

Yongwoo Lee

Exponential Prelude

for Piano Trio
and Live Electronics

2023

PROGRAM NOTE

곡 해설

피아노 삼중주와 라이브 일렉트로닉스를 위한 곡 *Exponential Prelude*는 지수 함수(exponential function)를 적극 활용한 곡이다. 삼중주의 각 악기 소리에 반응하는 전자음향들은 시간(time)과 기울기를 매개변수로 하여, 다양한 그래프의 모양을 가지고 지수함수에서 옥타브를 등분 짓는 수(nums)에 따라 다양한 지점들의 비율을 얻어 리듬가와 음정을 얻어 실제 라이브 음원에 더하며 미분화된 미세한 소리를 다룬다. 즉, 지수 함수에서 나타나는 굴곡적인 그래프에서 발견한 함수적 특성을 악기의 음에 대응하는 인위적 하모닉스와 같은 전자음향을 만들어내는 수단으로서 활용한 것이다. 다양한 기울기(slope)와 매개변수 등으로부터 만들어지는 지수 함수에서 추출한 특정 비율의 값들은 악기의 소리 위에 마치 인위적인 배음과 같이 쌓이며, 각 배음의 리듬 또한 위의 비율에 의해 세분화된다.

함수로부터 비롯된 인위적인 배음렬(artificial harmonics series)들은 곡의 초기에는 마치 배음(overtone)의 의미와 같이 기음으로부터 점차 시간 간격을 두고 그 배음들이 나타나는 것과 같이 점진적으로 지수 함수의 기울기에 비례하여 나타난다. 그러던 전자음들은 점차 라이브 악기들의 소리에 자연 없이 즉각적으로 반응하며 연주의 라이브 음향과 딜레이를 두지 않고 인위적인 배음렬들이 실제 악기 소리와 합쳐져 하나의 음색이 되어버린다. 이러한 곡의 전개는 마치 지수 함수가 x값이 증가할수록 y값이 조밀해지는 것을 연상시키듯 리듬이 점차 조밀해지며 템포가 빨라지는 것으로 나타난 것이다. 더불어, 곡의 구성 상에 나타나는 상대적으로 협화적인 부분들은 이러한 인위적인 하모닉스들이 자연적인 배음렬로 환기되는 것을 의미하며, 이러한 특징들은 수학적인 정렬 상태와 비정렬 상태를 떠올릴 수 있게 한다.

* 괄호 안의 영어는 맥스(max)에서 강조된 매개변수들을 확인하기 쉽게 하기 위해 첨가되었습니다.

* 첨부된 시뮬레이션 음원은 사보프로그램 MIDI 음원으로부터 추출된 한계로 인해 extended technique을 비롯한 다양한 기법들이 제대로 적용되지 못하였고, 이 곡의 모든 전자음은 실제 악기에서부터 비롯된 소리이나 위와 같은 이유로 실제 공연에서의 소리와 동일하지 않습니다.

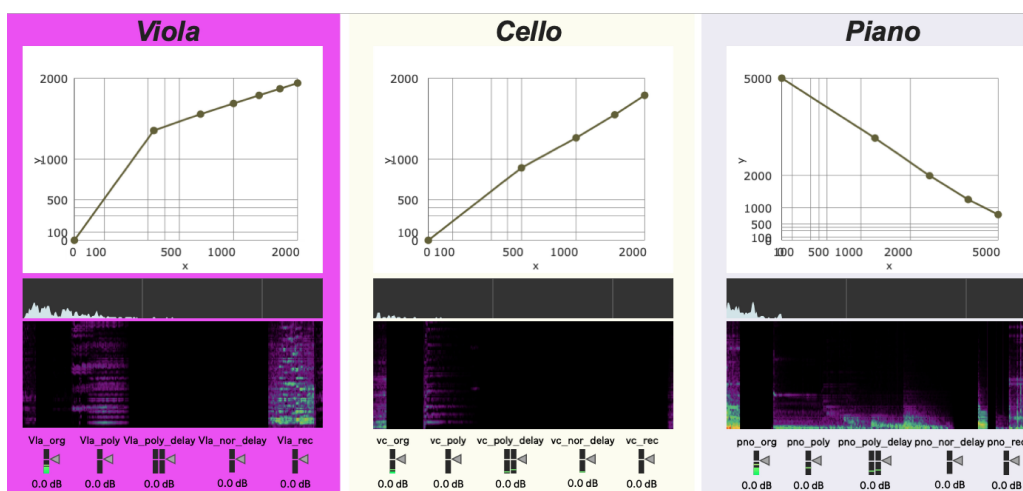
The piece *Exponential Prelude* for piano trio and live electronics extensively utilizes exponential functions. The electronic sounds, responsive to each instrument's sound in the trio, are parameterized by *time* and *slope*. They take on various shapes based on different graphs and divide octaves in the exponential function, obtaining ratios of various points according to the number of divisions (*nums*). These ratios contribute rhythm and pitch to the actual live audio, dealing with differentiated subtle sounds, microtones. Essentially, the piece employs the functional characteristics found in the exponential function, creating electronic sounds akin to artificial harmonics corresponding to an natural overtone series of instruments. The values extracted from the exponential function, derived from various *slopes* and parameters, are stacked upon the sound of the instruments, much like artificial overtones, and the rhythm of each electronics is also finely subdivided according to the above ratios.

The artificial harmonic series derived from functions gradually emerge in the initial stages of the piece, much like overtones gradually manifesting from a fundamental tone over time, in proportion to the slope of the exponential function. Meanwhile, the electronic sounds seamlessly and immediately respond to the live instruments without delay, blending the artificial harmonic series with the actual instrument sounds to form a distinctive and unified timbre. The development of the piece is reminiscent of how, as the x-values increase in an exponential function, the function's y-values become denser, just like in music, where the rhythm gradually densifies and the tempo accelerates. Additionally, the relatively consonant sections in the composition signify the transition of these artificial harmonics into natural harmonic series, evoking both ordered and disordered mathematical states.

* The italic font indicates the parameter values of Max so that they can be checked.

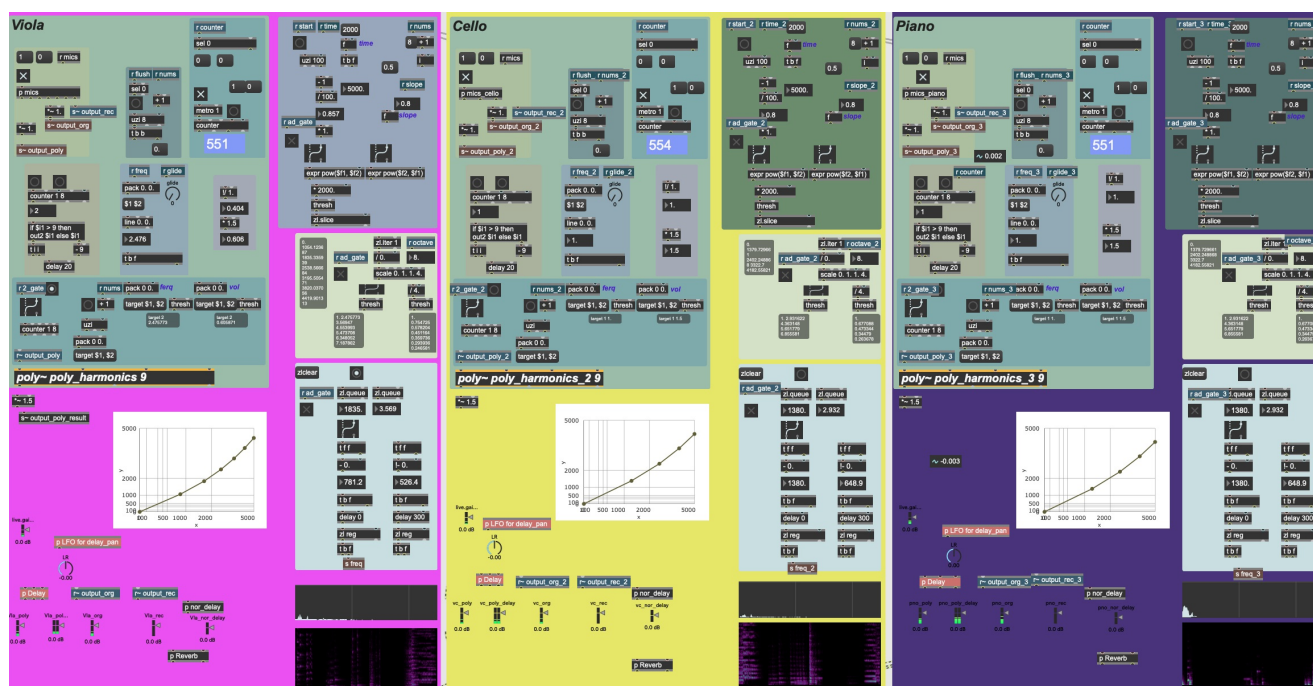
* The attached simulation sound source was not properly applied with various techniques, including extended techniques, due to the limitations extracted from the program MIDI sound source, and all electronic sounds of this piece are not the same as those of the actual performance for the above reasons.

MAX Patch



맥스로 표현된 위의 그래프는 함수의 기울기에 따라 달라지는 곡선과 그에 따른 시간과 음정의 비율을 포인트의 개수에 따라 등분하여 나타냈다. 함수에서 얻어진 다양한 포인트들은 poly~ 오브젝트를 통해 라이브 음원을 다양한 시간의 간격과 마이크로한 음정으로 pfft~를 통해 각기 프로세싱되었다. 이 곡은 4개의 마이크(vla vc. 1개씩, pno 2개)를 필요로 하며, 2ch 스테레오 환경을 대상으로 작곡되었다.

The graph above, depicted in Max, illustrates the curve that varies based on the function's slope, indicating the number of points affecting the ratio of time and pitch. The function's multiple points were processed using `pffft~` with diverse time intervals and micro pitches via the `poly~` object. This composition necessitates the use of four microphones (one for the viola, one for the cello, and two for the piano), and it was designed for a two-channel stereo environment.



NOTATION

Strings (for vla, vc.)



damping the string to make white noise (w.n.)



bowing on the bridge (o.t.b.)



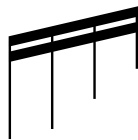
bowing behind the bridge (b.t.b.)



circular bowing (c.b.)



a highest note



notes of indefinite pitch
relating with chance music



rub the bow up and down
on the string

Piano



tap the wood located at front below the keyboard



pluck the string inside



sweep the surface of the white keys
with the fingernails to produce the noise



knock a fallboard with knuckles

Common

" *mp* "

action dynamics: intensity of playing,
not related to the absolute volume

Exponential Prelude

for Piano Trio and Live Electronics

이 용 우 (yongwoo lee)

1 Tranquillamente ♩ = 60

Viola

Violoncello

Piano

Cue

damping the string to make white noise (on the fingerboard) *con sord.* → o.t.b. (on the bridge) → b.t.b. (behinde the bridge)

pppp

damping the string to make white noise (on the fingerboard) *con sord.* → o.t.b. (on the bridge) → b.t.b. (behinde the bridge) → w.n. (white noise) *sul pont. (s.p.)*

pppp *ppp*

5

sul pont. (s.p.) *ppp* *gliss.* *w.n.* *pppp* *pp*

gliss. *w.n.* *gliss.* *s.p.* *III* *ppp*

3 4 5 6

Exponential Prelude

11

col legno
ord. w.n. → sul tasto

ppp pppp

s.p. → b.t.b. → s.p.

o.t.b. ord.

3 3

ppp

gliss.

ppp

1/4 (half sharp)

ord.

mp pizz.

pp

pizz.

8va.

8va.

Red.

7

17

rub the bow up and down on the string

w.n. (circular bowing, c.b.)

ord.

3 3 3

"mp"

pp

rub the bow up and down on the string

w.n. (circular bowing, c.b.)

ord.

3 3 3

"mp"

ppp pp

ord.

mp pizz.

pp

pizz.

8va.

8va.

Red.

8

9

Exponential Prelude

3

from indeterminate notes
to the white noise sound

21

mp

pp

w.n.

p

mf

"mp"

ppp

15ma bassa

mf

Led.

10

11

25

1/4 (half flat)

pp

mp

"mp"

(ord.)

p

col legno

mp

"mp"

p

mp

sf

12

Exponential Prelude

29 *col legno* *p* *c.b. ord.* *mf* *f*

ord. *ppp* *p* *c.b.* *mf* *f*

mp *mf* *mp* *f*

sf *8ba*

13

33 *accel.* *mp* *mp*

mp *mp*

mf *(mf)* *pp mf* *sf* *8ba*

rec 14

Exponential Prelude

5

36

mf *ppp* *mp* *ppp*

pizz. w.n. arco

(uncountable swipe but, faster than before) (ord.)

mf *ppp* *mf* *mp* *f* *sf* *sf*

15

39

3

mp *mf*

highest pitch

w.n.

p *f*

3

mf *sf*

8_{ba}

16

17

42

pizz. *mp* w.n. arco *pp* *sf* pizz. *f* w.n. arco *p* *f* highest pitch s.p.

ord. *sf* *pp* *f* *mp* *pp* *f*

15^{ma} *pp* *f* *pp* *f* 3

sf *sf* *f* *sf* 8^{ba} *sf* *sf*

18

45

w.n. *mp* circular bowing (c.b.) w.n. *mf* *f* *p*

15^{ma} *mf* *f* *mp* 8^{ba} *sf* Red.

19

Exponential Prelude

7

47

w.n. (c.b.)

Musical score for measures 47-50. The score is written for three staves: a single staff at the top, a single staff in the middle, and a grand staff (bass and treble clefs) at the bottom. The time signature is 3/4.

 Measure 47: The top staff has a melodic line starting with a half note, followed by a quarter note, and then a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern with many sixteenth notes. Dynamics include *mp* and *"mp"*.

 Measure 48: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *mp* and *"mp"*.

 Measure 49: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *sf*, *mp*, *mf*, *p*, and *p > ppp*.

 Measure 50: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *mp* and *gliss.*.

50

Musical score for measures 51-54. The score is written for three staves: a single staff at the top, a single staff in the middle, and a grand staff (bass and treble clefs) at the bottom. The time signature is 3/4.

 Measure 51: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *"mp"*, *mp*, and *p < mp*.

 Measure 52: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *mf* and *ppp*.

 Measure 53: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *p* and *mp*.

 Measure 54: The top staff has a half note. The middle staff has a half note. The grand staff has a complex rhythmic pattern. Dynamics include *mp*.

20

21

Exponential Prelude

53

pp

pp

ppp

p

pppp

ord.

s.p. arco

s.p.

sweep w/ nails

sweep the surface of the white keys with the fingernails to produce the noise

22

58

III

s.p. → w.n. → b.t.b.

ord.

gliss.

mp

pp

sweep w/ nails

ord.

gliss.

ppp " < " mp " > ppp

23

62 *sul pont.* **Adagietto** ♩ = 72

p "mp" *mp*

p *pizz.* *mf*

mp *pp* *mp*

mp "p" "mp" *p* *mf* *sf* *ppp* *mp*

8ba *24*

sweep w/ nails *ord.* (slide fingernails on wood when they're reached note 'E' then play it)

w.n. ord. arco

66 *pp* *ppp* *f* *f* *f* *mp* *sf*

ppp *f* *col legno* *mp* *sf*

(ord.) *ppp* *mp* *ppp* *mp* *p* *mf* *mp* *f*

(ord.) *ppp* *mp* *ppp* *mp* *p* *mf* *mp* *f*

25

highest pitch

accel.

69 **Adagio** ♩ = 60

Furioso ♩ = 72

arco

sf

p

pizz.

arco

mp

ppp *f*

highest pitch

mp

sf

pp

8va

Red.

26

72

pizz.

p

p

27

75 (pizz.) accel.....

sf sf sf

pizz. *pp* arco

mp p mf tap the wood located at front below the keyboard

sf sf sf

28

78 (pizz.) rit..... Adagietto ♩ = 76

p

pizz. *p*

tap the wood located at front below the keyboard

ppp p

sf sf

Exponential Prelude

82 (pizz.) *sf* *sf* *sf* *pp* *mf-pp* *accel.* *arco* *pizz.* *p* *mf-pp*

mf *p sub.*

29 30

86 *col legno* *pp mp* *pp mp cre* *pizz.* *sf cre* *knock a fallboard with knuckles* *mp* *sf* *cre*

31 32

Adagio ♩ = 60

90

ord.

scen

pp mp

do

arco

sf

scen

do

knock a fallboard with knuckles

E accel.

93

f

3

p

mf

3

3

f

3

3

sf

33

.....
97 **Furioso** ♩ = 72

f > *p* < *mp*

f > *p* < *mp*

pizz.

arco

p

f

mp

mf

p

gliss.

gliss.

gliss.

sf

sf

8va

glissando only the lowest note of the chord
(in this case, note 'C') with side palm of the hand

34

101 **accel.**.....

p

ppp < *mf*

mp

o.t.b.

o.t.b.

b.t.b.

o.t.b.

mp

f

ppp

3

f

p cresc.

sf

gliss.

8va

105 b.t.b. → o.t.b. o.t.b. → b.t.b.

f → *ppp* *mp* *f* sul pont.

o.t.b. → b.t.b. → o.t.b. *mp* *f* → *ppp* *pp* *sf* 8va

3 *gliss.* 3 *sf* 3 *mf* 3

35

108 o.t.b. → b.t.b. → o.t.b.

mp *mf* → *ppp* *arco* *mf-p sf* *mp*

o.t.b. → b.t.b. → o.t.b. *f* *mp* *f* → *ppp* *gliss.* 3 *8va* *pp* 3 *gliss.* 3 *8va* *gliss.* 3 *8va*

3 *sf* 3 *pp* 3 *8va* 3 *gliss.* 3 *8va*

3 *gliss.* 3 *8va*

rit.

pluck the string from the fingerboard
to the right above the bridge then
back to the fingerboard

111

pizz.

o.t.b.

position ord. (pizz.)

mf > ppp

ppp

36

115 Adagietto ♩ = 72

(pizz.)

mf

mf

sf

pp

3

mp

mf

8va

8va

8va

8va

37

Exponential Prelude

17

119

119

8

38

f *mp*

f *mp*

sf

sf

gliss.

122 **F** Più mosso ♩ = 90

122 **F** Più mosso ♩ = 90

(pizz.)
mp

mp

mp dolce

mp dolce

125

Musical score for measures 125-139. The score is written for three staves: Treble, Bass, and Piano. The key signature is one flat (B-flat), and the time signature is 2/4. The Treble staff features a melodic line with triplets and accents, marked *sf*. The Bass staff has a melodic line with triplets and accents, marked *mf* and *sf*. The Piano part consists of sixteenth-note arpeggiated figures in both hands, marked *sf* and *mp*. Measure 139 is marked with a box containing the number 39.

128

G Adagietto ♩ = 72

Musical score for measures 128-141. The score is written for three staves: Treble, Bass, and Piano. The key signature is one flat (B-flat), and the time signature is 2/4. The Treble staff features a melodic line with triplets and accents, marked *f* and *mp*. The Bass staff has a melodic line with triplets and accents, marked *f* and *mp*. The Piano part consists of sixteenth-note arpeggiated figures in both hands, marked *f* and *mp*. Measure 140 is marked with a box containing the number 40, and measure 141 is marked with a box containing the number 41.

highest pitch

132

f *mf* *fp* *f* *f* *mf* *ff*

f *fp* *f* *f* *mf* *ff*

f *sf* *f*

gliss. *sf*

15ma bassa
Red.

2/4 3/4 2/4

highest note

135

sf *f*

sf

f *sf* *sf*

(15)
(Red.) *sf*

42

2/4 3/4

138

Measures 138-140 of the musical score. The score is written for three staves: Treble, Bass, and Grand Staff. The time signature changes from 2/4 to 3/4. The key signature has one sharp (F#). The music features a variety of dynamics including *f* (forte), *p* (piano), *pizz.* (pizzicato), and *sf* (sforzando). A 15-measure bass line is indicated with a bracket and the text "15ma bassa". A box containing the number 43 is located at the bottom left of the page.

141

Measures 141-143 of the musical score. The score is written for three staves: Treble, Bass, and Grand Staff. The time signature is 3/4. The key signature has one sharp (F#). The music features a variety of dynamics including *p* (piano), *mf* (mezzo-forte), and *pizz.* (pizzicato). A box containing the number 44 is located at the bottom center of the page.

145 *accel.*..... *Moderate with tension* ♩ = 90

p

p

p

pizz.

8ba *8ed.*

45

150

arco

mf *sf*

arco

pizz.

mf

8ba

46

knock a fallboard
with knuckles

155

arco *f* *sf* gliss.

arco *f* *sf* gliss.

15ma bassa *sf* *mp* *mf*

Leg.

157

H Lento ♩ = 60
w.n.

sf *ppp*

sf *pizz.* *p*

f *p* *8va* *p dolce*

15ma bassa *sf* *mp* *mf*

47

161

mp

ppp

sul tasto arco

pizz.

mp

(8)

3

(20.)

165

accel.

mf

mf

sf

sf

3

4/4

Exponential Prelude

Più mosso ♩ = 72

168

Measures 168-171 of the Exponential Prelude. The score is written for three staves: Treble, Bass, and Piano. The key signature is B-flat major (two flats). The time signature is 4/4. Measure 168 features a treble staff with eighth-note patterns and a bass staff with a triplet of eighth notes. Measure 169 includes a piano part with a triplet of eighth notes and a glissando. Measure 170 shows a treble staff with a triplet of eighth notes and a bass staff with a triplet of eighth notes. Measure 171 features a treble staff with a triplet of eighth notes and a bass staff with a triplet of eighth notes. A box labeled '48' is present in the piano part.

171

Measures 171-174 of the Exponential Prelude. The score is written for three staves: Treble, Bass, and Piano. The key signature is B-flat major (two flats). The time signature is 4/4. Measure 171 features a treble staff with a triplet of eighth notes and a bass staff with a triplet of eighth notes. Measure 172 includes a piano part with a triplet of eighth notes and a glissando. Measure 173 shows a treble staff with a triplet of eighth notes and a bass staff with a triplet of eighth notes. Measure 174 features a treble staff with a triplet of eighth notes and a bass staff with a triplet of eighth notes. A box labeled '48' is present in the piano part.

174

just act like to play the notes
but do not produce the sound

pp

just act like to pizz. the notes
but do not produce the sound

pp

3

just act like to play the notes
but do not produce the sound

3