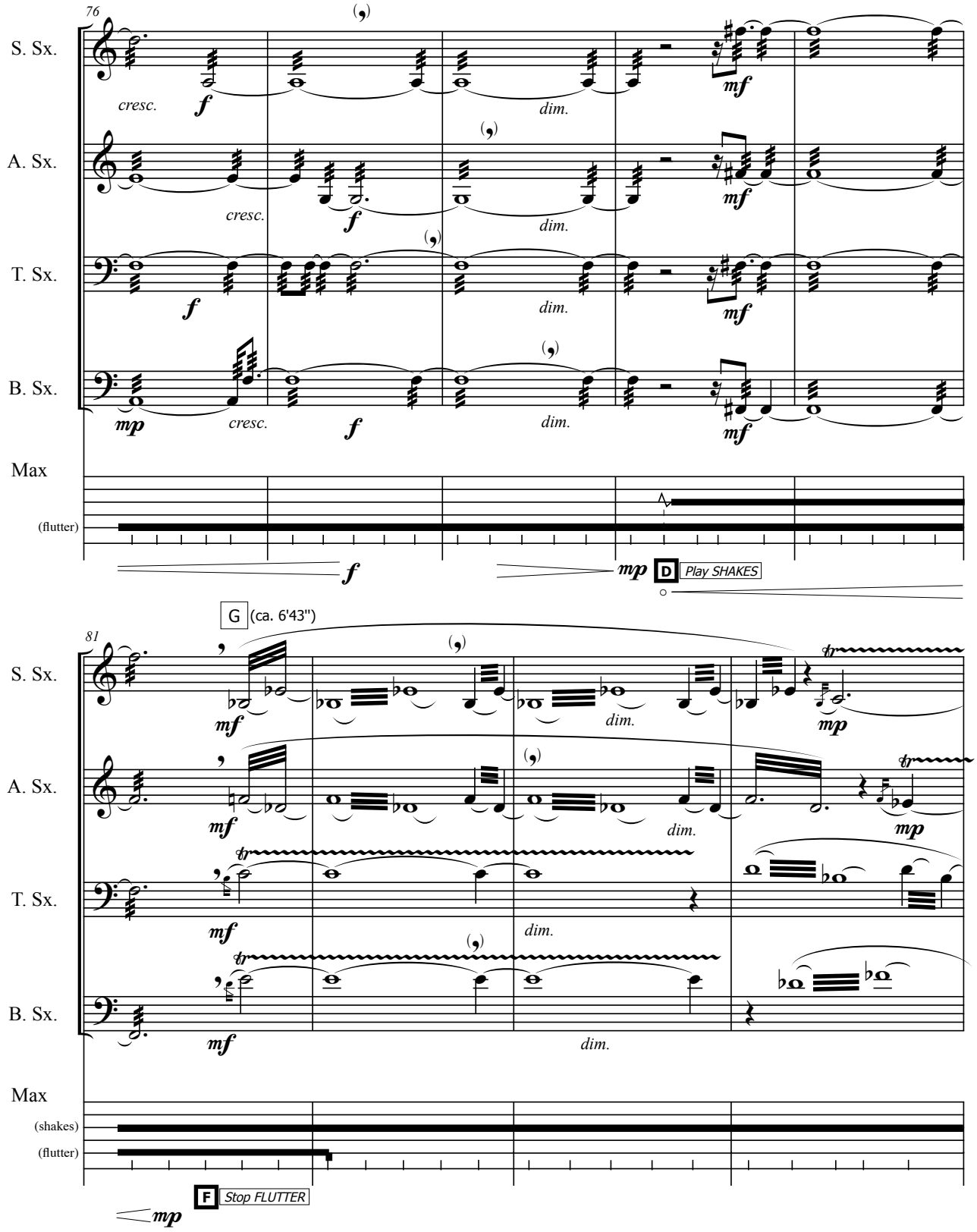

C2 (ca. 2'35")
16
29
S. Sx.
A. Sx.
T. Sx.
B. Sx.
flutter
pp
cresc.
dim.
Max
(air)
(keys)
(shakes)
(flutter)
T Stop recording MULTIPHONICS
G Play MULTIPHONICS
mp
34
(multiphonics)

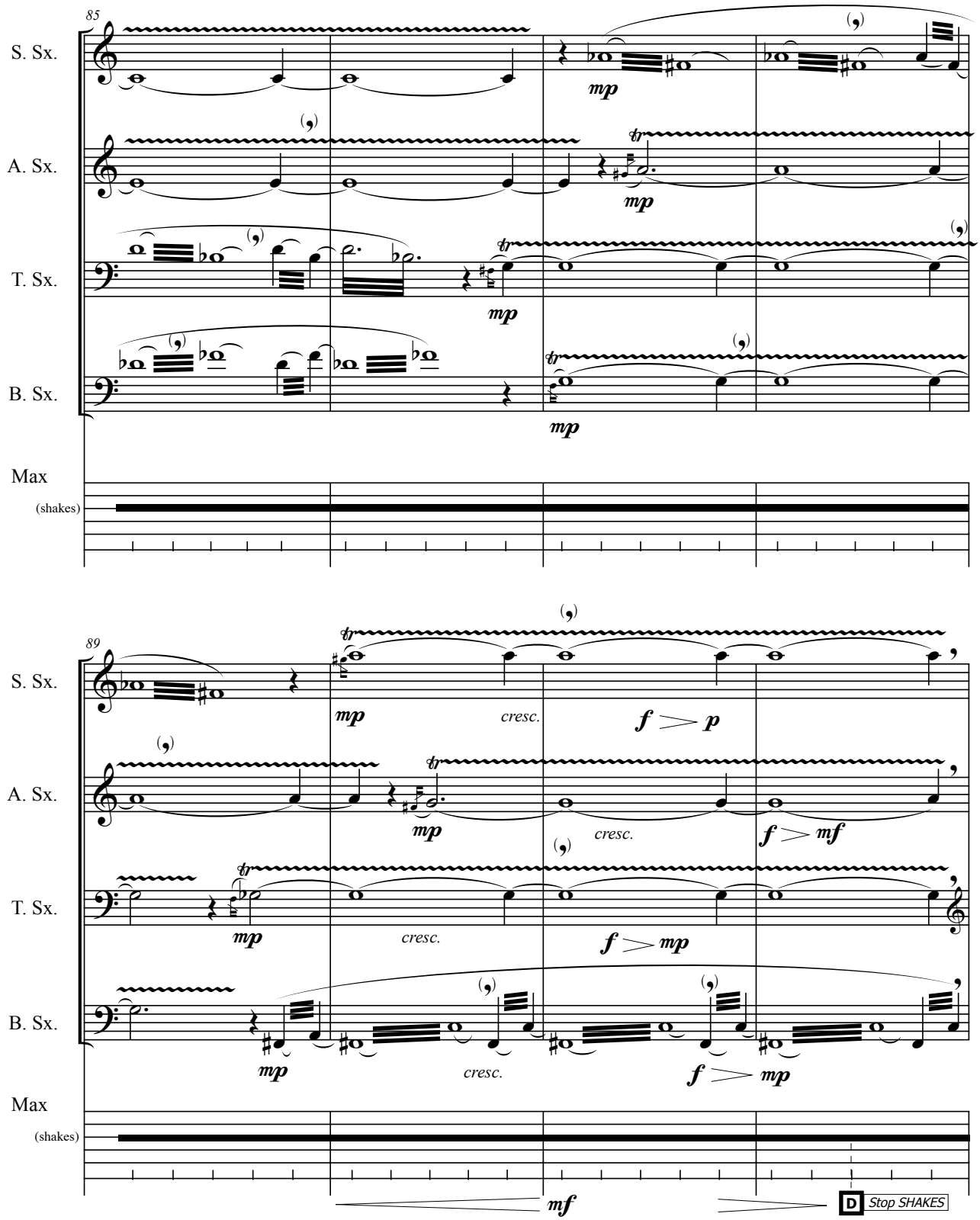

D1 (ca. 3'05")
38
S. Sx.
A. Sx.
T. Sx.
B. Sx.
slap tongue
sempre slap tongue
ord.
slap tongue
sim
Max
(air)
(keys)
(shakes)
(multiphonics)
(flutter)
A Stop AIR
S Stop KEYS
D Stop SHAKES
D2 (ca. 3'40")
42
ord.
mp
F Stop FLUTTER

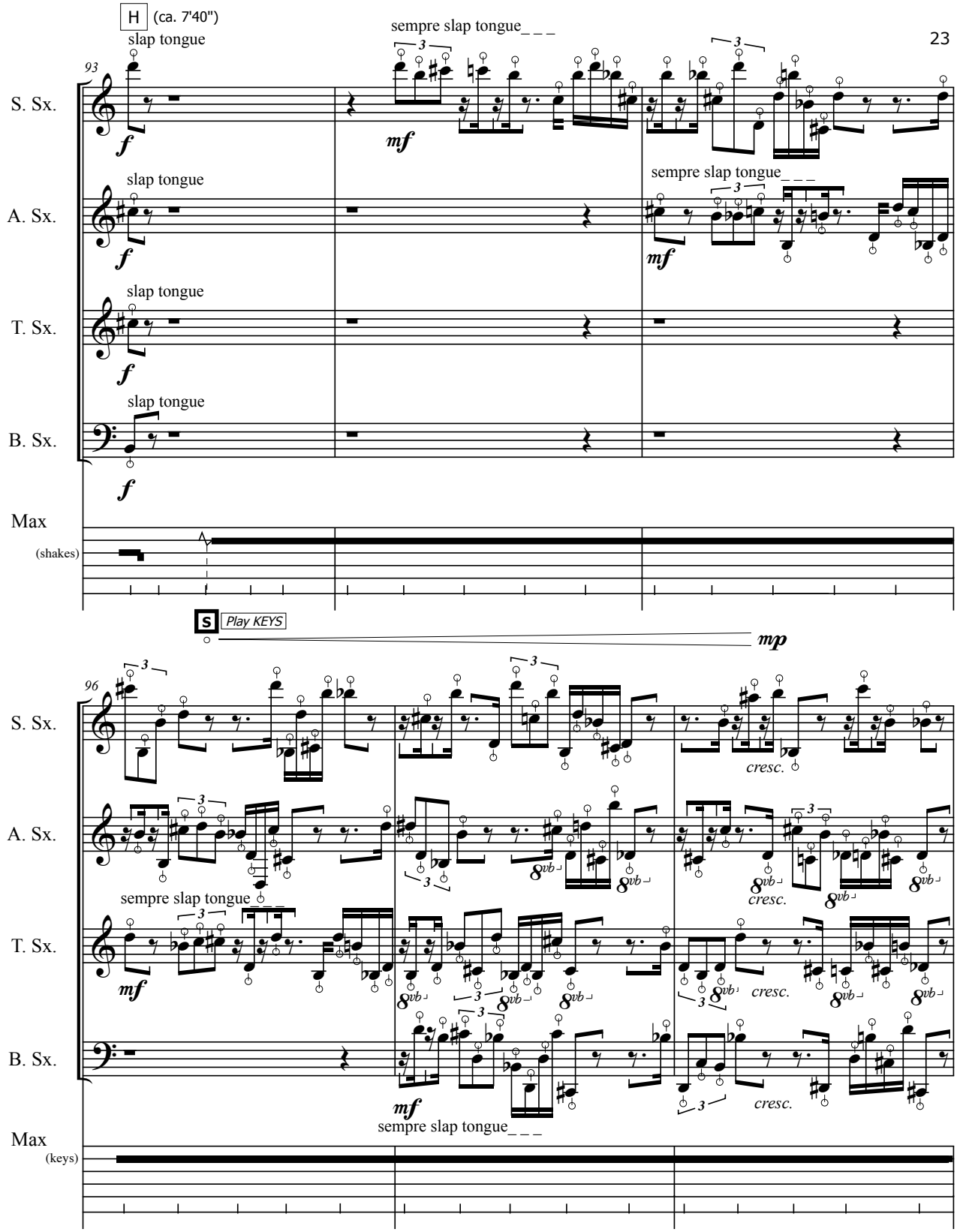

46
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(multiphonics)
mp
gliss.
E (ca. 4'20")
51
vib.
vib. simile
gliss.

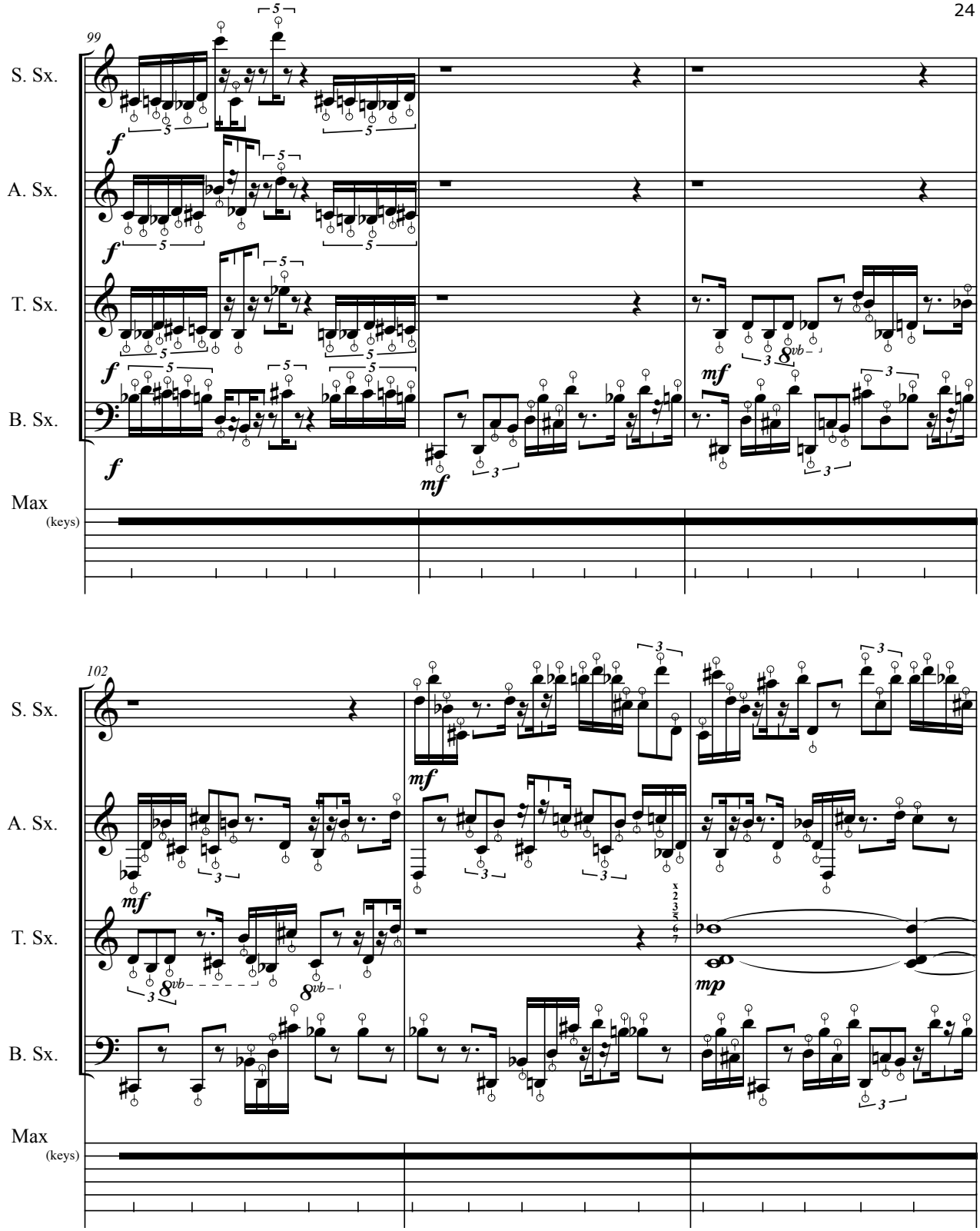

56
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(multiphonics)
vib. simile_ _ _
cresc.
mf
dim.
mp
61
normal vib.
non vibrato
F
Play FLUTTER

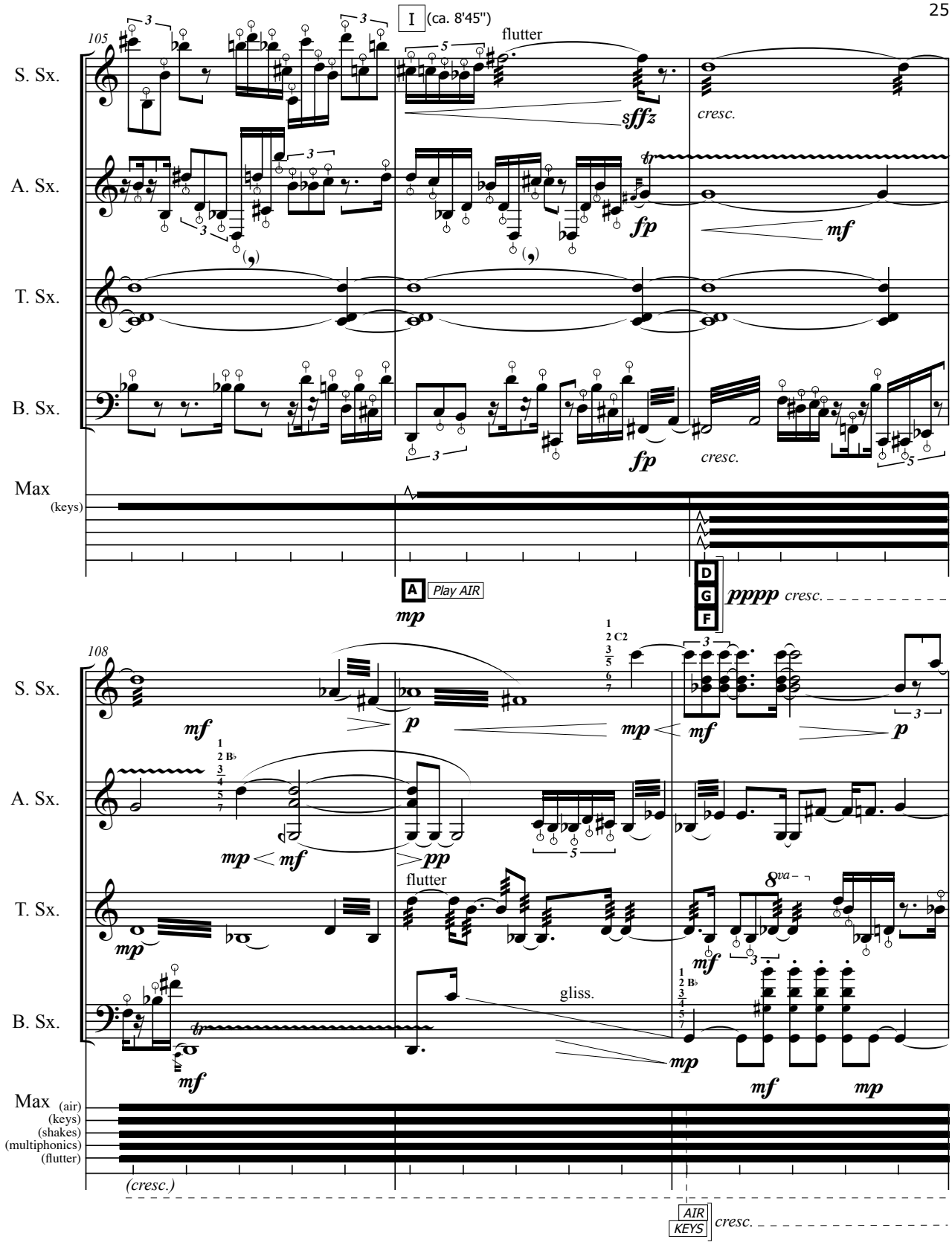

F (ca. 5'32")
66
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(multiphonics)
(flutter)
flutter de a poco
flutter
sempre flutter
cresc.
dim.
mf
p
G Stop MULTIPHONICS
71
mp
(flutter)

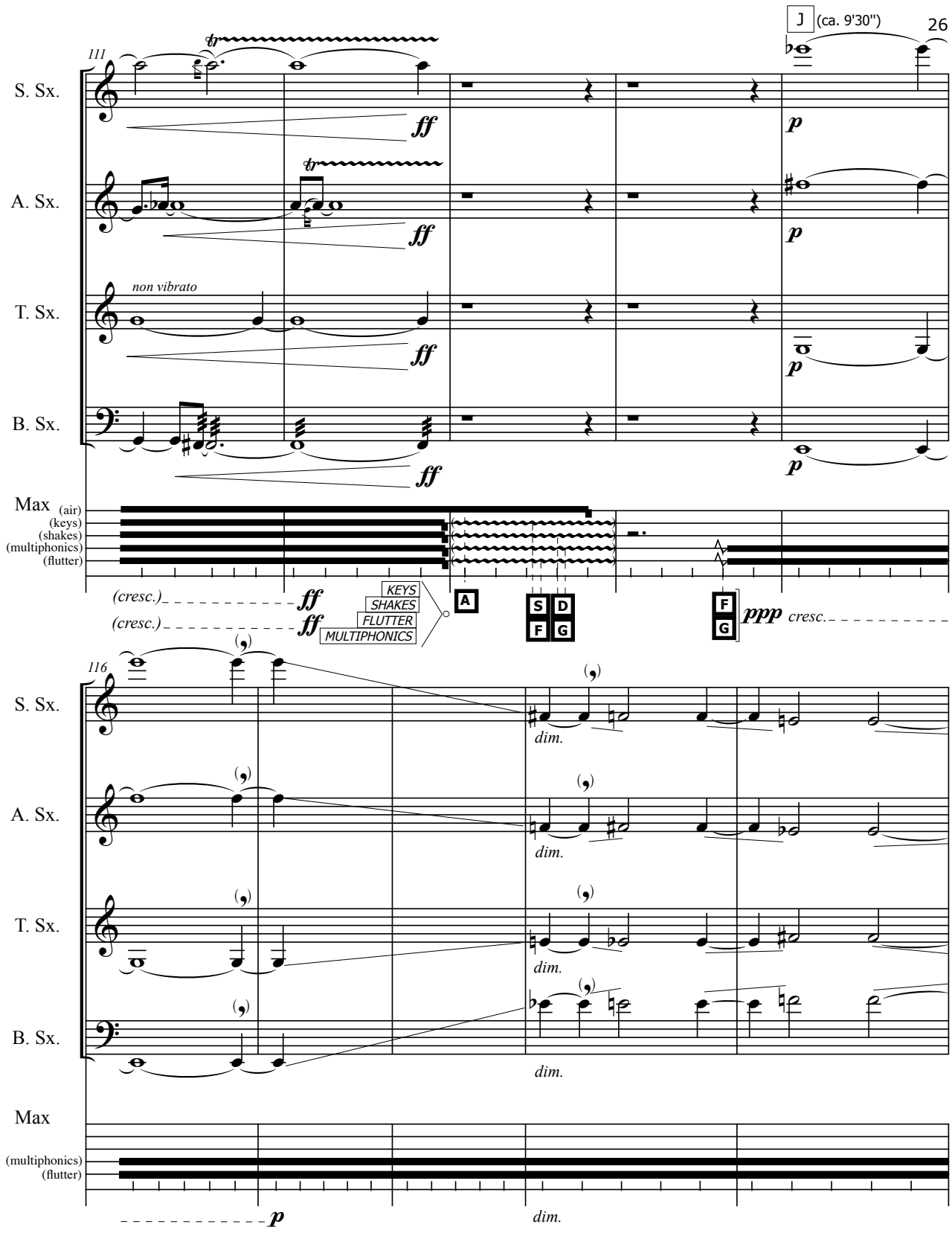

76
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(flutter)
cresc.
dim.
mp
mf
f
D
Play SHAKES
G
(ca. 6'43")
81
(shakes)
F
Stop FLUTTER

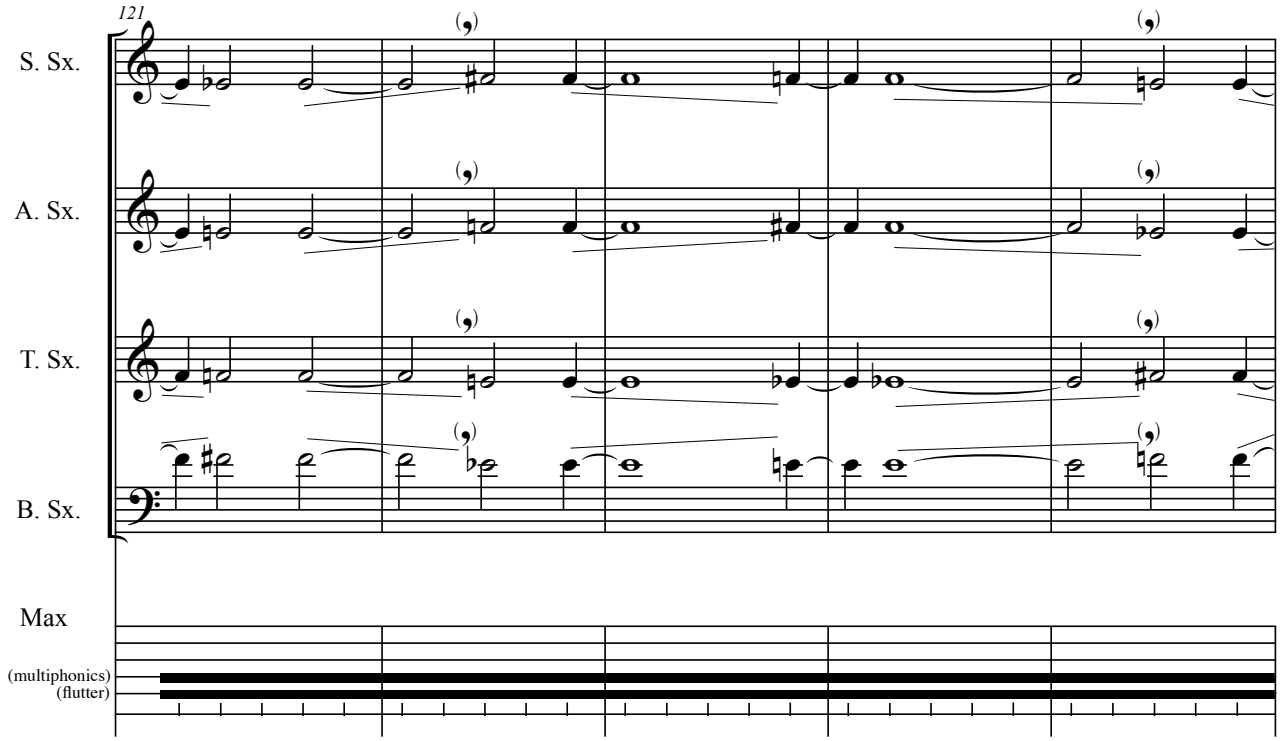

85
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(shakes)
mp
89
cresc.
f > p
f > mf
f > mp
mf
D Stop SHAKES

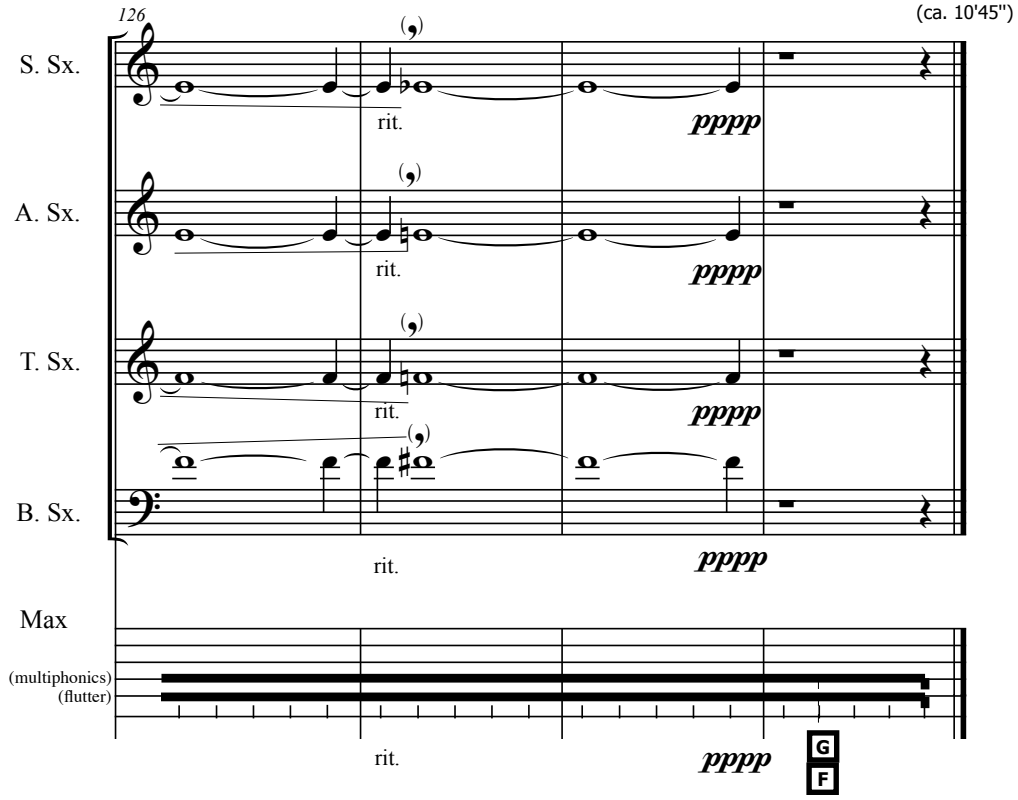

H (ca. 7'40")
93
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(shakes)
slap tongue
sempre slap tongue_ _ _
S Play KEYS
96
(keys)
cresc.
mp
mf
f


99
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(keys)
102
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(keys)


I (ca. 8'45")
105
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max (keys)
flutter
sffz
cresc.
fp
mf
A Play AIR
mp
D G F
pppp cresc.
108
p
pp
gliss.
8va
Max (air) (keys) (shakes) (multiphonics) (flutter)
(cresc.)
AIR KEYS
cresc.


J (ca. 9'30")
26
111
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(air)
(keys)
(shakes)
(multiphonics)
(flutter)
non vibrato
ff
p
(cresc.)
KEYS
SHAKES
FLUTTER
MULTIPHONICS
A
S D F G
F G
ppp cresc.
116
dim.
p


121
S. Sx.
A. Sx.
T. Sx.
B. Sx.
Max
(multiphonics)
(flutter)


126
(ca. 10'45")
S. Sx.
A. Sx.
T. Sx.
B. Sx.
rit.
pppp
Max
(multiphonics)
(flutter)
G
F

CHAPTER 2

Al filo del espejo

Al filo del espejo [On the Verge of the Mirror]

Al filo del espejo (2013) is written for two pianos and two percussionists and there are no electronics involved in this piece. The work can be understood as a new way of using space in acoustic composition. Spacialization has been used in three ways. Firstly, interlocking minimalistic patterns are played by two instruments. The distance from one instrument to the other has a principal role in the piece (see "staging" on the score) which is to clarify texture and to perform the patterns in a sort of "acoustic stereo" movement.

Secondly, space and registral development are symbolically joined through different kinds of movement relationships: Contrary movements with some instruments moving up in register (and symbolically in altitude) and others moving down; oblique movements in which one instrument remains in its register while the other moves up or down; and direct movements in which both instruments move in the same registral direction.

The third development of space is through interactions between space and frequencies. It is natural to associate low frequencies with objects that wander on the floor (imagine large animals that normally move slowly on the surface). High frequencies are related in nature to small, light and agile animals that are able to fly very high in altitude. This piece tries to emulate this vertical order of frequencies in nature, featuring low, cloudy textures moving on the ground and high, light and defined pitches phrases flying in the atmosphere. This translation from the natural world to music spacialization is of course metaphorical, and the audible results are not precisely perceived in

this way. However I believe it is an interesting approach to manage verticality in harmony and the vertical spatial axis in acoustic composition.

Al filo del espejo

Arnáez Nicolás

Al filo del espejo

[On the Verge of the Mirror]

For two pianos, two percussion and conductor

Duration: c. 13:25

Inspirada y dedicada a Delma

Premiered by Andriy Talpash, Sandra Joy Friesen, Mathew Walton, Brian Thurgood and Brian Jones

April 16th, 2013, Convocation Hall, University of Alberta, Edmonton, Canada

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PROGRAM NOTES

Ethereal. Light and dark. Polygrooving, repeat. Expressivo e rubato. Transition I. Precise and mechanic, repeat. Transition II. Sinking into the darkness. Shifting conclusion, repeat. Final.
Gracias, te amo, repeat.

INTRODUCTION

“Al filo del espejo” [On the Verge of the Mirror] is a piece composed between January and March 2013, during my Master’s in Music Composition at the University of Alberta, under the supervision of Dr. Howard Bashaw.

The form of the piece is a result of the alternation between two musical textures. Most of the time, soft and smooth processes work as a transition between these two worlds, which slowly allows one to become the other.

These two worlds are presented in sections, the texture of one of them is a hazy cloud in permanent change, with technical indications about how to perform the lines in favor of timbric results. During these cloudy areas, precision in performance is not necessary. They are marked as A, B, H and J.

The opposing texture is based on repetitive minimalistic patterns. The constructions of the patterns is characterized by an accent layer organized in a repetitive process different that the one used on pitch (this non-correlation, at the same time, is different for each instrument). This characteristic generates new relationships between the pitches involved in the ensemble. During these sections precise performance of the patterns is crucial. These sections are marked as C, F and I.

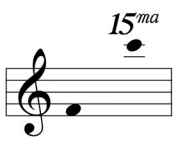
It is important to mention that these letters are just rehearsal marks, the entire piece must be played continuously without any pause, except for those indicated in the score.

INSTRUMENTATION

2 Grand pianos.

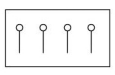
Percussion 1:

- Cymbal 22” (see note below)
- Bongos (high and low)
- Maracas (biggest size available)
- Congas (high and low)
- Tam Tam 32” or bigger (sometimes bowed on the top edge; when bowed the performer has to make it “sing” harmonics)
- Snare Drum (metal shell if possible, snares off all the time)
- Floor Tom
- Bass Drum (shared with percussion 2, see “Stage Diagram” attached)
- Xylophone. Range (concert pitch):



MALLETS:

- Contrabass bow.


- 4 Soft mallets (sometimes uses just 2)

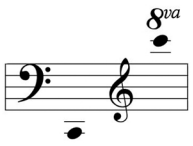

- 2 Medium mallets


- 2 Hard mallets


- 1 Soft Tam Tam mallet

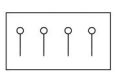
Percussion 2:

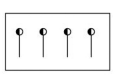
- Tambourine
- Cymbal 18” (see note below)
- Cymbal 16 “ (see note below)
- 2 Crotales (pitch is not required, one must be as high as possible, the other as low as possible)
- Bass Drum (shared with percussion 1, see “Stage Diagram” attached)
- Marimba. Range (concert pitch):



MALLETS:

- Contrabass bow


- 4 Soft mallets (sometimes uses just 2)


- 4 Medium mallets (sometimes uses just 2)


- 2 Hard mallets


- 2 Drumsticks


- 1 Soft Bass Drum mallet


- 2 Crotales mallets with metal head

Note: Cymbals’ sizes are suggested, if these 3 sizes are not available they can be replaced whith other sizes existing, but always the size’s relation must be respected: Percussion 1 has the biggest one, Percussion 2 has the medium-sized and the smaller one.

NOTATION

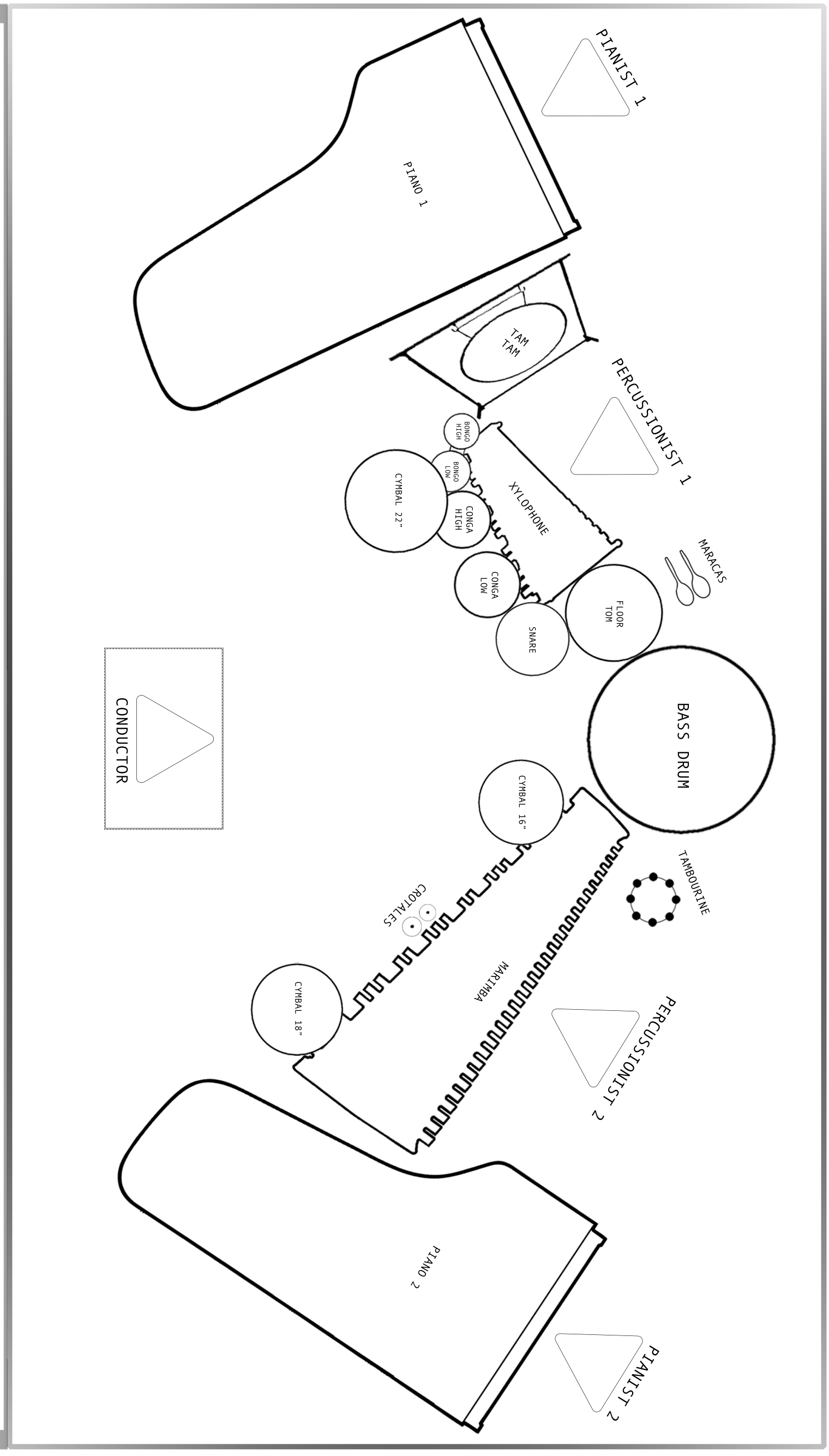
- Referring to accidentals: When a sharp or flat is written, it refers to the note in that measure in that line/space. No octaves of the same note are modified. A new measure will need a new accidental to modify the pitch and if there is nothing written, the note must be played natural. When in the same measure there is an accidental and an octave change (15ma, 8va, 8vb, 15mb), the notes under the octave change, and written in the same line or space, keep the accidental.

- ⌈i‾ These marks are just a visual help for the performers and for the conductor. They are useful for rehearsal purposes.

- Beaming is done in order to clarify different voices on the same instruments, and sometimes on the same hand.

- Piano dynamics: When a dynamic indication is above the top staff, it applies just to the right hand. When it is below the bottom staff, it applies just to the left hand and when is in the middle, it applies to both hands together.

STAGING



Note: - Percussionists can set up their instruments differently if convenient, but the position on the stage is fixed.
- Pianos must be as more spearated as possible.

SCORE

Al filo del espejo

Dedicada a Delma

ARNÁEZ, Nicolás

A ♩= 69

Ethereal

Very light and thin, like coming from nowhere to the world of metal noises.

Piano 1

Percussion 1 — Cymbal 22" · Bongo High · Bongo Low · Conga High · Conga Low · Maracas △ · Tam Tam · Snare Drum · Floor tom · Bass Drum

Xylophone

Percussion 2 — Tambourine · Cymbal 18" · Cymbal 16" · Bass Drum · Crotal High · Crotal Low

Marimba

Piano 2

c. 6" c. 5" c. 4" c. 4"

arco sempre L.V. *pp* *mp*

arco *ppp*

A1

T.T. *tremolo de a poco* L.V. *mf*

Prc. 1 — **crotales H** **crotales L** *pp* *mp* *p* *f* *arco* **mar.** *mallets* *15mb* *p* *f*

Prc. 2

B **Light and dark.**

The accuracy in rhythmic subdivision and rhythmic synchronization can fluctuate in favor of a light and vibrating texture sensation.

Tremolo rapido, legato e leggiero

molto leggiero simile

Pno. 1 — *15mb* *pppp* una corda *Ped.*

Prc. 1 — **tom** *pp*

Prc. 2 — **B.D.** *pp*

Pno. 2 — Tremolo rapido, legato e leggiero *15mb* *pppp* una corda *Ped.*

Pno. 1

Prc. 1

Prc. 2

Pno. 2

Pno. 1

Prc. 1

Prc. 2

Pno. 2

Pno. 1

Prc. 1

Prc. 2

Pno. 2

22

simile

etc.

(half Ped.)

xyl.

mar.

release the pedal very slowly until half pedal

sempre half Ped.

rit. to

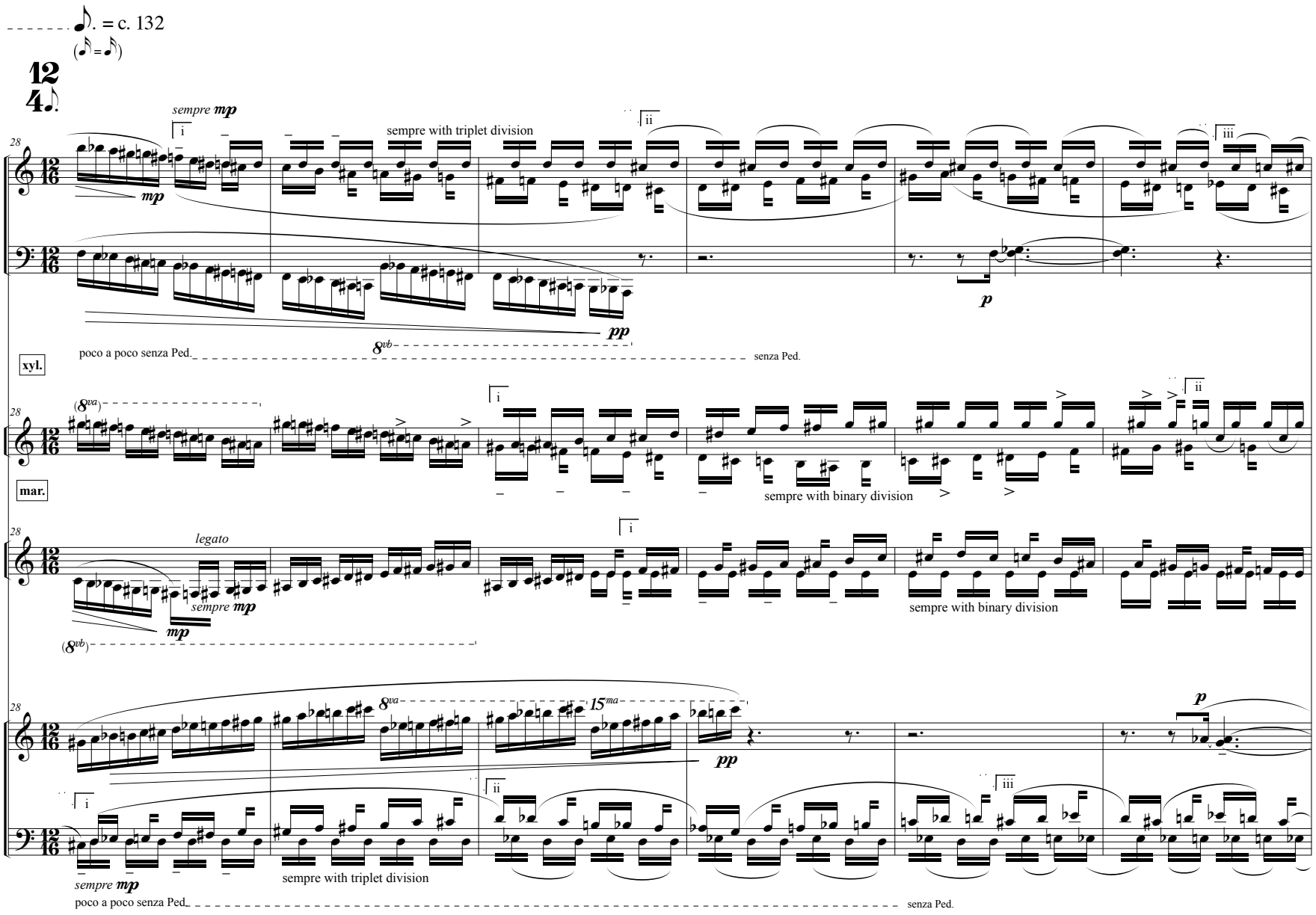
(to ♪. = c. 132)

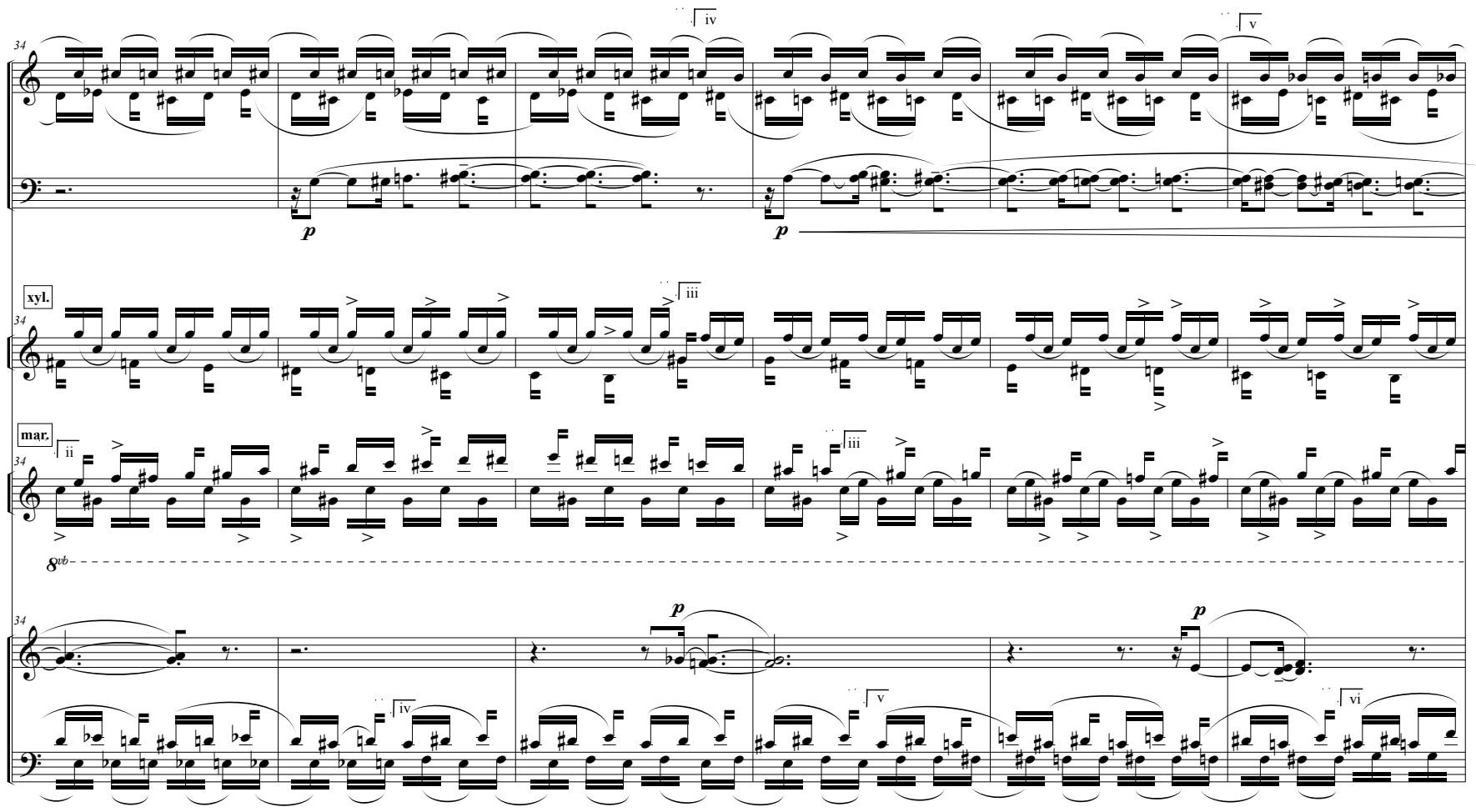
B1

25

legato

C **Polygrooving**
Precise accuracy in rhythmic values and coordination between instruments is needed.
Playing with groove each line will reach the goal of this section.





Pno. 1
Prc. 1
Prc. 2
Pno. 2
xyl.
mar.
simile
C1
5

58

Pno. 1

simile

x

simile

(8vb)

xyl.

Prc. 1

mar.

Prc. 2

(8vb)

(8va)

Pno. 2

simile

xi

62

Pno. 1

simile

8vb

mf

xyl.

Prc. 1

mar.

Prc. 2

mf

8va

15ma

xii

Pno. 2

C2

66

Pno. 1

sfz

xyl.

Prc. 1

mar.

Prc. 2

8va

sfz

Pno. 2

Pno. 1

Prc. 1

Prc. 2

Pno. 2

70

sfz sfz sfz sffz mp 8vb

cymb. L.V. ff

tom

S.D. fmp fmp fmp fmp

xyl. f

cymb. L.V. B.D. ff L.V.

choke choke choke simile

mar. f

sfz sfz sffz mp 8vb

C3

74

(8vb)

f

S.D. tom

fmp fmp

f L.V.

cymb. L.V. B.D. pp

mallets

f L.V.

(8vb)

78

Pno. 1

mp

Prc. 1

bongo H
bongo L
conga H
conga L

78

pp

mp

Prc. 2

78

mar.

8vb

mf

Pno. 2

78

mp

82

f

Pno. 1

Prc. 1

bongo H
bongo L
conga H
conga L

82

Prc. 2

82

mar.

(8vb)

mf

Pno. 2

82

86

8va

Pno. 1

f

poco a poco con Ped.

Prc. 1

bongo H
bongo L
conga H
conga L

86

Prc. 2

86

mar.

(8vb)

Pno. 2

86

8vb

Pno. 1
Prc. 1
bongo H
bongo L
conga H
conga L
Prc. 2
Pno. 2

(8va) 15ma
90
Ped.
mar.
(8vb)
f
8vb
(8vb) 15mb
poco a poco con Ped.

(15ma)
94
fff
8va
(Ped.)
mf
subito p
f
C5
(8vb)
(15mb)

molto rit.
♪. = c. 66
4/4
99
mp
release Ped. very slowly
B.D.
mf
L.V.

D **Espressivo e rubato**
Personal phrasing, dynamics and tempo fluctuations are needed.
Indications are suggested.

Pno. 1

Pno. 2

Molto espressivo e rubato ♩ = c. 90

legato e leggiero

Ped: change with each note

a tempo

rit.

half Ped.

poco a poco più Ped.

E **Transition one**
From rubatto and expressivo
to precision and mechanic.

♩ = c. 108

Prc. 2

poco a poco con Ped.

cymb.

L.V.

Pno. 1

Pno. 2

E1

release the pedal very slowly until half pedal

sempre half Ped.

Prc. 1

arco

T.T.

Prc. 2

mallets

crotales H

change to tambourine

tamb.

finger-tip stroke

simile

poco a poco meno Ped.

half Ped.

sempre half Ped.

121

Pno. 1

(half Ped.)

8vb

leggiero

pp

espress.

mf

T.T.

Prc. 1

p

tamb.

finger-tip stroke

Prc. 2

p mf

normal

pp

Pno. 2

mp

leggiero

simile

espress.

mf

leggiero

pp

(half Ped.)

125

Pno. 1

mp

8vb

mf

T.T.

Prc. 1

mp

tamb.

Prc. 2

p

Pno. 2

etc.

mf

mp

etc.

accel.

(to ♪ = c. 132)

sempre staccato e leggiero

ppp

poco a poco senza Ped.

senza Ped.

129

Pno. 1

mf

pp

(half Ped.)

T.T.

Prc. 1

L.V.

mallets

mf

tamb.

Prc. 2

mallets

mf

pp

Pno. 2

ppp

sempre staccato e leggiero

mp

ppp

poco a poco senza Ped.

mp

senza Ped.

(⌒ = dashed slurs show pitch grouping)

F **Precise and mechanic**
Rhythms should be precisilly performed and at the same time it must be light and agile.

♩ = c. 132

Pno. 1
Prc. 1
Prc. 2
Pno. 2

135 mp
T.T.
L.V.
mallets
p
B.D.
mallets
p
L.V.
B.D.
ii
ii

142
iii
iii
tom
B.D.
ppp

149
iv
iv
tom
ppp
T.T.
p
B.D.
L.V.
p
cymb.
pp

156

Pno. 1

T.T.

Prc. 1

pp

p

cymb.

Prc. 2

p

Pno. 2

F1

163

Pno. 1

cymb.

L.V.

change to maracas

maracas

Prc. 1

T.T.

L.V.

mp

cymb.

Prc. 2

cymb.

L.V.

change to tambourine

L.V.

mp

Pno. 2

F2

170

Pno. 1

maracas

Prc. 1

mp

mallets

xyl.

ppp

pp

tamb.

Prc. 2

mp

mallets

crotales L

pp

sempre L.V.

Pno. 2

177
Pno. 1
viii
ix
x
mf
177
xyl.
Prc. 1
p
3
177
crotales L
crotales H
Prc. 2
3
177
mar.
8va
mp
3
177
Pno. 2
iii
iv
mf

F3

184
Pno. 1
viii
ix
x
xi
xii
xiii
xiv
xi
xii
184
xyl.
Prc. 1
3
mar.
184
(8va)
Prc. 2
3
184
Pno. 2
iv
v
vi

190
Pno. 1
xv
xvi
xvii
xviii
xix
xx
xxi
xxii
xiii
mp
xiv
190
xyl.
Prc. 1
3
5
mallets
mp
mar.
190
(8va)
Prc. 2
3
5
mallets
mp
190
Pno. 2
v
vi
vii
xviii
mp

G **Transition two**
From the brightness to the darkness. During this section, a transition on the performance from precise playing at the beginning to non-precise playing to the end is required.

196 meno staccato de a poco — legato

Pno. 1 — mp

Prc. 1 — xyl. — pp — mp — p — mp

Prc. 2 — mar. — pp — mp — p

Pno. 2 — meno staccato de a poco — legato — mp

(= new pitch substitutions)

203

Pno. 1 — simile

Prc. 1 — xyl. — f — mp — mp — f

Prc. 2 — mar. — mp — f — mp — mp

Pno. 2 — simile

H **Sinking into the darkness**
Rhythmic coordination and accuracy is not necesary. The essence of this section is to obtain a blurry texture moving to the pianos' register limits, and a vibrant drone that mutes slowly through the harmony on the percussions.

209

Pno. 1 — etc. — non legato — mf

Prc. 1 — xyl. — p — p — f

Prc. 2 — mar. — f — p — p — f

Pno. 2 — etc. — non legato — simile — mf

Pno. 1
Prc. 1
Prc. 2
Pno. 2
215
iv
non legato
3
simile
v
poco a poco to half Ped.
vi
sempre half Ped.
xyl.
mar.
mf
f
etc.
221
H1
(half Ped.)
vii
(poco a poco to half Ped.)
227
viii

Pno. 1
Prc. 1
Prc. 2
Pno. 2
233
vii
ix
H2
5
etc.
(half Ped.)
cymb.
ppp
xyl.
mallets
pp
mar.
8vb
v
239
viii
simile
mp
bongo H
L.V.
p
mf
(8vb)
vi
245
x
bongo L
conga H
15mb
17

H3

Pno. 1

Prc. 1

Prc. 2

Pno. 2

conga H

conga L

S.D.

mar.

mallets

This roll must be done through a circular movement of the wrists,
in a very relaxed manner, with the mallets perpendicular to the keys.

R L R L R simile

simile

(half Ped.)

H4

bongo H

tom

B.D.

L.V.

mallets

xi

poco a poco più Ped.

bongo L

viii

I **Shifting conclusion**
Light and mechanical playing.
Rhythmic precision needed.

Pno. 1
Prc. 1
Prc. 2
Pno. 2

268
(15ma)
etc.
(poco a poco più Ped.)
Ped.
clear sustain slowly
senza Ped.
right hand sempre staccato
left hand sempre legato
S.D.
tom
B.D.
L.V.
change to maracas
mar.
(15mb)
(8vb)
ppp
273
simile
(Ped.)
280
maracas
tamb.
(15ma)
8va
ii

287

Pno. 1

Prc. 1 — maracas — *p*

Prc. 2 — tamb. — *mf* — *pp* — mallets

Pno. 2

294

I1

Pno. 1

Prc. 1 — maracas — *mp* — *pp*

Prc. 2 — mar. — *legato* L L etc. / R R etc. — *pp* — *mp*

Pno. 2

301

simile

Pno. 1

simile

Prc. 1 — xyl. — *legato* L L etc. / R R etc. — *pp* — *mp*

Prc. 2 — mar.

Pno. 2

308

Pno. 1

308 xyl.

Prc. 1

308 mar.

Prc. 2

308

Pno. 2

iii

iii

315

Pno. 1

8vb

8vb

poco a poco con Ped.

315 xyl.

Prc. 1

ppp

315 mar.

Prc. 2

315

Pno. 2

8vb

8vb

poco a poco con Ped.

I2

321

Pno. 1

15mb

v

iv

15mb

(poco a poco con Ped.)

Ped.

T.T.

arco

321

Prc. 1

mp

ff

L.V.

321 mar.

Prc. 2

mallets

ppp

321

Pno. 2

vi

(8vb)

15mb

15mb

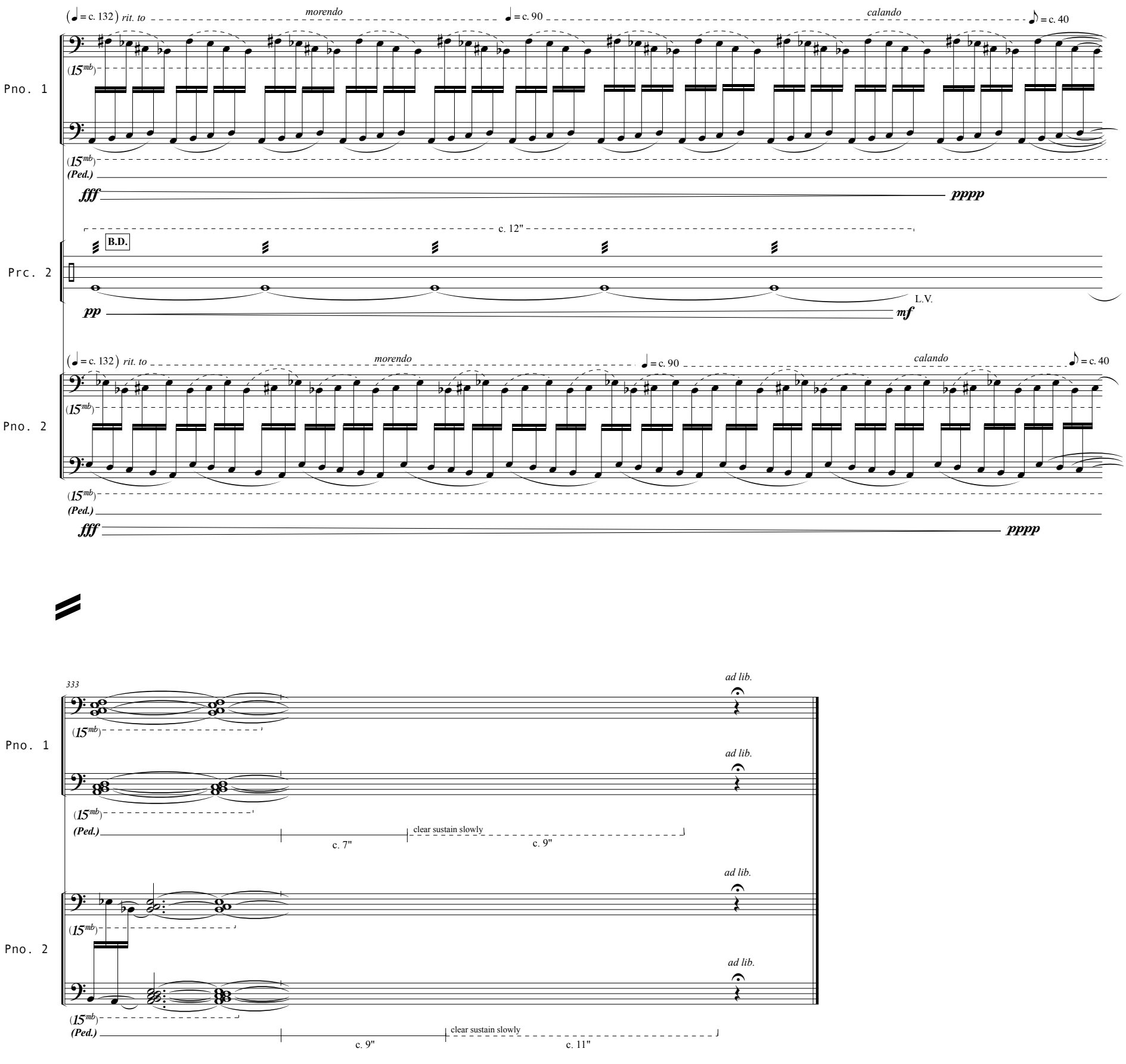
iv

(8vb)

(poco a poco con Ped.)

Ped.

J **Final**
Conductor out. Each performer will finish his phrase in a molto ritardando e diminuendo ad libitum. Tempo marks are approximations. No rhythmic and dynamic coordination between instruments is encouraged.



CHAPTER 3

Sobre cómo pintar en el tiempo

Sobre cómo pintar en el tiempo [On How to Draw Over Time]

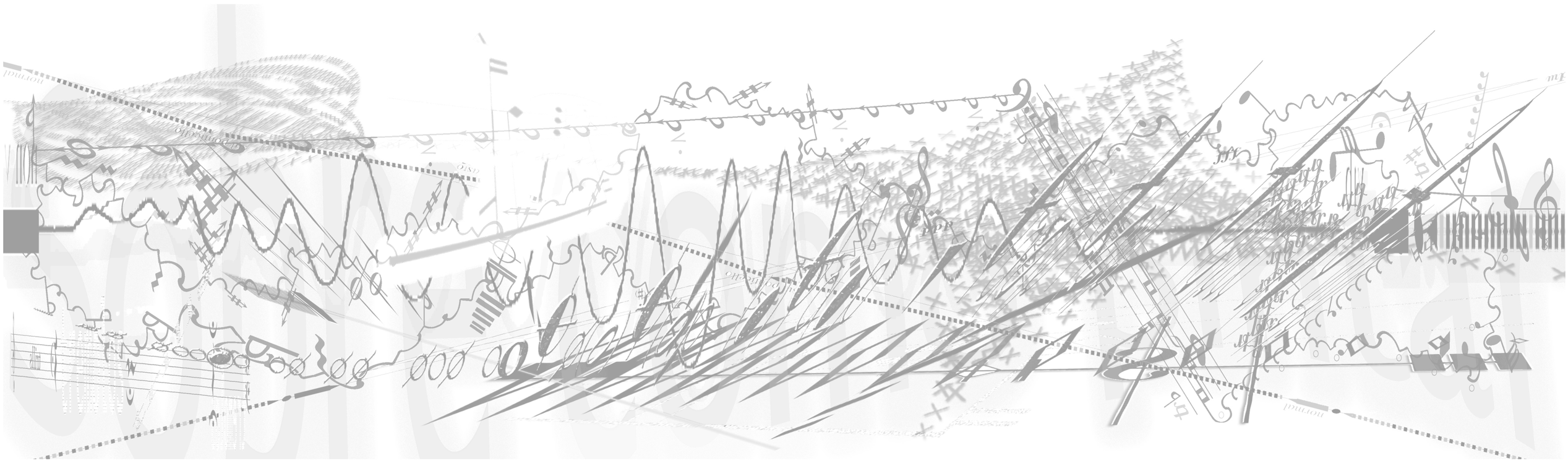
Sobre cómo pintar en el tiempo (2013) is a piece for string quartet, three-dimensional ambisonic sound system and real-time processing. Space, in this case, defines the development of form, texture and timbre.

The spacialization treatment is similar to the one used in *Ecos Boreales* (recording and playing earlier events and then creating spatial pathways for them to traverse). The difference is that this time I used three axes for reproducing the recordings instead of two: left-right, front-back and top-bottom (when a recording is played, it traverses different spatial areas of an imaginary cube surrounding the audience, see Technical Aspects). The first recording is played on the bottom of the cube, the second on the front, and the third on the top, etc. These recordings are in a constant motion in the assigned area, i.e. the first recording is played on the bottom of the cube, while simultaneously making circular movements.

In the second section, lights in the hall are turned off and instruments stop playing. For the next 4 minutes, some specific recordings made of the earlier performances are played in the cube in three-dimensional movement. The listener experiences a choreography of sounds that "dance" all over the room in precise and organized movements such as circular, linear, spinning, swirling and spherical trajectories in fast, medium or slow speeds and organized in canon, in "unison" and in reverse motions. All the sound sources' movements are made by using the IRCAM software *Spat* (Jot, 2013)

Sobre cómo pintar en el tiempo

ARNÁEZ, Nicolás



Sobre cómo pintar en el tiempo

[On How to Draw Over the Time]

ARNÁEZ, Nicolás

For String Quartet

© 2013 Nicolás Arnáez

Like a painter traces lines of colours that interact on the canvas' space for creating a final image, *Sobre cómo pintar en el tiempo* takes sound material played by the strings to build a spatial soundscape. The piece then, is an invitation to witness the constructive process of a final sound image, like watching a painter during the process of painting, for eventually seeing the complete work.
his work.
A painter's strokes are musical gestures, colour is timbre, perspective is space and space is time. The final painting is equivalent to the soundscape presented at the end, when string players stop playing, and the music develops itself.

INTRODUCTION

This piece was composed between September and December 2013, during my Masters in Music Composition at the University of Alberta, under Dr. Mark Hannesson's supervision.

A string quartet is distributed in a semicircle on the stage and will play segments of music written on the score. Each instrument will have its own microphone, connected to an audio interface and a computer with Max 6. The Max patch controls recording and playing of musical sections. Also, it contains the sound spacialization of live and recorded instruments, which is crucial for the piece's development. An ambisonic three-dimensional sound system (eight speakers) must be arranged in a "cube" configuration, where the audience is located inside. Please refer to Technical Aspects below for details. A sound projectionist is recommended to monitor and adjust the loudspeakers volume, if necessary. The piece can be played with or without conductor. If the piece is performed without conductor, the violin I player will be responsible for performing the indications written on the score for the conductor.

There are two types of writing:
One is partially defined (marked on the score as 1, 3, 6, 8, 10, 12 and 14) written using a quasi-traditional music notation; where some musical parameters are defined (i.e. rhythm, registry, attack) while others are open to performer's decisions. This sound material is recorded by the Max patch and will be played automatically at the end of the piece.

The second kind of writing uses graphic notation, where some rules are given at the beginning. The performers are responsible for assigning lines, curves, thickness, symbols, gray scale variations to musical parameters such as rhythm, pitch, articulation, dynamics as requested. This is done by following the graphics freely for the duration indicated. This notation is organized in "boxes" from I to VI. These boxes are placed between the regular notation described above. There are moments where players have two or three boxes to choose from (i.e. in box IV we find IVa, IVb and IVc). These boxes are also recorded, they are performed looped automatically by the Max patch right after they are finished being played. The reproduction through the sound system is additive, which means that once they start playing they do not stop until the end of the last measure of the piece.

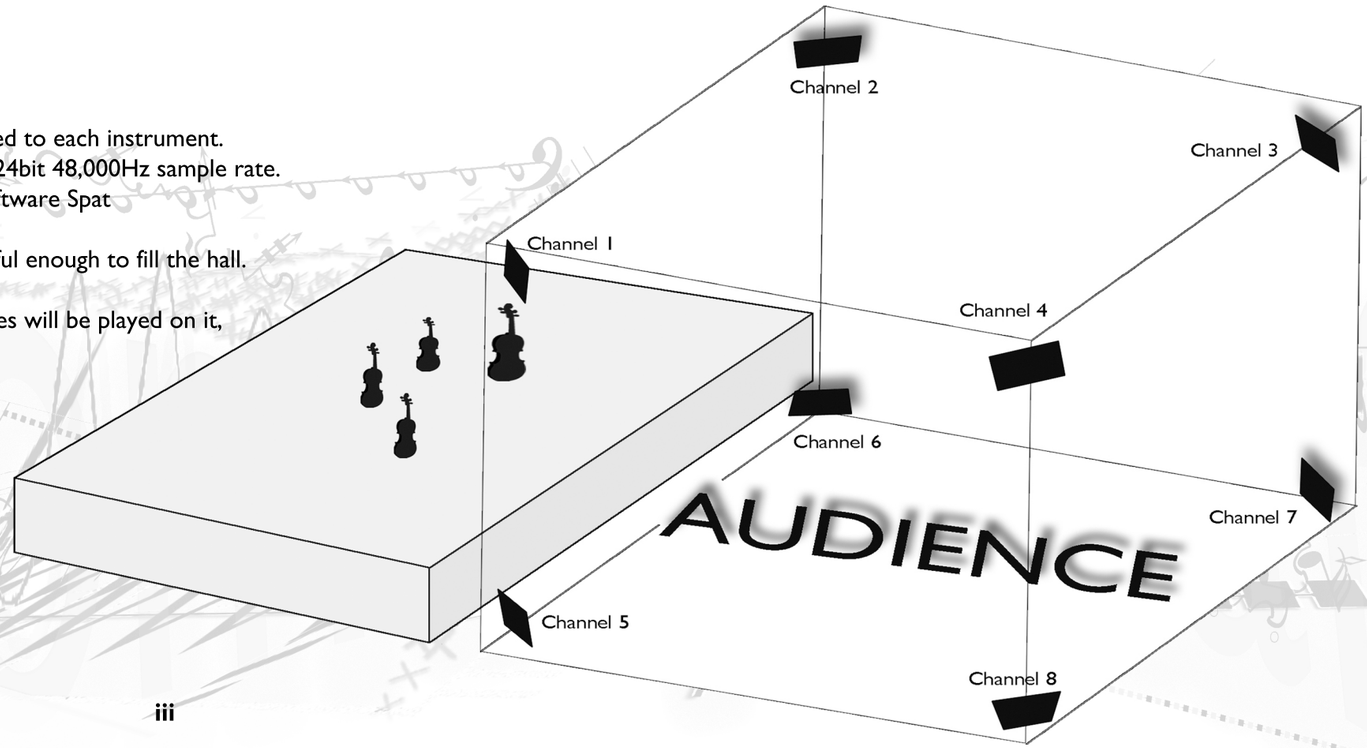
The piece has two big sections. In the first one, performers play the written music and the Max patch records and plays fragments. The second section (after 15) requires no performers. In addition, the hall's lights should be turned off completely (if this is not possible, performers must leave the stage quietly). The Max patch will perform automatically for about 4 minutes, spreading pre-recorded sounds throughout the hall, with a very precise tridimensional space trajectory.

It is required that the conductor (or the violin I player in case of a non-conducted performance) executes the line on the score called "Max/MSP". This line is used to trigger the different areas of the Max patch. Using a foot switch, the conductor should press it once when an arrow indicates. The numbers on the arrows are in sequence with the numbers on the patch; they define sections and can be used as rehearsal marks.

TECHNICAL ASPECTS

For performing this piece, the following equipment is necessary:

- 4 microphones (high quality contact microphones are preferred), one connected to each instrument.
- An audio interface able to manage 4 individual inputs, 8 individual outputs and 24bit 48,000Hz sample rate.
- A computer loaded with Max 6.1.4 (or higher) or Max runtime, the IRCAM software Spat (available in: http://forumnet.ircam.fr/product/spat/), and the piece's patch.
- 8 identical speakers distributed in a "cube" configuration (see diagram), powerful enough to fill the hall. No subwoofers are needed.
- A MIDI keyboard with foot-switch connected to the sound interface. No pitches will be played on it, just the pedal will be used. It must not be visible to the audience.



NOTATION

The score contains many special symbols, graphics and explanation of how to perform them.

The following explanation is applicable only to the partially defined regular notation areas. Boxes (where exclusively graphic notation is used) are free of these restrictions.

Staves:

- *One-line staff:* no pitch allowed, just noises described in the notes.

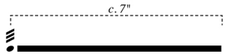
- *Three-line staff:* Registry indication. Bottom line represents low register, middle line represents middle register, higher line represents high register. Any note-head placed above the top lines suggest very high pitches, others placed under the bottom line suggests very low pitches. Noteheads placed in between lines represent pitches in between registers (middle-low or middle-high).

- *Four-line staff*: Represent each one of the four strings, where the bottom one represents the fourth string, the next the third string and so on (tablature-like notation).

- *Five-line staff:* Regular notation, pitches defined.

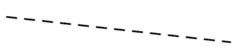
Lines:

You will find during the piece different line types that represent different processes:



Keep repeating last event, with the articulation showed first, until new notification. Do not make changes while playing unless indicated.

Keep repeating last event, with the articulation showed first, during the time specified. This line requires an ongoing process, from one point to the other (i.e. from sul pont to sul tasto, during the length of the line).


Muted glissandi. Slightly slide your left hand through the fingerboard according with the line direction (top: high register, middle: middle register, bottom: low register).


Glissando.

Noteheads:


Regular notes.


Sounds made on other parts of the instrument, not string (unpitched noises).


Sound of muted strings with left hand (do not allow harmonics).

Symbols:


Short fermata.


Normal fermata.

Measured fermata.

This patch is responsible of recording, playing, looping sounds and its spacialization. For performance each microphone coming from the instruments must be connected to the following audio interface input:
Channel 1 = Violin I
Channel 2 = Violin II
Channel 3 = Viola
Channel 4 = Violoncello
Individual gain controls are found on the patch's top left area, in the section labeled INPUTS. For performance set these signals as loud as possible, without clipping.
The audio interface outputs must be connected following the graphic offered on page iii (output 1 = channel 1, output 2 = channel 2, etcetera). Individual volume controls are located in OUTPUTS (bottom right).
A master volume control is offered. Do not adjust individual volumes unless strictly necessary.

In the CONTROLS area (top right) you will find the following commands:

PATCH CONTROL:

Current position: shows which rehearsal number the piece is located at the moment, it increases when the footswitch or spacebar is pressed.

Set desired position: This control allows the sound projectionist to select any rehearsal number. The sound projectionist will introduce the desired number by clicking on the box, entering the number, and pressing enter, the patch will wait for the trigger control signal to start performing the code written for that number (this control is offered for rehearsing situations).

Trigger control (spacebar, MIDI pedal): Emulates trigger control (made also by pressing the spacebar or footswitch).

Stop: Stop max patch's performance.

Start again: Set up the patch for starting the piece from the beginning.

SPAT WINDOW:
Shows the spacialization program used on the piece (Spat~ by IRCAM) and allows the sound projectionist to visualize sound movements. It is not recommended to use visualizations during performance, in this manner unneeded use of the computer's CPU will be prevented.

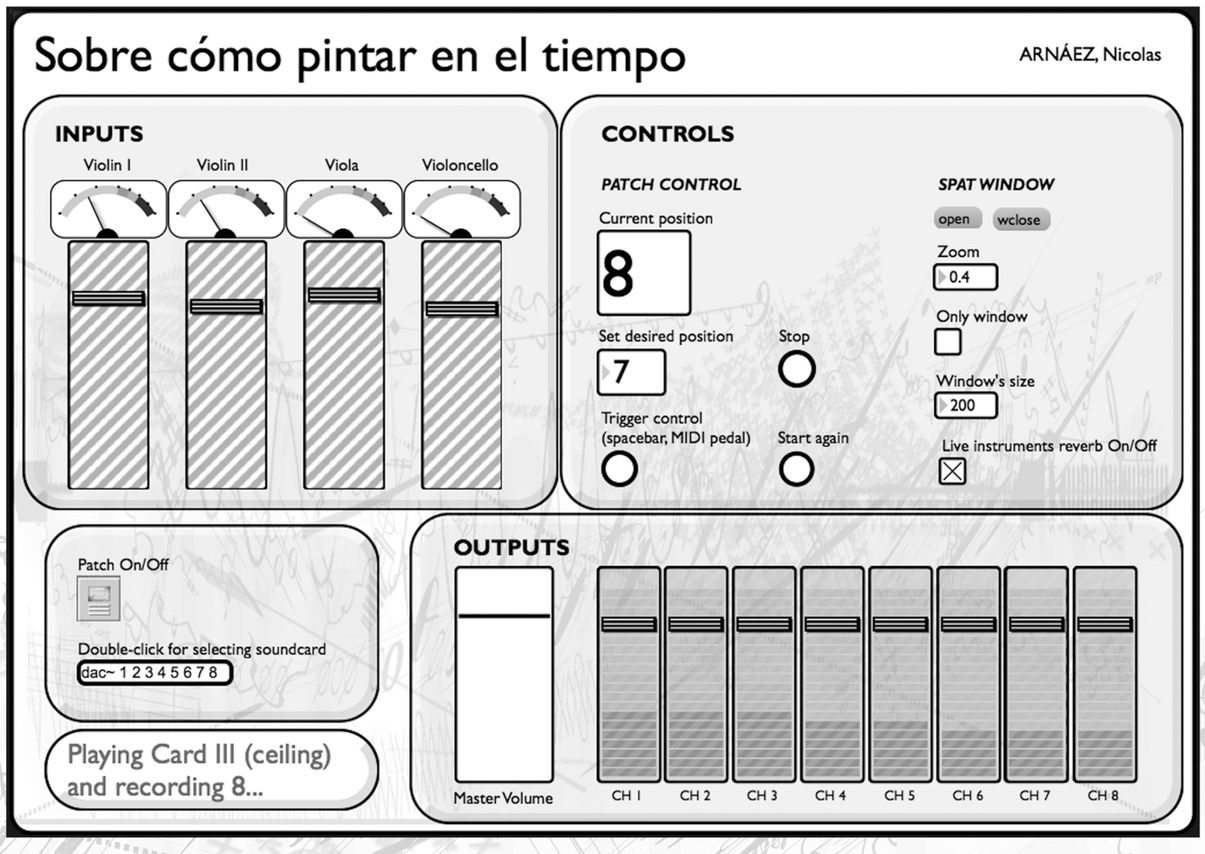
Open – wclose: Opens and closes Spat~.

Zoom: Sets the Spat~ viewer's zoom.

Only window: Change the view of Spat~ from full view (including controls for sound spacialization and EQing) to simple view (just the sound movements' window).

Window's size: When "Only window" is activated, this control changes the size of the sound spacialization window.

Live instruments reverb on/off: Allows activating or deactivating the reverb on the microphones. The patch automatizes this control.



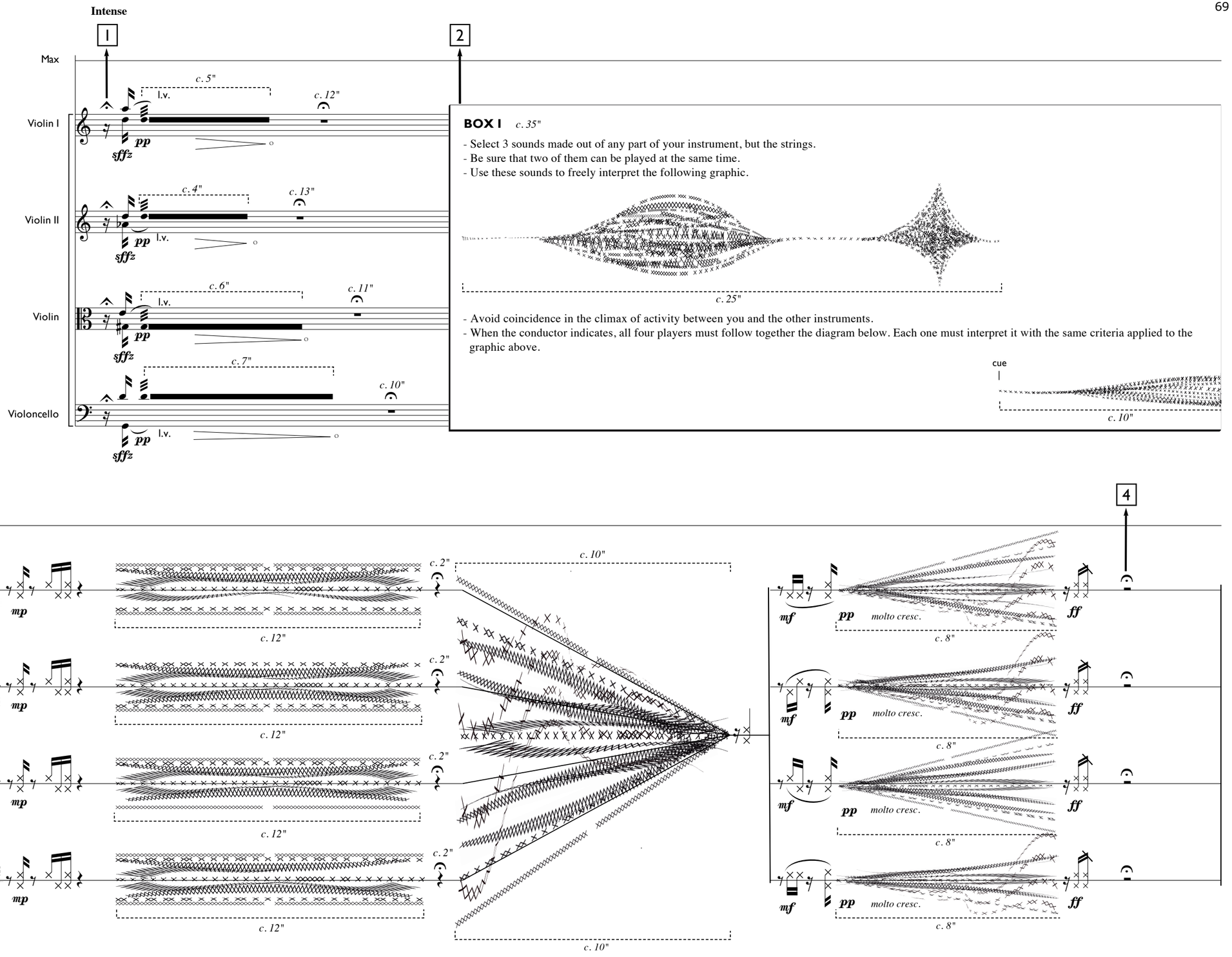
At the bottom left of the program, the patch will show what actions are being done at the moment. Green colour is just information. Red colour is a request (turn off the lights on 15, and turn them back on when the piece is finished).

SCORE

Sobre cómo pintar en el tiempo

[On How to Draw Over Time]

ARNÁEZ, Nicolás



- Play regular notation normally. The two vertical × noteheads refer to the two sounds that can be played together, requested on BOX I.
- Conductor chooses tempo on 3
- Beginning, duration and end must be synchronized, dynamics are free if not indicated.

I

5

Max

Vln. I

Vln. II

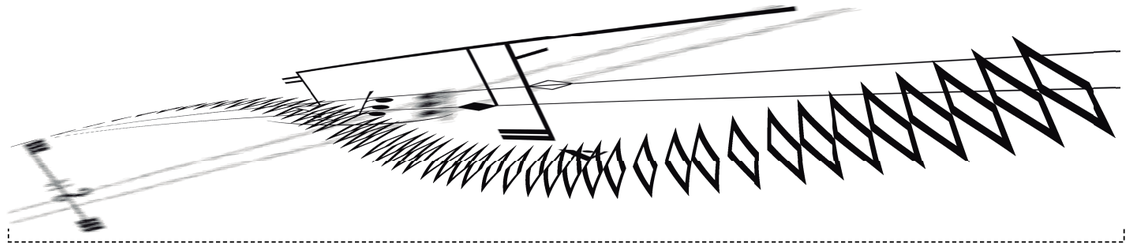
Choose one

Vla.

Vc.

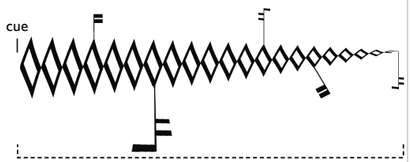
BOX IIa *c. 48"*

- Select as many sounds as you want, they must come from your strings, but regular pitches are prohibited. Play them following your own interpretation of the next graphic.



c. 36"

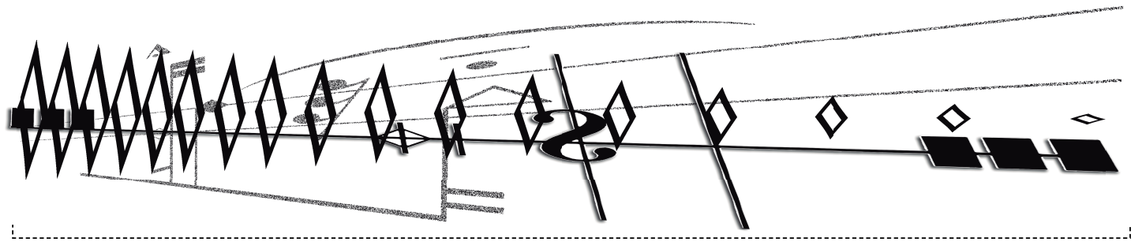
- When the conductor indicates, all players must follow together the diagram below. Each one must interpret it with the same criteria applied to the graphic above.



c. 12"

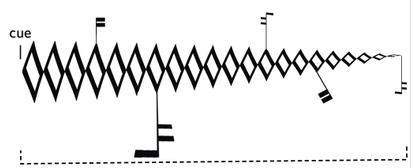
BOX IIb *c. 48"*

- Select as many sounds as you want, they must come from your strings, but regular pitches are prohibited. Play them following your own interpretation of the next graphic.



c. 36"

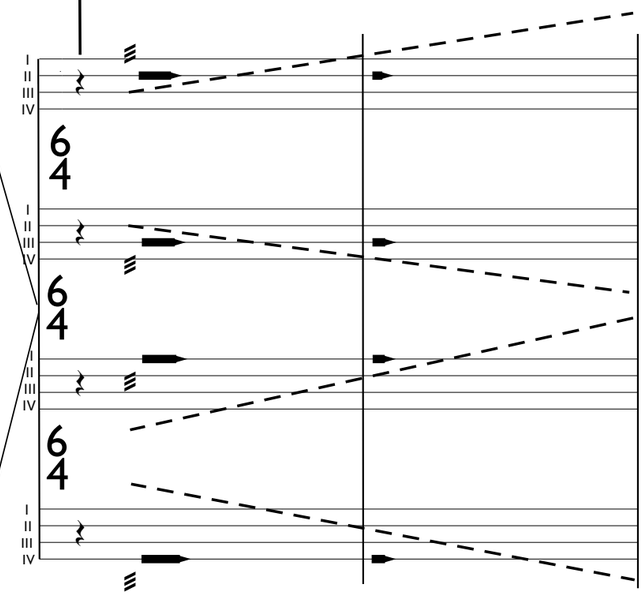
- When the conductor indicates, all players must follow together the diagram below. Each one must interpret it with the same criteria applied to the graphic above.



c. 12"

As fast as possible

6



- : Mute the strings with left hand (do not allow harmonics).
- : Slightly slide your left hand through the fingerboard according with the line direction (top: high register, middle: center register, bottom: low register)
- : Keep repeating last event until new notification.
- Dynamics: to be decided for each performer.

synchronization between instruments only required on the accented beats

Vln. I

Vln. II

Vla.

Vc.

7 7 7 etc.

7 7 etc.

9

synchronization between all instruments is required

7 7 etc.

synchronization between instruments only required on the accented beats

9 10

9 10

synchronization between all instruments is required

7 etc.

synchronization between instruments only required on the accented beats

synchronization between all instruments is required

Synchronization between instruments only required on the accented beats

Vln. I

Vln. II

Vla.

Vc.

7

Max

BOX IIIa *c. 48"*
- Within 10 seconds, slowly change from muting the string to pressing down normally, until pitches begin to ring out.
- After the 10" play tremolo as indicated, also include variations in dynamics, vibrato and timbre (sul ponticello, sul tasto, etc.) as you wish.
- Never stop bowing, always in the (III) string, never change pitch.

BOX IIIb *c. 52"*
- Within 10 seconds, slowly change from muting the string to pressing down normally, until pitches begin to ring out.
- After the 10" play dynamics as indicated, also include variations in tremolo, vibrato and timbre (sul ponticello, sul tasto, etc.) as you wish.
- Never stop bowing, always in the (III) string, never change pitch.

BOX IIIc *c. 57"*
- Within 10 seconds, slowly change from muting the string to pressing down normally, until pitches begin to ring out.
- After the 10" play vibrato as indicated, also include variations in dynamics, tremolo and timbre (sul ponticello, sul tasto, etc.) as you wish.
- Never stop bowing, always in the (III) string, never change pitch.

BOX IIId *c. 60"*
- Within 10 seconds, slowly change from muting the string to pressing down normally, until pitches begin to ring out.
- After the 10" play timbre as indicated, also include variations in dynamics, vibrato and tremolo as you wish.
- Never stop bowing, always in the (III) string, never change pitch.

tremolo rall_ _ _ _ _ _ _ _ _

c. 12" *c. 8"* *c. 3"*

vib. non vib.

normal *sul ponticello* *sul tasto* *sul ponticello* *normal*

* *tremolo glissando* starting in the note used on BOX III,
never change the string in the followings measures, never stop tremolo.

♩= 60
Tense

8

Max

Vln. I

dim.

glissando to the highest note on III

ppp cresc. poco a poco

5/4

at the highest point on III add IV

Vln. II

dim.

ppp cresc. poco a poco

5/4

glissando to the highest note on III

Vla.

dim. poco a poco

ppp cresc. poco a poco

5/4

Vc.

dim. poco a poco

glissando to the highest note on III

ppp cresc. poco a poco

Vln. I

ff

f mf p

Vln. II

ff

mf

Vla.

ff

f mf p

Vc.

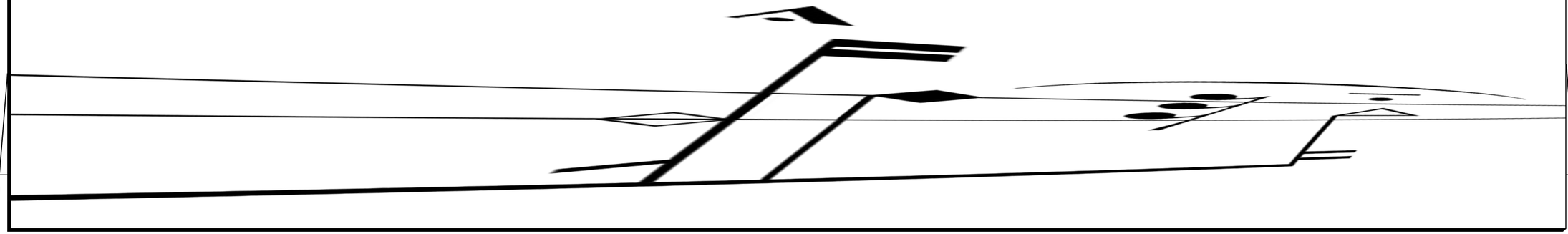
ff

f mf p

Beats: 1 2 3 4 5 1 2 3 4 5 1 2 3 4 5

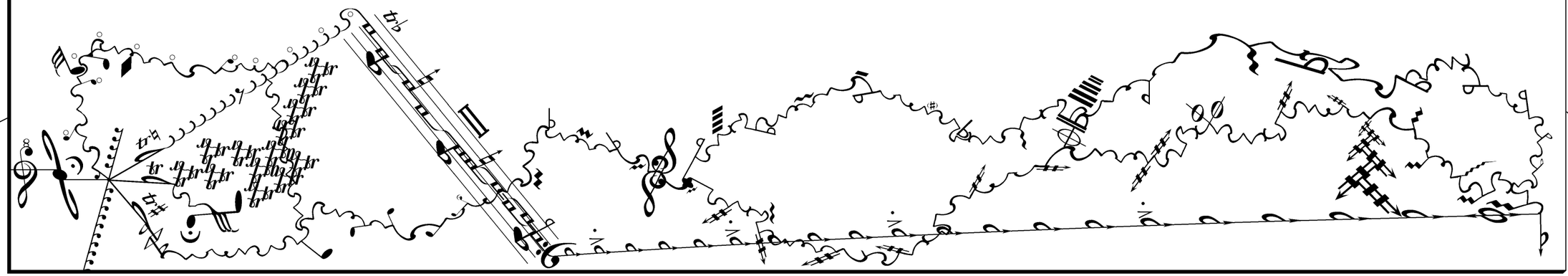
BOX IVa *c. 60"*

- Play tremolos between 2 strings. Play them following your own interpretation of this graphic.



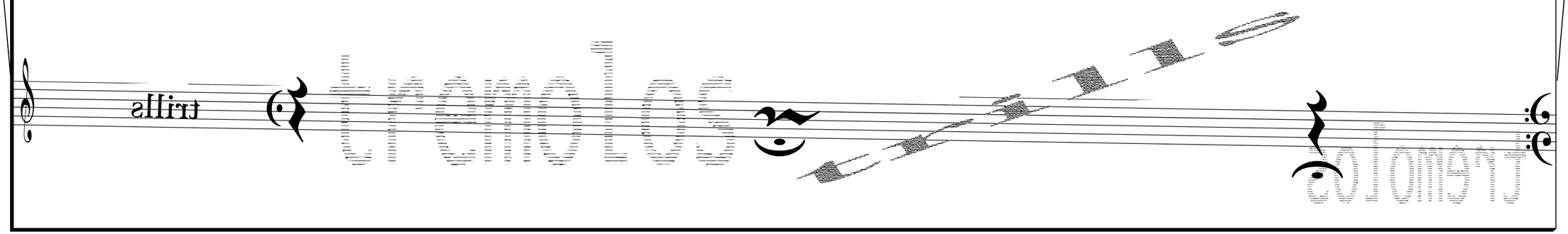
BOX IVb *c. 60"*

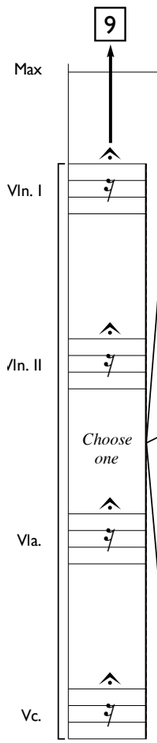
- Play trills. Play them following your own interpretation of this graphic.



BOX IVc *c. 60"*

- Play tremolos and trills. Play them following your own interpretation of this graphic.





♩= 60 Trills can be any size from microtone to larger.

Vln. I
Vln. II
Vla.
Vc.
High
Med.
Low

ppp cresc. p dim. ppp ppp cresc. mp dim. ppp ppp cresc.

ppp cresc. p dim. ppp ppp cresc. mp dim. ppp ppp cresc.

ppp cresc. p dim. ppp ppp cresc. mp dim. ppp ppp cresc.

ppp cresc. p dim. ppp ppp cresc. mp dim. ppp ppp cresc.

mf mf dim. ppp ppp cresc. f

ppp cresc. mf mf dim. ppp ppp cresc. f

mf mf dim. ppp ppp cresc. f

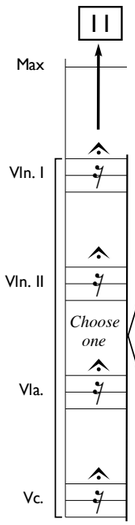
mf mf dim. ppp ppp cresc. f

p cresc. f dim. p cresc. f dim. mp cresc. f dim. mf cresc. ff

p cresc. f dim. p cresc. f dim. mp cresc. f dim. mf cresc. ff

p cresc. f dim. p cresc. f dim. mp cresc. f dim. mf cresc. ff

p cresc. f dim. p cresc. f dim. mp cresc. f dim. mf cresc. ff

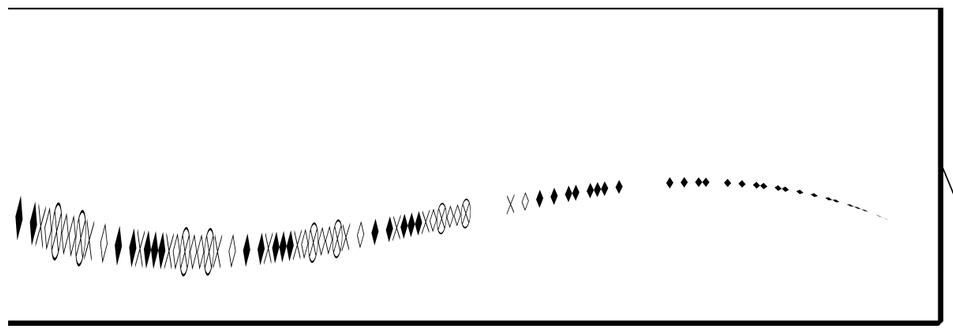


BOX Va *c. 1' 15"*

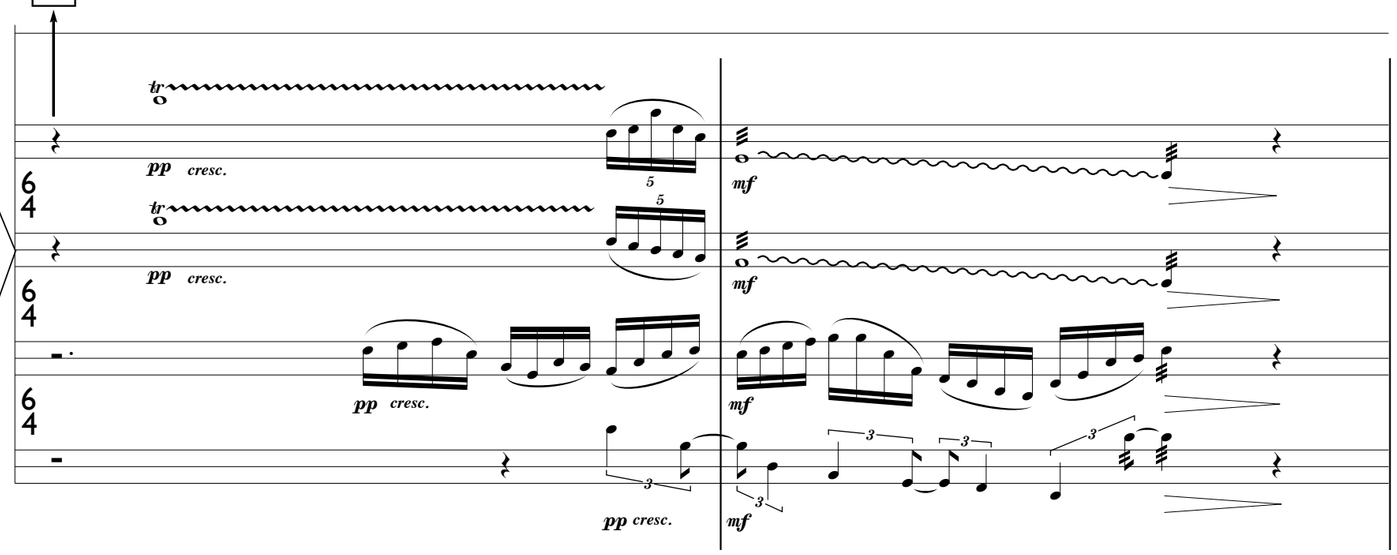
- Choose a note in the medium-high register. Never change the pitch.
- Play it with different techniques but always using short articulations. For example: staccato, spiccato, pizzicato, col legno, etc.
- Use the following graphic according to your understanding.

BOX Vb *c. 1' 15"*

- Play harmonics and artificial harmonics. Change the pitch every time you play, you can play a pitch already played, but sure do not play it two or more times consecutively.
- Play it with different techniques. For example: staccato, spiccato, pizzicato, sul tasto, sul ponticelo, etc.
- Use the following graphic according to your understanding.



♩= 60 Trills can be any size from microtone to larger.



Vln. I

Vln. II

Vla.

Vc.

All ricochets are one quarter note long. When four performers play together, just the first attack must be synchronized

13

Max

Vln. I

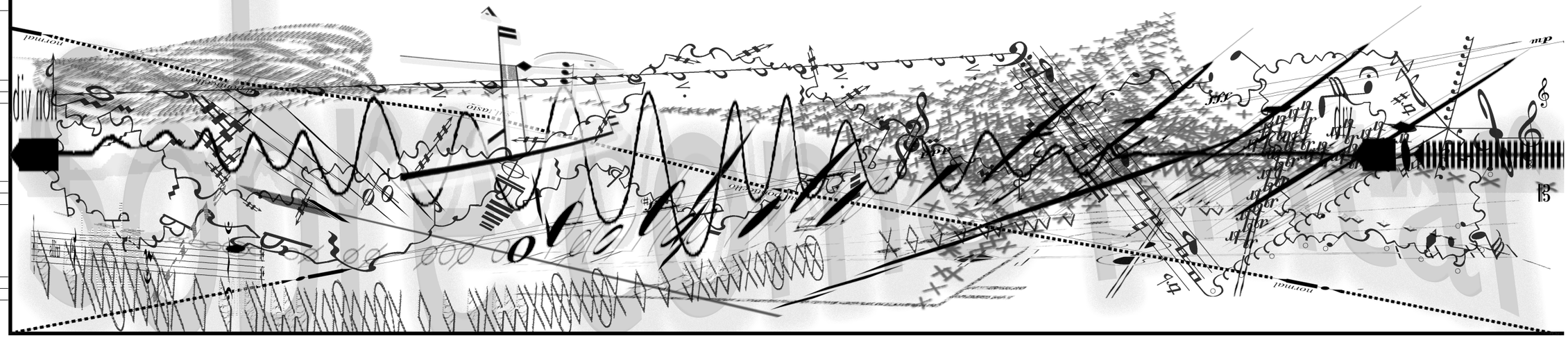
Vln. II

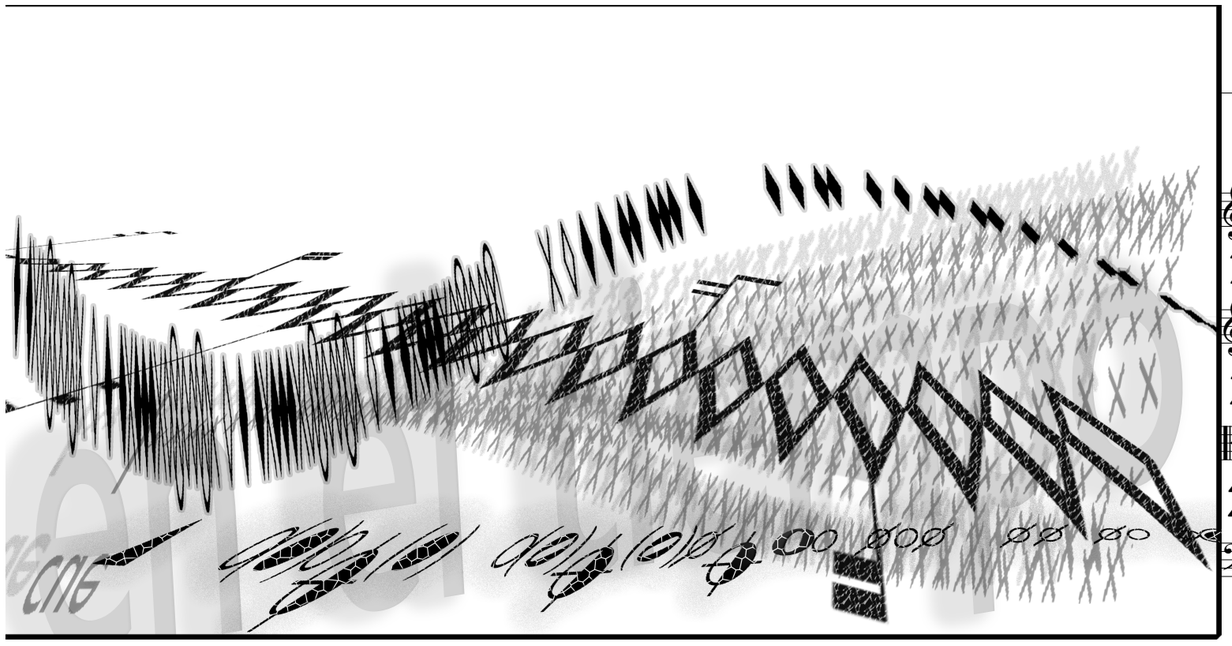
Vla.

Vc.

BOX VI *c. 1'40"*

- Replay freely musical material performed before. Do not play new material.
- Play them following your own interpretation of the next graphic.



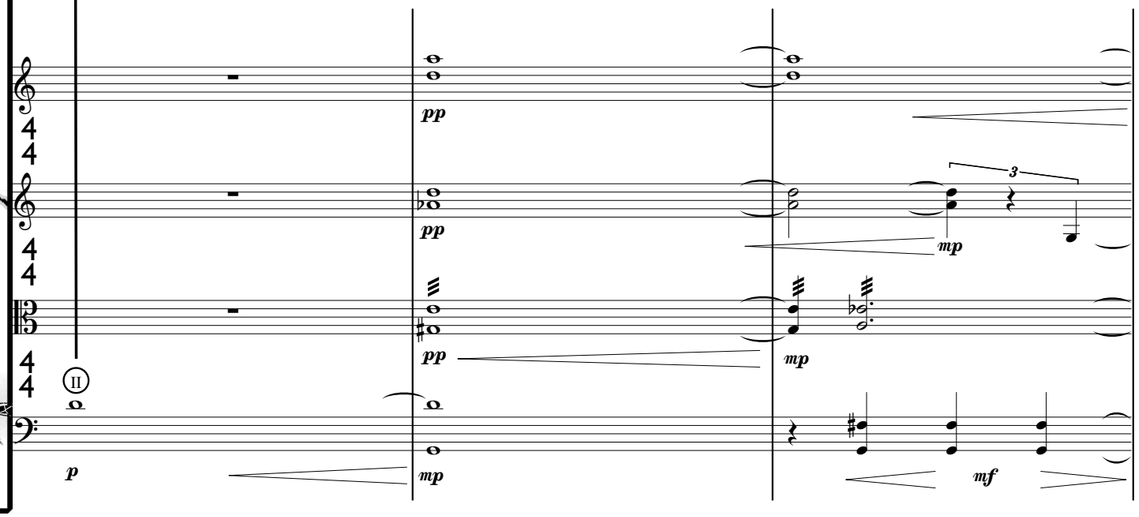


♩= 60 Play as written

Molto espressivo

14

II



Molto espressivo e rubato

Vln. I
Vln. II
Vla.
Vc.

mp *mf* *p* *mp* *mf* *p* *mp* *mf*

sul tasto

p *mp* *mf*

Max

sul ponticello

15

pp

c. 4'

- *The lights in the room must turn off slowly as soon as the performers complete the last figure. Performers will remain in their seat in silence.*
- *If turning off lights is not possible, performers must leave quietly the stage right after finishing playing the last figure.*

Max patch will automatically perform sounds in the cube for approximately 4 minutes.

- *After the last sound performed by the Max patch, lights will turn on slowly, performers must be standing up ready for the applause.*
- *If lights could not be turned off, performers will return to the stage after the last sound performed by the Max patch to receive the applause.*

Projection

The musical results and experience in the field attained by composing these pieces has encouraged me to keep working and researching areas of sound and space.

I feel the necessity of making connections between music and everyday life. Since sound is present in urban and natural life, my musical pieces seek to modify these natural, urban soundscapes by adding a layer of sound that will transform public spaces such as metro stations, sidewalks, town squares, etc. For example: a person crossing an area from left to right will find a sound moving in the same direction (or opposite, or from the top to bottom, etc). The sound played can be its own, or another person's sound, or maybe a recording of an instrument. This project is in process and will be finished soon.

Also, another projection of this research will be to solve the need to create my own sound spacialization system that will respond accurately to my very specific artistic needs. The existing sound systems are very precise and the results are excellent, but if I am able to achieve this goal, I would like to create a more precise tool for controlling the spaces as I image.

Conclusion

The potential of expression of sounds in space is huge. The pieces presented here are based on the development of space through time, and the artistic results have been challenging, intriguing and promising.

How to create spacialization, how to control sound sources and how to theorize the phenomena are still issues to solve. Much research remains to be done, and will be an excellent challenge to confront.

Researching while composing has been a unique experience. I feel highly motivated to continue this practice. To contribute to the music world by sharing the knowledge achieved during the past and future years will be a pleasure.

Bibliography

Arnáez Nicolás, *The Use of Space in Music from 1950 onwards: A Contribution of Electroacoustics to Music Theories.* trans. Nicolás Arnáez*.* Licenciate diss., National University of Cuyo, 2009.

Eimert Herbert and Stockhausen Karlheinz. *die Reihe: Number 1, Electronic Music.* Pennsylvania: Theodore Presser Company in association with Universal Edition, 1958.

Jot, Jean-Marc. *Spat*. Computer software. *IRCAM Forumnet*. Vers. 4.7.1. IRCAM, 2013. Web. <http://forumnet.ircam.fr/product/spat/>.

Puckette, Miller, Max Mathews, and David Zicarelli. *Max*. Computer software. *Max*. Vers. 6.0.7. Cycling 74, 2013. Web. <http://cycling74.com/products/max/>.

Pulkki Ville. *Spatial Sound Generation and Perception by Amplitude Panning Techniques*. Helsinki: Helsinki University of Technology, 2001.