TERRAFORMATION: FOR VIOLIN OR VIOLA AND COMPUTER

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ABSTRACT

This paper introduces my real-time notation (RTN) work *Terraformation* (2016–17) for violin or viola and computer. Program notes, performance directions, and two score excerpts from violinist Florian Vlashi's performance on May 25, 2017 at the Third International Conference on Technologies for Music Notation and Representation are included.

1. PROGRAM NOTE

Terraformation concerns a fusion of several disparate themes. The first, and perhaps central, theme is that of terraforming. This is the hypothesized large-scale transformation of an inhospitable planetary body into one fit for Earth-like organic life. Popularized in science fiction, serious studies on the procedures for terraforming come from the gradually maturing scientific exploration programs on Earths moon, Mars, and Venus. These issues prompt reflection on humanity's history of colonialism, abuse of resources, lack of environmental concern, and how these might manifest beyond our home planet.

At the same time, *Terraformation* is inspired by Philip Johnsons sculptures and architecture at the Fort Worth Water Gardens in Fort Worth, Texas. This urban park contains several named "micro-environments": Active Water Pool, Aerated Water Pool, Quiet Water Pool, Mountain, Central Square, Stage, and Events Plaza. The style of the Gardens is minimal and angular. They give an abstracted impression of a natural landmark such as a mountain or a river canyon, ignoring many realistic details in favor of sensory appeal.

The connection between terraforming and the Fort Worth Water Gardens is humanity's attempt to fashion a world after its own design. This world has rough edges and missing details, no oceans and preciously little oxygen. Everything is synthetically derived. We bring our plants and animals, our histories and cultures. We also bring our diseases, our selfishness, and our unchecked ambitions. *Terraformation* is a creation story.

This piece uses a computer screen to display music notation that changes during the performance based on decisions made by both the musician and the computer. In this way, every performance is unique and unrepeatable.

2. PERFORMANCE DIRECTIONS

2.1 Performance Overview

Terraformation uses real-time notation and requires the performer to sight-read music as it is algorithmically generated during the performance. The goal of a performance of the piece, therefore, is not perfect adherence to the demands of the score, but a productive interaction between human and artificial intelligence. The performer should attempt to both read the music as accurately as possible and respond to it intuitively, which will in turn influence the computer's musical decisions. The piece is "cartographically" composed meaning that the large-scale structure is mapped by the composer but the surface details are left to the computer and performer to determine. The violist drives the notation forward by briefly depressing a MIDI foot switch. Pressing and holding the foot switch down will cycle through alternate paths through the piece. The pacing and direction of the piece are thus determined by the performer.

2.2 Real-Time Audio

A computer-generated audio component is generated live during the performance. A microphone placed near the performer allows the computer to analyze the performance which then influences the resulting computer-generated audio. In addition, the acoustic sound of the viola is both amplified and processed by the computer.

2.3 Real-Time Notation, Sight-Reading, and Improvisation

The notation is generated in the moment of performance and requires the performer to sight-read the notation in front of an audience. This is an incredibly vulnerable act to ask the performer to engage in. The goal of a performance of the piece, therefore, is not about perfect adherence to the demands of the score, but about the collaborative interaction between human and computer. The performer should attempt to both read the music as accurately as possible and respond to and influence the computer's musical decisions.

Although the notation for *Terraformation* is displayed with a great deal of precision, the composer realizes that the high demands of sight-reading might place the musician in a situation where a completely accurate rendering of the notation will result in a stilted performance. On the other hand, this piece requires no improvisation. For this reason, the CPN elements are supplemented with the fingerboard diagram and color gradients. It is the composer's hope that these additional notational elements can be read simultane-

ously so as to efficiently read the notation quicker and more accurately.

In conversations with violist Michael Capone, he narrated his music reading experience. He would often consult the fingerboard notation at the start of a new system, approximately placing his fingers while beginning to move the bow. Next, he would quickly assess the rhythmic figure and shape of the gesture, and begin playing the approximate rhythm and gesture. Finally, he would closely read the CPN, refining his hand position, rhythm, gesture, and other playing parameters in the process. The entire procedure could be summarized as approximation moving toward accuracy over the course of each new system of notation.

2.4 Reading Notation From A Display

Due to the real-time nature of the notation, the musical directions must be read from a computer display. In order to facilitate ease of use for the performer, the software that must be run during the performance is divided into two applications: the score application, where real-time notation will appear for the musician to read and perform, and the audio application, where a microphone input, speaker outputs, and computer processing levels are set.

2.5 Rehearsal and Example Scores

Despite the fact that you will be sight-reading during performance, this piece requires rehearsal. Rehearsal with the software will give the performer a general sense of how the piece unfolds, what you might expect to play, and an ear for the types of interactions available between computer and performer.

If rehearsal with the software is not possible, the composer can provide several example scores. These are intended to provide the performer with a sense of the work and not to be used as live performance scores.

3. PERFORMANCE HISTORY

Terraformation was premiered by violist Michael Capone on April 24, 2017 at the University of North Texas. A video of the premiere performance is available here: https://youtu.be/wrAcQiGzvVQ.

Florian Vlashi preformed the premiere of the violin version of *Terraformation* at the Third International Conference on Technologies for Music Notation and Representation on May 25, 2017 at the University of A Coruña, Spain.

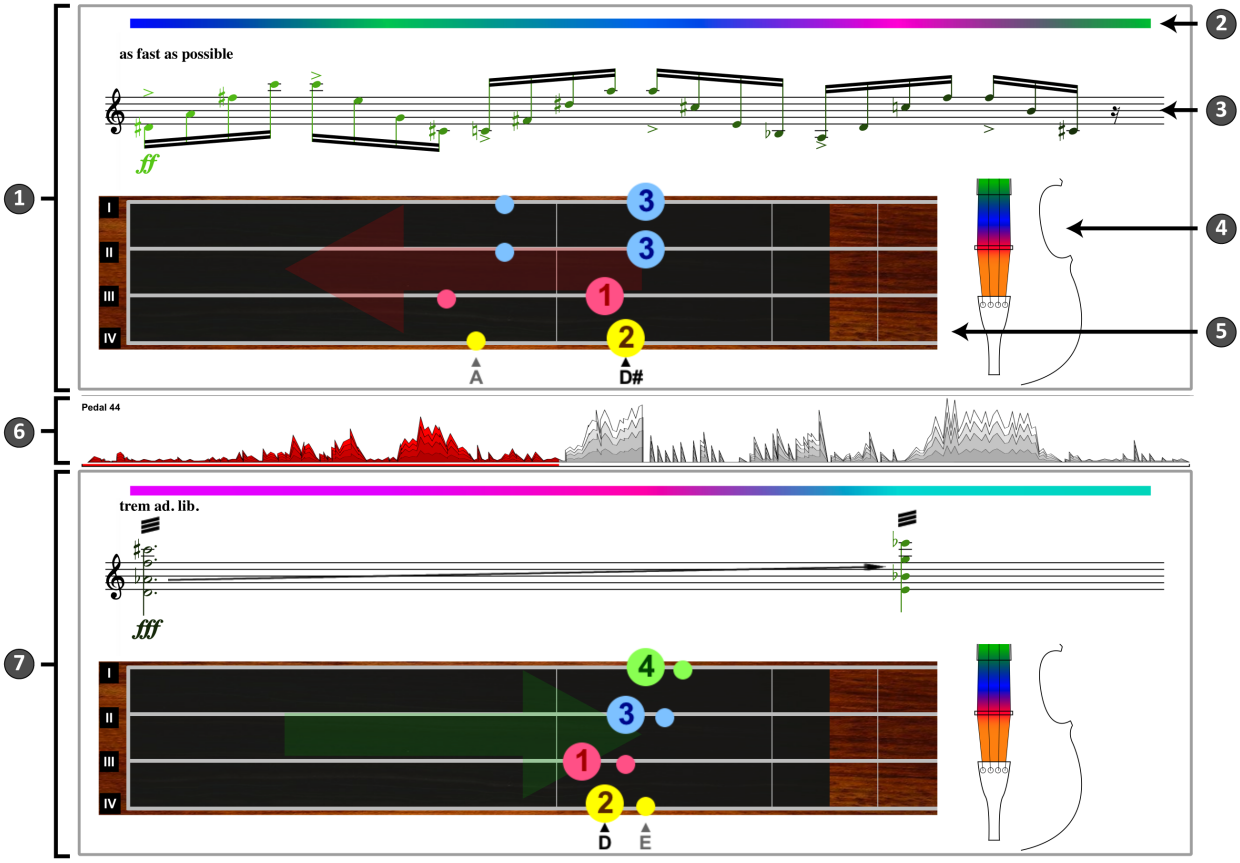
4. ACKNOWLEDGEMENTS

The composer would like to thank violist Michael Capone for his enthusiastic collaboration in the development of this piece.

5. FURTHER QUESTIONS

Please address all further questions and concerns directly to the composer at sethshafer@gmail.com. Please contact directly for links to download the performance software and example scores.

Score – Notation Window



1. **Current Staff System:** The current location in the piece is displayed in the upper section of the GUI.

2. **Bow Contact Position Gradient:** This color graphic informs the player where to place the bow on the instrument. The color matches a location shown on the viola graphic (4) and should be read left-to-right in vertical alignment with the common practice notation (3).

3. **Common Practice Notation (CPN):** The traditional symbols for pitches, rhythms, articulations, dynamics, and other playing techniques are displayed here. Text indications for tempo and character are notated in the top left corner.

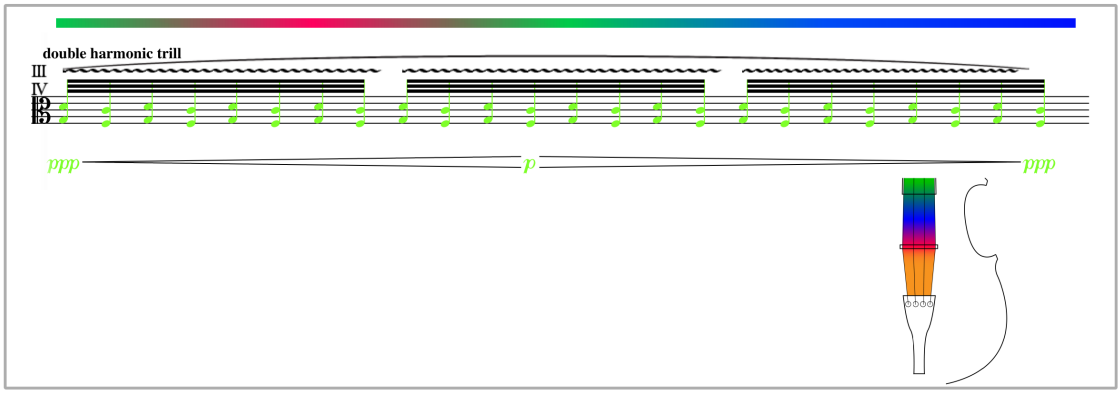
4. **Viola Graphic:** This graphic serves as a reference for the bow contact position gradient (2) showing the physical locations of the different colors.

5. **Fingerboard Notation:** This is a pictorial representation of the viola's fingerboard. Each finger is notated with a corresponding number and color on each of the instrument's strings. The pitch of the lowest string is displayed in black below. Further, the player may be asked to slide the hand position along the fingerboard to an ending location indicated by small, colored circles. The pitch of the lowest string at the terminus of a glissando is displayed in grey below.

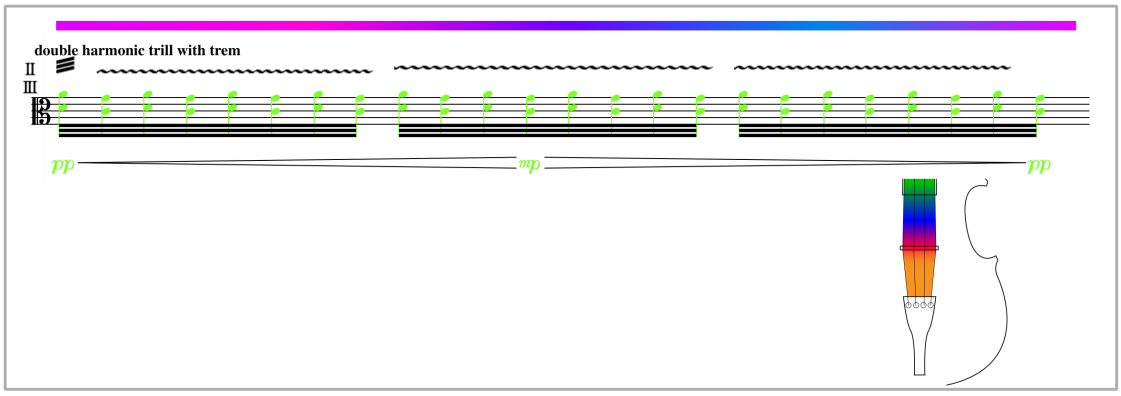
6. **Formal Map:** This graphic informs the player of their current location in the overall form. The red bar progresses from left-to-right at each press of the foot switch. The vertical axis of the graphic indicates expected areas of intense rhythms, dynamics, or range. The current system number is displayed in the upper left hand corner.

7. **Read-Ahead Staff System:** The lower section of the GUI allows the player to read ahead and anticipate upcoming material.

Performance Techniques

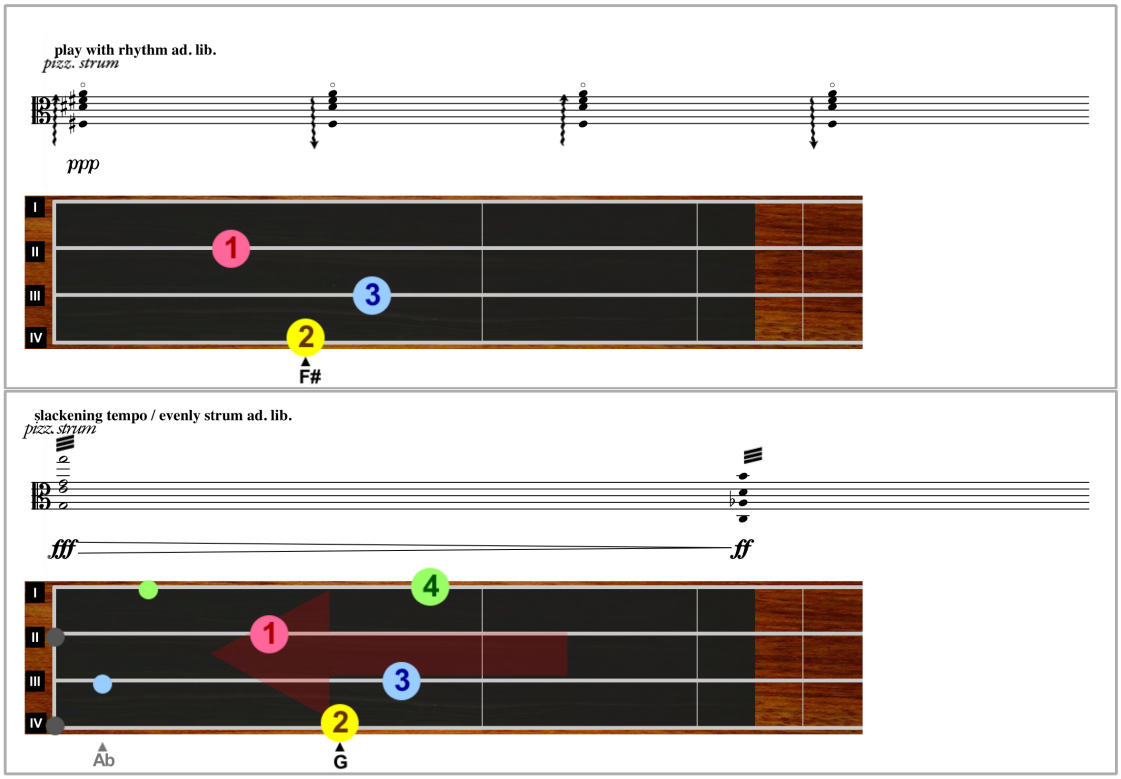


Double harmonic trill: quickly trill between two double-stopped harmonics using a legato bow. Pitches indicate fingering location. Duration of the trill can be determined by the performer rather than the exact number of notes.

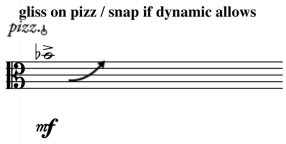


Double harmonic trill with tremolo: quickly trill between two double-stopped harmonics using a tremolo bow. Pitches indicate fingering location. Duration of the trill can be determined by the performer rather than the exact number of notes.

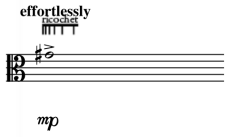
Bow behind bridge: the orange gradient above the notation indicates that the performer bow behind the bridge. Specific string and resulting pitch are indeterminate.



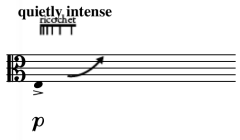
Pizzicato strum: pluck chord using fingers. Direction of the strum is either indicated with up or down arrows, or (as pictured here) is of indeterminate direction. Speed and character of the strum indicated in text.



Pizzicato glissando: pluck the string and immediately slide the left hand finger in indicated direction.



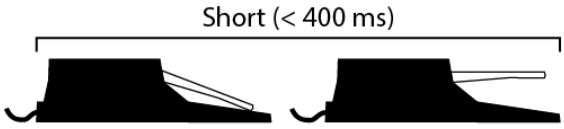
Ricochet bowing: throw down bow at the string with enough force to cause the bow to bounce on the string.

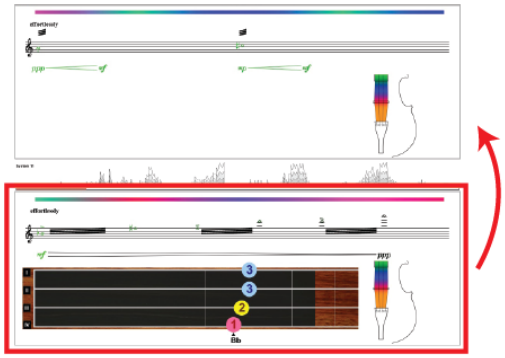


Ricochet bowing with glissando: glissando with left hand finger while performing a ricochet bow technique.

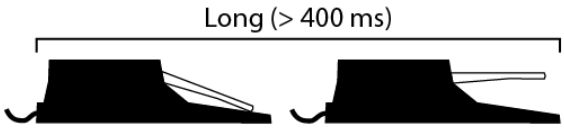
Footswitch (Pedal) Technique

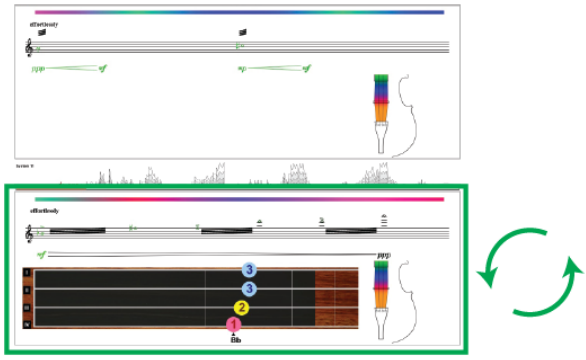
The performer controls the progression of the music by depressing a MIDI footswitch. When the performer has finished playing the music on the current staff system, a quick press and release of the footswitch will cause the music in the read-ahead staff system to move up to the current staff system.





The performer can choose alternative options from the read-ahead staff system by pressing and holding the footswitch until the read-ahead staff system refreshes. The performance can execute a “long press” as many times as they want to cycle unlimited alternative music options. When an option appears that the performer would like to play, a “short press” on the footswitch will cause it to move up to the current staff system.





Flow Between Systems

In general, the performer should strive to connect each system of notation to the next to create a seamless musical experience. However, the performer is free to speed up or slow down the pace of notation advancement in any way that they deem musical.

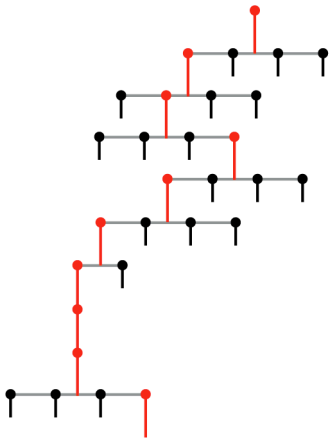
Study Scores

Overview

No single score can represent *Terraformation*. Individual performances can be captured and notated for study. Two score excerpts from the same performance on May 25, 2017 by violinist Florian Vlashi at the Third International Conference on Technologies for Music Notation and Representation are described and then presented below.

Tree Structure Score

Once selected music is selected by depressing the footswitch, the algorithms driving *Terraformation* create new notation based on the current material. The performer has the power to select what to play. This choice affects the outcome of subsequent music, which is in turn also open to performer selection. This creates a type of tree structure of performer choice where future choices are dependent on previous ones.



The notation of the piece is therefore directly shaped by the performer's selection process. The tree structure score shows the performer's choices in dark black notation connected by arrows. The light grey notation is indicative of other choices that may have been available given the number of notation-generating parameters. These parameters are printed above each system and describe the degree of variability at each moment in the piece. This single page of *Terraformation* corresponds to the first six pages of the performer's view score.

Performer's View Score

Another way to examine *Terraformation* is from the vantage point of the performer. This score captures exactly what was displayed during performance. As already described, the top system is the current staff system and the bottom system is the read-ahead staff system.

TERRAFORMATION

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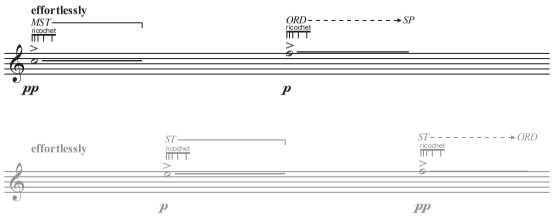
Tree structure score generated on May 24, 2017 at the Third International Conference on Technologies for Music Notation and Representation in performance by violinist Florian Vlashi

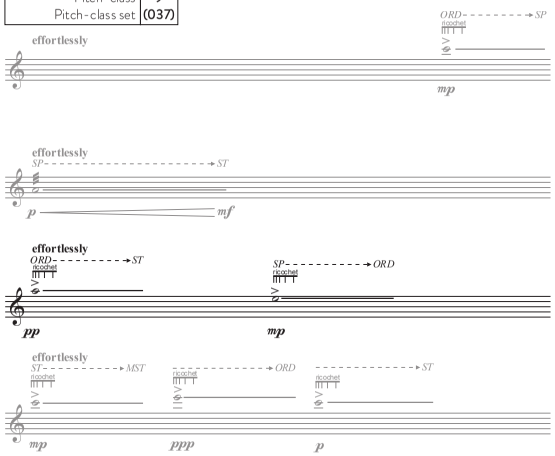
Rhythm Variables	1
Pitch Pattern Variables	1
Articulation Variables	1
Fret Range	low
Pitch-class	9
Pitch-class set	(037)

wait for tam-tam (approx 1 minute)

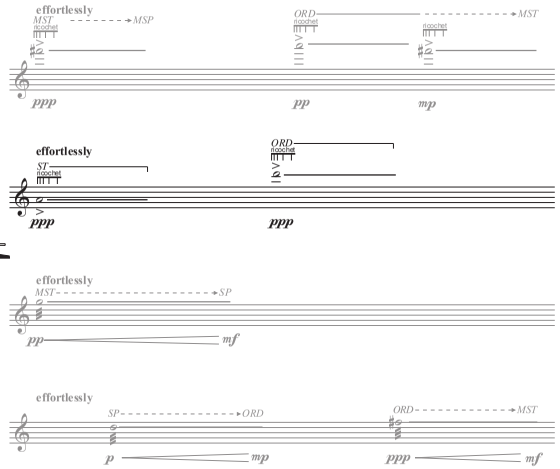
Rhythm Variables	2
Pitch Pattern Variables	2
Articulation Variables	2
Fret Range	low
Pitch-class	9
Pitch-class set	(037)



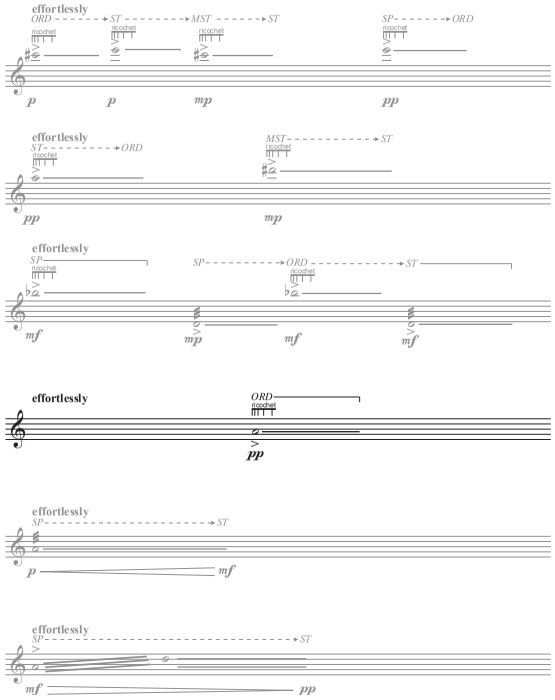
Rhythm Variables	4
Pitch Pattern Variables	4
Articulation Variables	4
Fret Range	free
Pitch-class	9
Pitch-class set	(037)



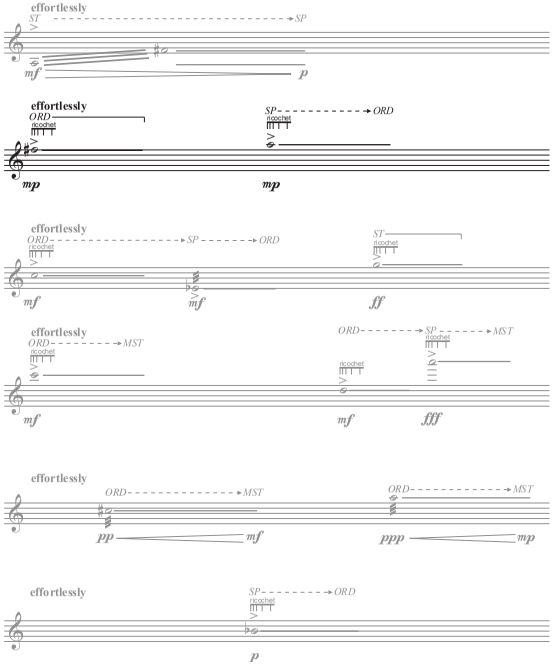
Rhythm Variables	4
Pitch Pattern Variables	4
Articulation Variables	4
Fret Range	free
Pitch-class	9
Pitch-class set	(037)



Rhythm Variables	6
Pitch Pattern Variables	6
Articulation Variables	6
Fret Range	free
Pitch-class	free
Pitch-class set	free



Rhythm Variables	6
Pitch Pattern Variables	6
Articulation Variables	6
Fret Range	free
Pitch-class	free
Pitch-class set	free



TERRAFORMATION

Performer's view score generated on May 25, 2017 at the Third International Conference
on Technologies for Music Notation and Representation in performance by violinist Florian Vlashi

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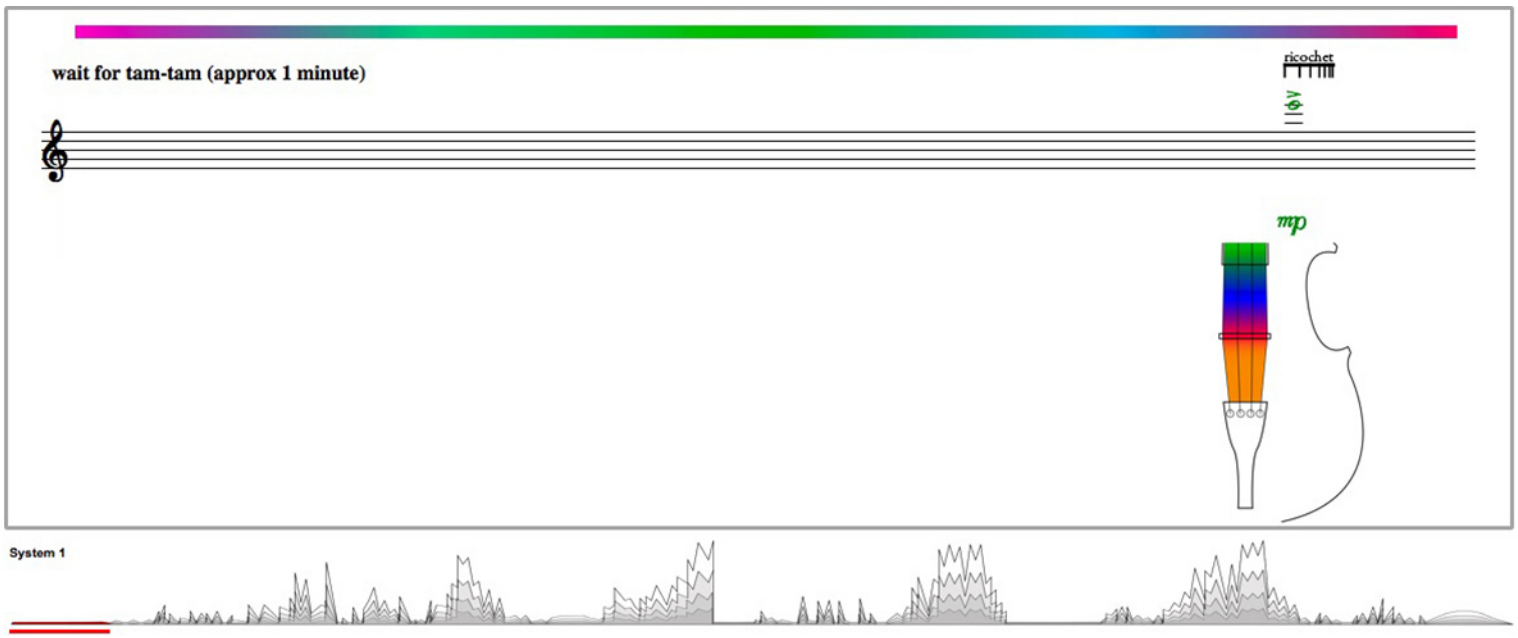
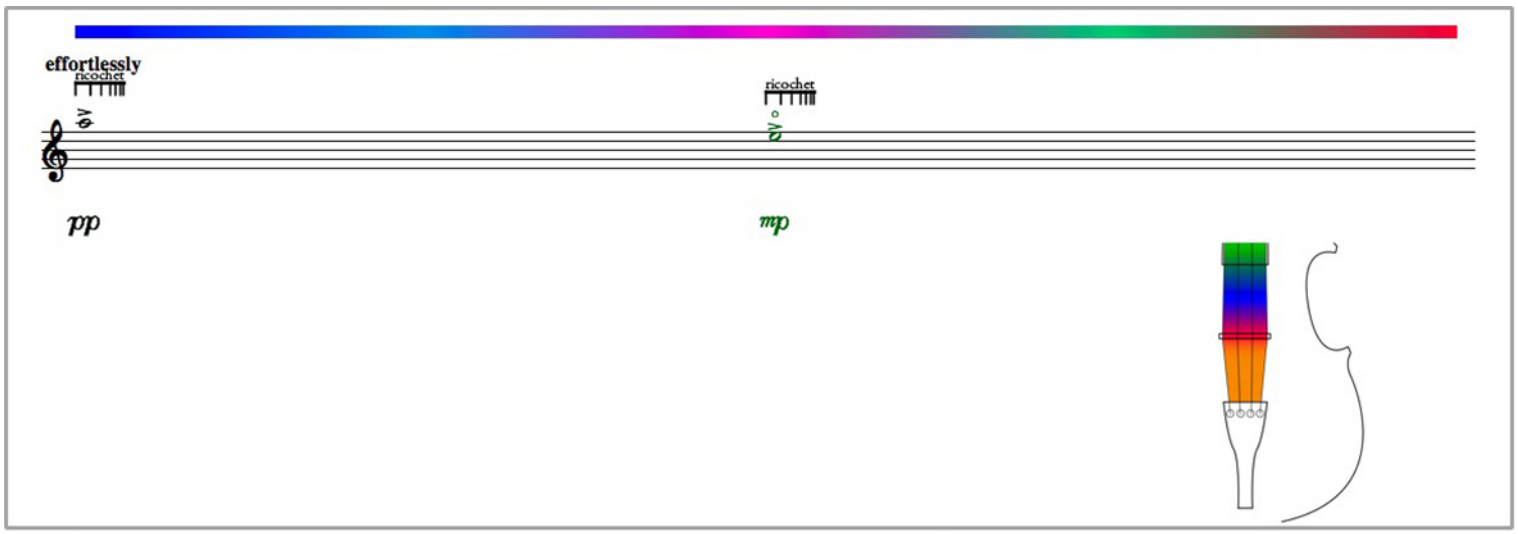
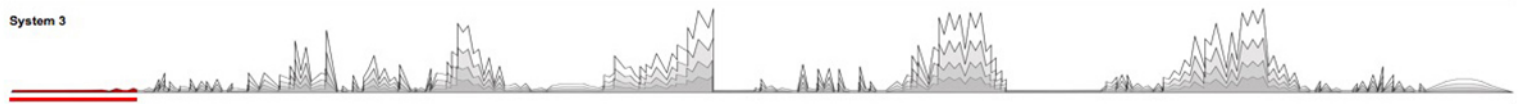




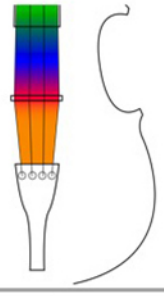


effortlessly
ricochet

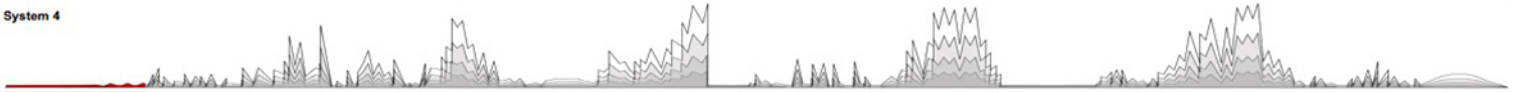
ricochet

ppp

ppp



System 4



effortlessly

ricochet

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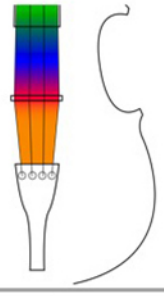
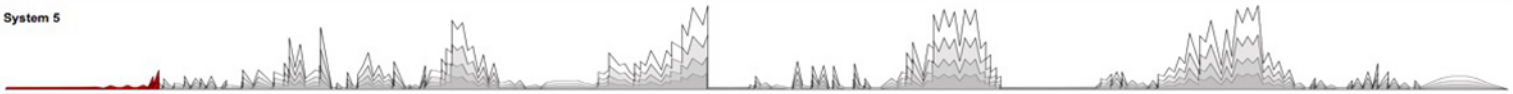


System 5



effortlessly
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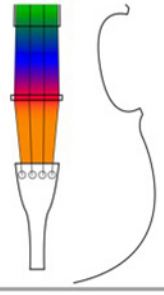
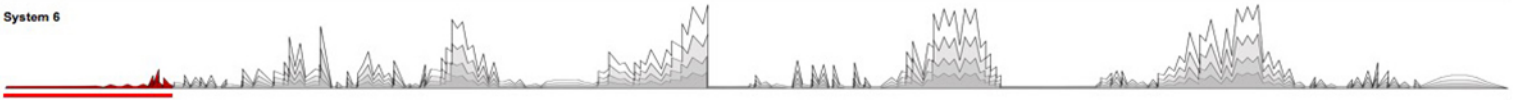


System 6



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ricochet

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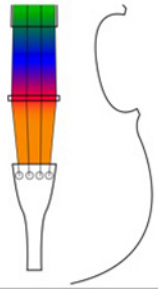


System 7

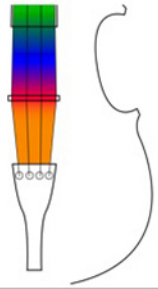
effortlessly

ricochet

pp

ricochet

p

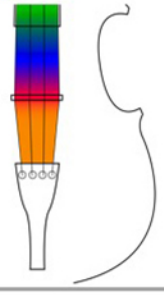


System 2

effortlessly

p *mp*

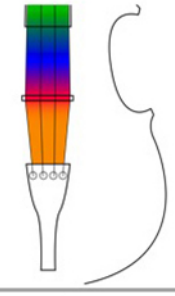
ppp *mf*



System 8

effortlessly

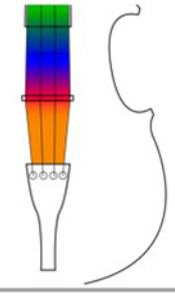
mf pp



System 10

effortlessly

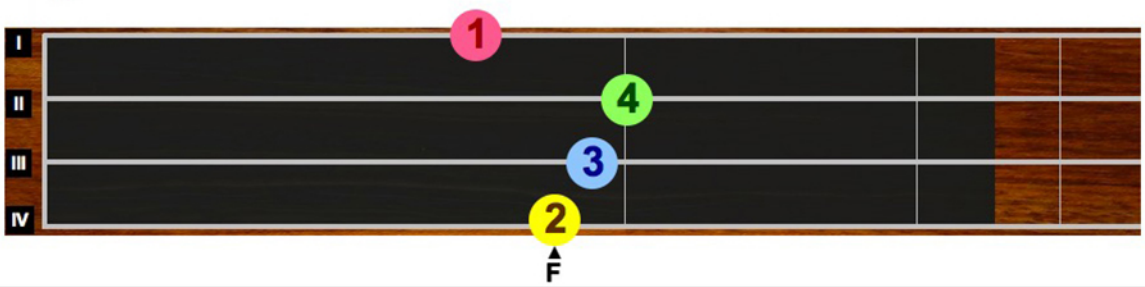
mf p

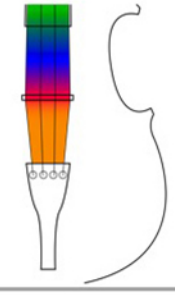


System 11

effortlessly

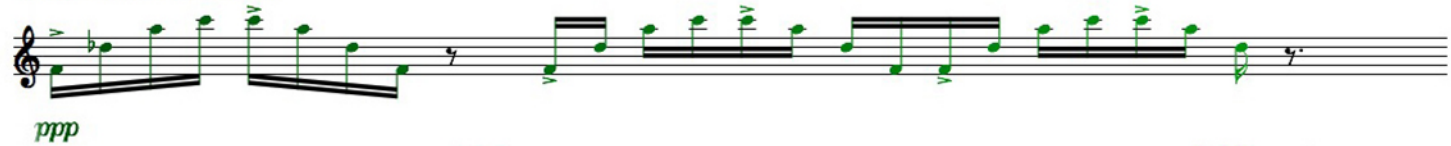
mp p



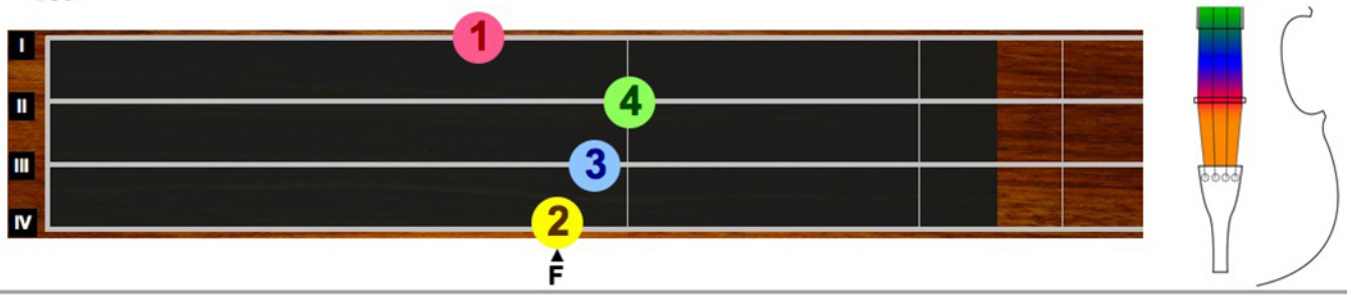


System 12

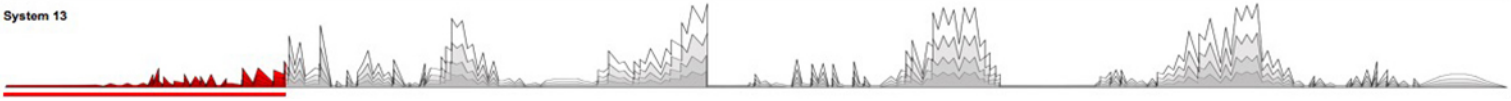
attempting to start but failing



ppp

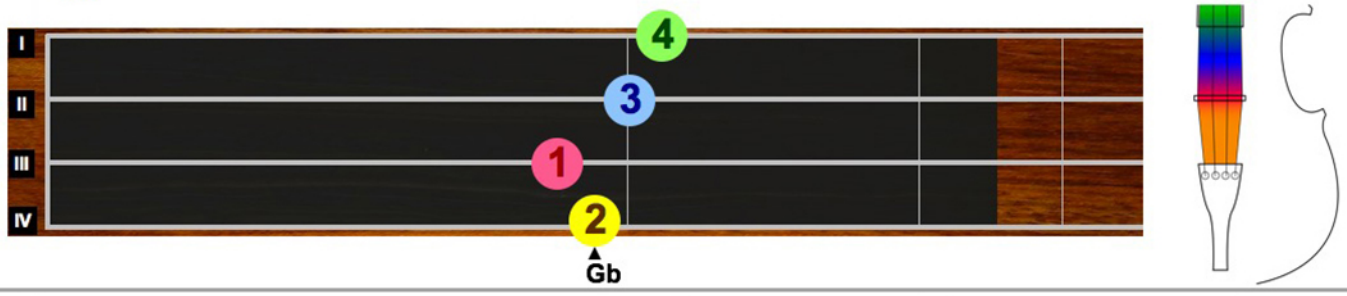


System 13

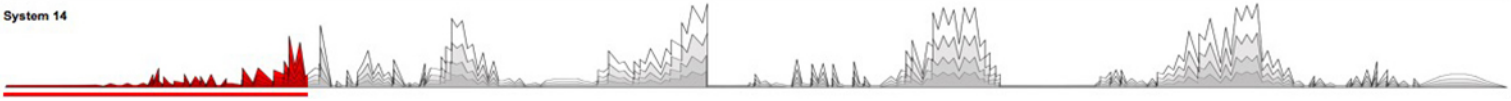


effortlessly

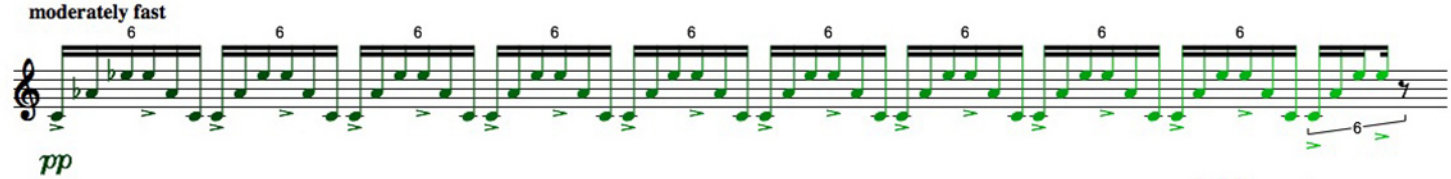
mp *mf*



System 14



moderately fast



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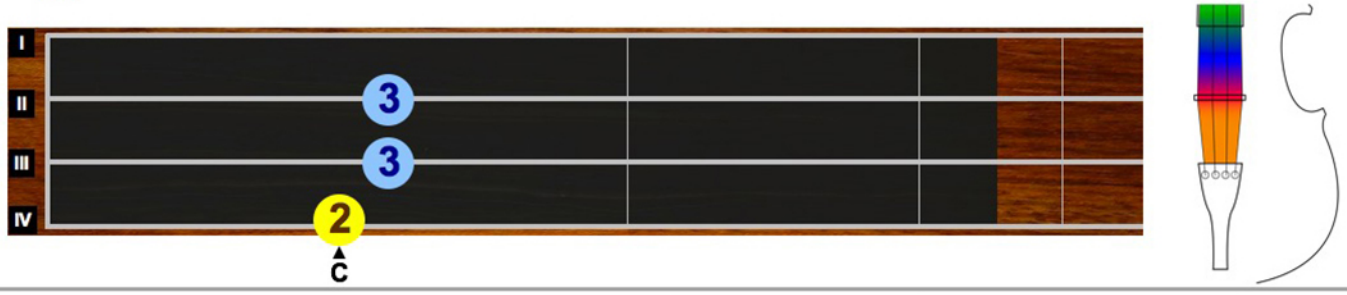

System 15