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Orders of Magnitude: Three Works for Instruments and Electronics

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Author
Einbond, Aaron Michael

Publication Date
2009

Peer reviewed|Thesis/dissertation

Orders of Magnitude:
Three Works for Instruments and Electronics

by

Aaron Michael Einbond

A.B. (Harvard University) 2000

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Music

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Edmund Campion, Chair
Professor David Wessel
Professor Cindy Cox

Fall 2009

Abstract

Orders of Magnitude:
Three Works for Instruments and Electronics

by

Aaron Michael Einbond

Doctor of Philosophy in Music

University of California, Berkeley

Professor Edmund Campion, Chair

Orders of Magnitude comprises three works for acoustic instruments and live

electronic sounds: *Temper* for bass clarinet and electronics, *Beside Oneself* for viola and

electronics, and *What the Blind See* for bass clarinet, viola, harp, piano, percussion, and

electronics. The works may be performed together in this order or separately. All works

are performed using an interactive electronic patch programmed by the composer in the

computer program *Max/MSP*.

The works respond to the question of how to organize noise-based sounds, arising

from extended instrumental playing techniques, into a flexible and expressive live-

electronic environment. The process of rapidly analyzing the live instrumental sounds

and synthesizing responses based on their timbre becomes the basis of the work's

structural logic. This technique is carried to a further degree in the notated score, where

the computer programs *Max/MSP* and *OpenMusic* are used to produce timbrally-coherent

acoustic combinations and trajectories that would be difficult to imagine otherwise.

The works are united musically by their instrumentation, their material, and by their

treatment of figurative scale. The temporal proportions of *Temper* and *Beside Oneself* are recast in *What the Blind See* transformed by different factors. Internally the works recall materials at different orders of magnitude, for example the conclusions of *Temper* and *What the Blind See* in which the material of the entire piece is compressed into increasingly concentrated outbursts.

The instrumental playing techniques and their amplification also relate to the notion of scale: certain gestures that are almost inaudible and invisible are amplified and brought into relation with material far different in its natural proportions. For example the opening of *Beside Oneself* and *What the Blind See* for viola is related to the close of *Temper* and *What the Blind See* for bass clarinet, in both of which punctual gestures alternate with silence. Finally, scale is treated in the spatialization of the works, which progresses from stereo to 4-channel to 8-channel and gradually fills the acoustic space with an increasingly-coherent landscape of electronic sound where gestures are spatialized in real time based on a mapping of their timbres.

To My Parents

And My Teachers

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Acknowledgements

ORDERS OF MAGNITUDE

I. *Temper* for bass clarinet and electronics

Written for Florent Gerenton for the Festival MANCA, Nice, France, 2006.

The bass clarinet sounds as if constantly on the verge of hysterics: its low register never far from breaking, squeaking, and splitting into multiphonics. These choleric fits are explored through a rotating sequence of multiphonic harmonies. Computer analyses of these sounds are resynthesized in response to the live clarinetist, shadowing him with evolving resonances, sonic X-rays. Despite repeated attempts at decorum, another outburst is always just beneath the surface. A clarinetist myself, it is a self-portrait. I dedicate *Temper* to my advisor Edmund Campion and his encouragement to push oneself to extremes.

II. *Beside Onseself* for viola and electronics

Written for Ellen Ruth Rose for Ensemble Earplay, 2007-08.

> *Most people think what could I do, I think what shouldn't I do. What I should do perhaps is involved with the fact that I'm Jewish and what is known as Jewish paranoia. I don't feel comfortable enough to feel that everything is on my side and that it's going to work just the way I want it.*
> --Morton Feldman

In *Beside Oneself* the violist alternates obsessively among a repertoire of gestures, testing the different responses they elicit from the electronics. Not until the end can she settle on a tenor incantation that unites the other gestures and the electronics into a plaintive call. The work takes as its point of departure *Temper* for bass clarinet and live electronics, written for the 2006 Festival MANCA in Nice, France. Computer analyses of complex sounds from the viola and bass clarinet are treated as models, re-sculpted, and

combined to produce a new environment in which their distinctions are blurred. I dedicate *Beside Oneself* to the memory of great composer and teacher Andrew Imbrie. The final elegaic melody is a tribute to his saying "music is singing and dancing."

III. *What the Blind See* for bass clarinet, viola, harp, piano, percussion, and electronics

Commissioned by IRCAM / Centre Pompidou for Ensemble L'Instant Donné and the Festival Agora, 2008-09.

What the Blind See takes as its point of departure the sonic and visual imagery of science: stars and particles, the infinitely small and infinitely large. Written in coordination with video artist Pierre Edouard Dumora, we attempted to realize a modular project, each part complemented by the other. The film alludes to an unheard musical work; the music evokes images isolated and abstracted from the film narrative. But all is unified by the notion of scale: perspectives that are distant and desolate, or close and distorted.

The microscopic sounds of the instruments are amplified with contact microphones, as if captured by scientific instruments. The electronics are modeled on field recordings of rain and snow, diffracted and projected in space. These "concrete" sounds from instruments and natural sources are manipulated using tools developed at IRCAM in Paris and inspired by research in music cognition. The title, taken from an article by neurologist Oliver Sacks, suggests perception as the focus of the listening experience.

I dedicate *What the Blind See* to Philippe Leroux and his insistence that we "continue to go farther."

Instrumentation

Viola (scordatura C → B flat)

Bass clarinet in B flat, notated at *fingered* pitch.

Harp (with triangle beater, plastic plectrum, knitting needle, and contrabass bow)

Piano (with plastic plectrum, wooden snare drum stick, knitting needle, and plastic fishing line)

Perussion (1 player):
> Vibraphone (motor with adjustable velocity)
> Marimba (5 octaves)
> 6 Crotales (F#6, C#7, D#7, E7, A7, B7)
> Tam tam (large symphonic)
> Bass drum (large symphonic)
> mallets: very hard Vibraphone mallets, superball mallets with wooden handles, brass glockenspiel mallets, wire brushes, wooden bundles, pine cone, and contrabass bow.

Notes

1/4-tone above, below. Accidentals hold for the entire measure.

Gradual change between playing techniques.

Black diamond noteheads indicate a quarter-note value. Hollow diamond noteheads.are used to indicate all other values.

Gracenotes before the beat and   on the beat to be played as fast as possible.

Deceleration, beginning as fast as possible.

Clef used for un-pitched playing techniques, indicating the relative register on the instrument.

Viola:

Scordatura, written at the *sounding* pitch.

m.s.p.   *molto sul ponticello* (directly on the bridge).
s.p.   *sul ponticello* (near the bridge).
s.t.   *sul tasto* (near the tailpiece).
m.s.t.   *molto sul tasto* (directly on the tailpiece).
c.l.b., c.l.t.   *col legno battuto, tratto* (wood of the bow without hair).
1/2 c.l.b.   1/2 *col legno battuto* (wood of the bow with some hair).

Dampen the string with several fingers to produce white noise without pitch.

Exaggerated bow pressure to produce a distored sound with some of the indicated pitch remaining.

Play between the bridge and the tailpiece.

Strike the table of the instrument with the fingers near the indicated position:

Natural harmonic at the indicated pitch, two octaves above the G-clef.

With the string dampened, ricochet *c.l.b.* while moving the bow toward (or away from) the bridge to produce a *glissando* up (or down).

With the string dampened, slide the hand in the indicated direction to produce a *glissando* of filtered noise.

Bass clarinet:
tk   Double-tongue.

Colored breath with some pitch.

Breath or articulation alone to produce white noise with no pitch.

4

 Key noise *ad lib.* following the approximate register indicated.

 Tongue slap combined with colored breath.

 Tongue as fast as possible for the duration indicated by the large note.
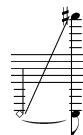
 Explore the partials of a multiphonic following the indicated contour.

Bass clarinet fingerings:

Harp:

 The C1 and F3 strings are retuned to the indicated pitches. The score is written at the *sounding* pitch.

 The indicated strings are muted with a cloth woven between the strings.

 The indicated strings are muted with a piece of paper woven between the strings.

Xylophonic sound: play while pressing on the string with the other hand near the table.

Dampened: play while pressing with the other hand in the middle of the string.

Draw a plectrum along the string lightly and quickly.

Play the strings between the nuts and tuning pegs.

On the tuning pegs, *glissando* while applying pressure.

Strike the table or back of the instrument with the palm, fingers, or fingernails.

Draw the palm lightly along the table to produce a sustained white noise without pitch.

Piano:

Prepare the three indicated strings with plastic fishing line, rosined and threaded around the strings.

Play on the keyboard while muting the string near the nut to produce some pitch.

Play on the keyboard while muting the string in the center to produce almost no pitch.

Play on the keyboard while touching the string lightly in the center to produce a harmonic-rich sound.

Draw a plectrum along the string lightly and quickly toward the keyboard.

Draw the plectrum along the string with pressure to produce the indicated rhythm against the coils.

Play on the strings between the nuts and tuning pegs.

On the sides of the tuning pegs, *glissando* while applying pressure

Play on the metal harp.

Draw a mallet along the harp to produce a sustained white noise.

Tremolo with a mallet on the harp, moving toward or away from the keyboard to produce a *glissando*.

Percussion:

"Dead stroke": strike while leaving the mallet in contact with the instrument to dampen the sound.

Play on the resonant tubes of the Vibraphone or Marimba in the approximate register indicated.

Vibraphone and Marimba: draw the mallet along the key or resonant tube to produce a sustained sound. With superball add pressure to produce a distorted sound with some of the indicated pitch remaining.

Tam tam and Bass drum: draw the hand or mallet in a curve along the surface of the instrument to produce a sustained sound accentuating the friction with the skin or metal. With superball add pressure to produce a sustained pitch.

Draw the superball lightly over the instrument to produce a fine staccato at the indicated pitch.

Technical Specifications

TEMPER

Aaron Einbond

Premiere 9 November 2006, Festival Manca, Nice, Florent Gerenton bass clarinet.

Equipment
- 2 cardioid microphones (Neumann KA 140/KM 184)
- 1 pedal (optional)
- mixer, 4 ins, 3 outs, plus additional outs to speakers in hall
- stereo reverb
- 2 speakers on stage, additional speakers in hall as available
- 1 Apple MacBook Intel 2.0 GHz, 1GB RAM, Max/MSP 4.6
- 1 audio interface, 1 in, 2 outs, 1 pedal in (optional)

Audio Connections
- 2 mics -> 2 ins console -> reverb -> 2 outs console -> 2 speakers on stage
- 1 out console (2 mics summed) -> 1 in interface
- 2 outs interface -> 2 ins console -> 2 speakers on stage and speakers in hall

The two microphones are placed close to the left-hand keys and to the bell of the bass clarinet, respectively. The bass clarinet is reinforced, with light reverb, only in the onstage speakers. The two channels of the electronics are diffused in all of the speakers in the hall.

One or two assistants are required to trigger the electronic events (or they are triggered with optional pedal by the clarinetist), adjust the amplification of the clarinet, and diffuse the electronic sounds throughout the hall.

The provided electronic patch, written in Max/MSP 4.6, plays recorded sound files, granulation (excited by the amplitude envelope of the clarinet), and resonances (excited by the signal of the clarinet). The placement and level of microphones and speakers must be carefully adjusted to avoid feedback from the resonances.

ircam
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Pompidou

Technical Specifications

BESIDE ONESELF

Aaron Einbond

Cursus 1 in Music Composition and Technologies, IRCAM, Paris.
Premiere 11 February 2008, Earplay Ensemble, San Francisco, Ellen Ruth Rose Viola.
Atelier 9 February 2008, IRCAM, Adrian LaMarca, viola.
Aaron Einbond, Alexis Baskind, and John MacCallum, technical realization.

Equipment
- 1 DPA microphone affixed to tailpiece
- 1 MIDI pedal (optional)
- mixer, 5 ins, 6 outs, plus additional outs if available
- stereo reverb
- 4 channel output, distributed among speakers in hall as available
- 1 Apple MacBook Intel 2.0 GHz, 1GB RAM, Max/MSP 4.6.3 with FTM 3.0.
- 1 audio interface, 1 in, 4 outs, 1 pedal in (optional)

Audio Connections
- mic -> console -> reverb -> console -> speakers 1-2
- mic -> console -> 1 in interface
- 4 outs interface -> 4 ins console -> 4 speakers on stage and in hall, more if available

- Approximate speaker placement:

<div align="center">

Viola

1   2

Audience

3   4

</div>
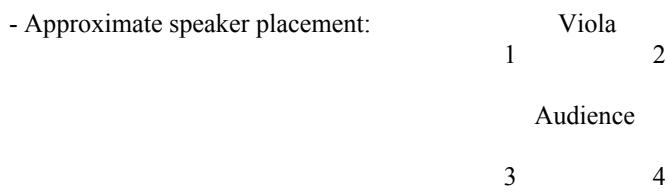
One microphone, preferably model DPA 500, is affixed to the tailpiece pointing towards the bridge.   The viola is reinforced, with light reverb, only in the onstage speakers. Amplification may be adjusted to give extra reinforcement at quiet passages.

The electronic events are triggered by the violist with the pedal, or from the computer by an assistant who may also adjust the amplification of the viola and diffuse the electronic sounds.

The electronic patch provided requires the computer program Max/MSP 4.6 and the signal processing package FTM 3.0. The audio input to the patch may be lightly compressed. The placement and level of microphones and speakers must be carefully adjusted to avoid feedback.

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Technical Specifications

WHAT THE BLIND SEE

Aaron Einbond

Cursus 2 in Music Composition and Technologies, IRCAM, Paris.
Premiere 13 June 2009, Ensemble L'Instant Donné, CentQuatre, Festival Agora, Paris.
Aaron Einbond and Eric Daubresse, technical realization.

Equipment
- 2 Apple MacBooks Intel 2 GHz, 4GB RAM, Max/MSP 4.6.3 with FTM 2.3.7
- 2 audio interfaces (RME Fireface 800, 400, or similar)
- 2 MIDI pedals and interface
- 8-channel output, plus additional speakers to amplify the ensemble
- microphones as necessary to amplify and treat the five musicians (see attached diagram of microphones used for the premiere)

- Approximate speaker placement: Stage

                                                            2
                                                    1   3

                                        8   Audience   4

                                            7   5
                                                    6
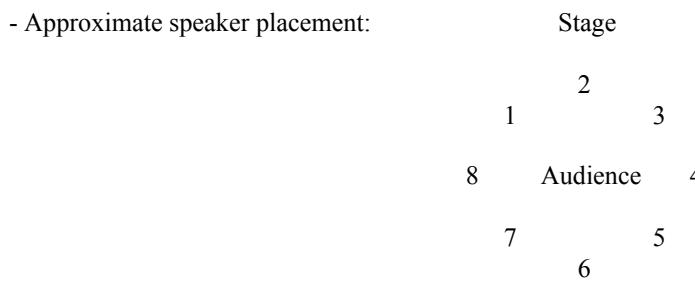
Microphones are chosen to give as close an amplification of the quiet sounds of the ensemble as possible. Contact microphones may be used on certain instruments: Schertler contact microphones on the surface of the bass drum and metal interior of the piano, Accusound contact microphones on the surface of the tam tam and table of the piano, and DPA microphones clipped on the tailpiece of the viola and interior of the harp. These are complemented with aerial microphones (see attached diagram).

The electronic events are triggered by the violist and bass clarinetist with the pedals, or from the computer by an assistant. The two pedal sources are not differentiated in the patch.

The electronic patch provided requires the computer program Max/MSP 4.6.3 and the signal processing package FTM 2.3.7. The audio input to the patch may be lightly compressed.

What the Blind See — Interface Audio Connections

Patch Concert   --- Aaron EINBOND - AGORA 09

		Instrument	MAX/MSP Input	ADC input							
				1	2	3	4	5	6	7	8
Fireface 800	Port ADAT 1 Input	Alto DPA	13	■							
		Clarinet aérien up	14		■						
		Harpe DPA in	15			■					
		Piano aérien up	16				■				
		Vibra	17					■			
		Marimba	18						■		
		Grosse caisse aérien up	19							■	
		Tam aérien up	20								■
	Analog IN	Piano Schertler	7				■				
		Piano Accusound	8				■				
		GC Schertler	9							■	
		Tam Accusound	10								■
		Retour CataRT	1								
		Retour CATART	2								

			MAX/MSP Output	DAC							
				1	2	3	4	5	6	7	8
Fireface 800	Port ADAT 1 Output	HP 1	13	■							
		HP 2	14		■						
		HP 3	15			■					
		HP 4	16				■				
		HP 5	17					■			
		HP 6	18						■		
		HP 7	19							■	
		HP 8	20								■
	Analog OUT	Audio to CataRT (FF400)	1	Sortie sur analog 1							
		Audio to CataRT (FF400)	2	Sortie sur analog 2							

Pour ADC 4 : mixage dans Fireface mixer de 16 + 7 +8 ou dans Max/MSP….
Pour ADC 7 : mixage dans Fireface mixer de 19 + 9 ou dans Max/MSP…..
Pour ADC 8 : mixage dans Fireface mixer de 20 + 10 ou dans Max/MSP…..

		Instrument	MAX/MSP Input	ADC input							
				1	2	3	4	5	6	7	8
FireFace 400	Analog	Audio from Fireface 800	1	■							
		Audio from Fireface 800	2		■						
			MAX/MSP Output	DAC							
				1	2	3	4	5	6	7	8
	Port ADAT 1 Output	HP 1	13	■							
		HP 2	14		■						
		HP 3	15			■					
		HP 4	16				■				
		HP 5	17					■			
		HP 6	18						■		
		HP 7	19							■	
		HP 8	20								■
	Analog	Audio to FireFace 800	1	Sortie sur analog 1							
		Audio to FireFace 800	2	Sortie sur analog 2							
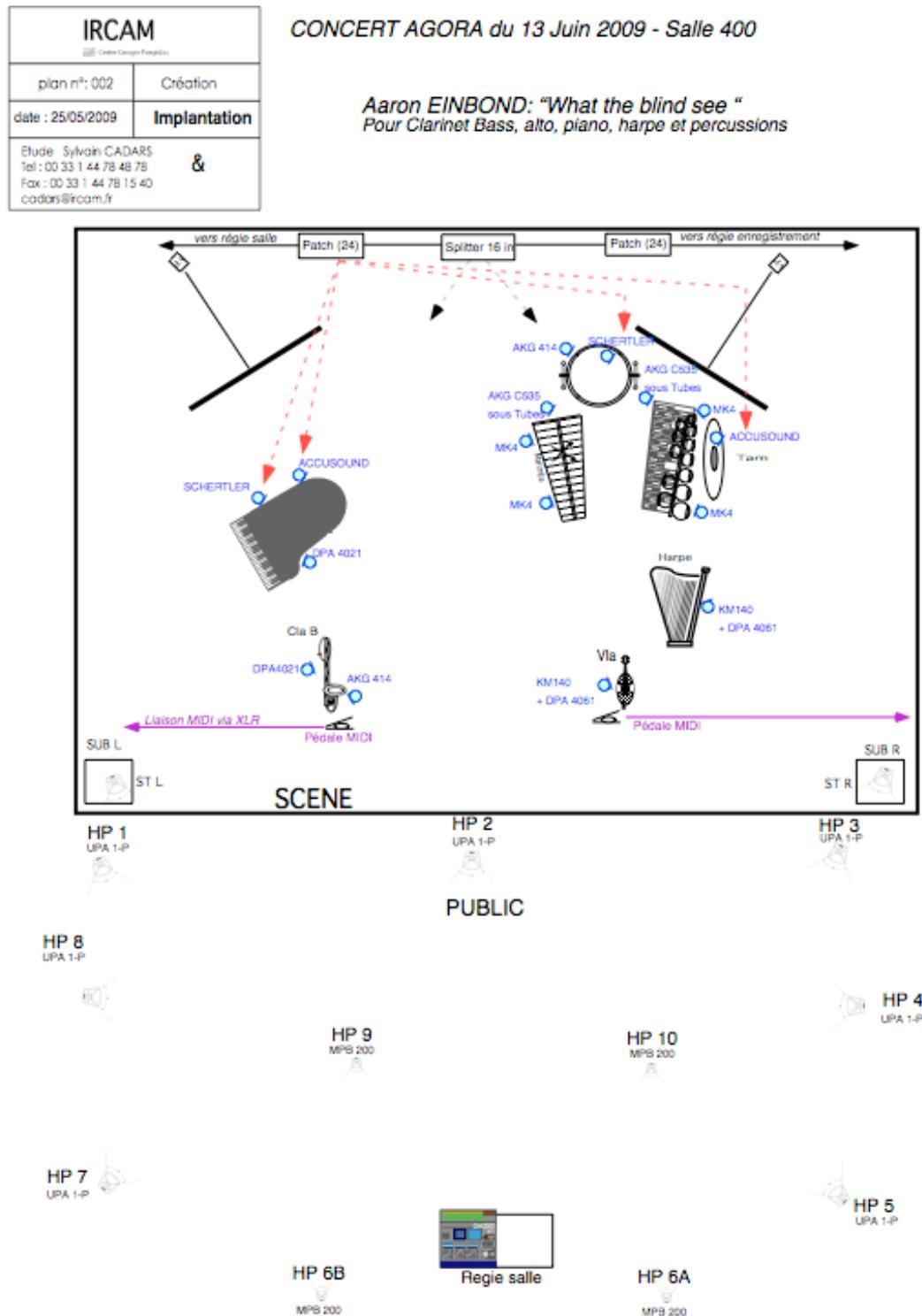
à Florent Gerenton pour le Festival Manca

TEMPER
for bass clarinet and live electronics

AARON EINBOND
2006

overblow

22 SF22, granulated burbling **ff**, low C mph. resonance

sƒƒƒz ƒƒ sempre

ƒƒƒƒ terrifying

overblow

overblow
s.t. s.t.

23 SF23, granulation responds only to playing **ƒ** and as little as possible to playing **p**

ƒ confused

ƒƒ

sƒƒƒz

ƒƒ pp

sƒpp

breath
s.t. s.t. s.t.

sƒƒp

ƒƒ sub.

sƒƒp

sƒƒz

p hesitant

sƒpp

24 Granulation fades out, low C resonance

breath - - - - → tone
s.t.

mƒ sƒz pp

sƒz

p poco

sƒz ƒ

- - - - - - - → breath

tone - - - - - → breath

tone

overblow
s.t.

s.t.

G. P.

sƒz p

ppp

sƒpp

ppp

sƒz

pp poco

poco sƒz

25 Granulated burbling **pp**, low C resonance continues

19

to Ellen Ruth Rose

BESIDE ONESELF
for viola and live electronics

AARON EINBOND
2007

21

23

Transposed score

AARON EINBOND
2009

to Ensemble Instant Donné for the Festival Agora

WHAT THE BLIND SEE

for viola, bass clarinet, harp, piano, percussion, and electronics

Lointain, ♩=60, ♪=120

Viola

Pédale 1

Bass Clarinet in B♭

Pédale 2

Harpe

Piano

Vibraphone, Marimba

Percussion

Crotales, Tam-Tam, Bass Drum

fingers on the wood
c.l.b.
pppp

① concatenative Vla.

ppp

② add Hp. samples

muted with cloth
sempre

E♭ F♭ G♯ A♭
D♯ C♭ B♭

ppp

fingers sur la table