

Rotations and Resonances

[Part Two – Electroacoustic]

For amplified string quartet

Pre-composed tape, amplified prepared piano resonances and interactive concrete sound

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Violin 1
Violin 2
Viola
Violoncello

Duration: ca. 16' 16"

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This is a single source, single movement electroacoustic composition for amplified string quartet and interactive media realised from the soundworld of a violin during 2012. It is the second part of a triptych of pieces sharing the same name and materials: Part One – Acoustic, Part Two – Electroacoustic and Part Three – Acousmatic.

During a period of lectures taught on twentieth century American classical music: specifically, the music of Elliott Carter and Steve Reich, the composer noticed how Reich's music often influenced his own in many subtle ways, mostly on a subliminal level and seemingly only ever recognised in retrospect. This quartet consciously refers to the music of gradual process from Reich's early years within a passage of rotation and repetition where the rhythm gradually alters to create a stream of pulsing melodic fragments, shifting-beats, contrapuntal rhythms and displaced accents.

Whilst the rhythmic structure for this section refers to the phasing music of Reich, the pitch content and organisation refers to the work of Elliott Carter and specifically his All-Triad Hexachord (ATH): 012478. The hexachord (C – C[#] – D – E – G – G[#]) can be heard in various guises throughout the piece and became the primary pitch material for the string quartet parts.

Carter's All-Triad Hexachord (ATH): Carter Hexachord 35, Forte 6-17 [6-z17b]

0	1	2	4	7	8
C	C [#]	D	E	G	G [#]

A hexachord is any sequence of six notes laid out in a scalic pattern. This hexachord takes its name from the fact it contains all twelve of the prime-form triads only once (within the octave):

012	013	014	015	016
024	025	026	027	
036	037			
048				

Alongside these two referential characteristics, this quartet also continues the composer's own practical research using heterodyning frequencies to shape contrapuntal textures and resonant vertical harmony. These theories are used to colour, dilute, and abandon the pitch-content of the All-Triad Hexachord and help to establish a coherent form within the movement. The combined and difference tones for all registers (frequencies) of A^b (chosen as the 'prime' pitch within the hexachord) were calculated and used to produce the many variables explored within the textures of the string quartet. The following example can be transposed by the octave for all registers of A^b. In theory and although never physically present, A^b4 (middle A^b) is an omnipresent 'invisible' pitch sympathetically produced by each of the heterodyning pitch-pairs:

Heterodyning frequencies (pairs) of Ab4 [415.30]:

Difference tones:

Combined tones:

Concrete Audio (Pre-composed tape):

This electroacoustic version was composed around the pre-existing form of the original acoustic score: *Rotations and Resonances: Part One – Acoustic*. A symbiotic communication of aural cues and triggered responses evolved naturally between the combined resources whilst realising the final form. All concrete sounds were produced from the sounds of a violin.

It was initially planned that synthesised variable pitch-shifting sub-bass frequencies would be fed into dedicated sub-bass speakers to produce real-time acoustic heterodyning frequencies in the ambience of the concert hall during performance, but practical research found that it took an age for the 'invisible' sub-bass tones to literally heterodyne together into audible acoustic frequencies (resultant tones) and nearly blew-up the speakers during the process. Instead, a short example of this acoustic phenomenon was pre-recorded in a controlled studio environment as a separate concrete audio file that can be diffused into the speakers for a subtle (and optional) 'ghost resonance'.

The main concrete audio is in six separate files: an introduction (which starts the piece) and five additional files, which are triggered on cue (written in the score). This format allows the live quartet to be more flexible with their timing and tempo and increases the level of interaction between the musicians and the mixing desk.

The score tells the engineer when to trigger the concrete audio files and instructs the musicians to listen for important cues. Timings given in the score have been synchronised to digital audio playback of the EAS Guide Form (recorded with silences), so that the string quartet can rehearse most of the work without the need for an engineer. This file is available from the composer via the addresses given on the back cover of the score.

The chronometric timings obviously become redundant when realising the work live, reading from the score and using the triggered (interactive) concrete audio.

Optional Prepared Piano Resonances:

Low frequency bass resonances (LFE) from the concrete audio can also be fed to a sub-bass speaker that is placed directly under a pedalled grand piano (preferably housed offstage and/or out of sight) to stimulate subtle sympathetic resonances that can be amplified during performance. The speaker should have its bass feed exaggerated and should be almost touching the underside of the piano.

The piano should have its strings muted with blu-tac (or rather epoxy free white-tac) so that only the notes of the All-Triad Hexachord (ATH) are resonating. The chord should be prepared, and the piano pedalled with a stage-weight before performance. Adjacent semi-tones (C – D^b and G – A^b) should be avoided as much as possible when preparing the piano.

The lid of the piano should be almost closed, and the sympathetic resonances amplified through two 'live' microphones placed in x/y stereo as close to the strings as possible. The sound produced is subtle but can offer an enhanced atmosphere: a reverb-type resonance, which sounds very effective in some concert halls.

The score offers suggestions where it is suitable to amplify the prepared piano resonances, but this element can be omitted to simplify concert realisation if required.

Amplification and Diffusion:

The concrete sounds (precomposed tape) should be diffused to eight speakers (4 stereo pairs) placed in an equidistant circle around the audience, but there is also a premixed stereo version available to simplify concert realisation.

Ideally, each member of the string quartet (positioned front and centre in traditional placement) should be amplified with their own stereo x/y condenser microphone, and the collective sound mixed into a separate dedicated pair of speakers placed either side of the stage (front a/b stereo). Obviously, the technician is responsible for establishing the balance between amplified media and amplified string quartet.

The musicians will also require monitor speakers through which they can hear themselves and the audio cue points.

The score also suggests a few places where it would be effective to add some reverb and multi-tap delay to the sound of the amplified string quartet. The use of the additional effects is optional.

Acknowledgements:

Thanks go to the Rodewald Concert Society and Arts Council England for commissioning this work. Further thanks go to violinist-musicologist (and friend) Dr Alberto Sanna for recording the primary sound material from which the concrete parts were composed. Final thanks go to fellow composer James Wishart for initially proposing this project.

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♩ = 60 0.16 0.20 0.24 0.28 0.32 0.36 0.40 0.44 0.48 0.49.6 0.52 0.56 0.58 1.00 1.02 1.04 1.08 1.12 1.14

... and so the journey begins ... in tranquility ...

Cue: 5 metal clicks Concrete speckles ----- Cue Metal click Ticking ----- Metal click Bass Thud Ticking ----- Bass thud Metal click

16 second intro

1.16 1.20 1.24 1.27 1.28 1.32 1.36 1.40 1.44 1.46 1.48 1.52 1.56

Concrete speckles ----- Cue Bass Thud Ticking ----- Cue Bass Bell ----- Concrete Trills ----- Cue Bass Thud Concrete Trills ----- Cue Bass Bell Concrete Trills -----

17

mp *mf* [variable speed tone trill] *p* *pp* *pp*

approx. [tone trill] 3 5 3

rubato

2.00 2.04 2.06 2.08 2.12 2.22 2.24 2.34 2.36 2.40

Cue **Cue** **poco rit.** [♩ = 52] **poco rit.** [♩ = 48] **B** ♩ = 52 ... a tranquil resonance: the end of the beginning ... **Cue**

Bass Thud Ticking ----- Metal click Bass Bell Dull percussion ----- Ticking ----- Bass Bell Ticking ----- Percussion, bells and basses --- Bass Bell Percussion, bells and basses ---- Tape fades ----- WAIT for silence

28

p *expressive rubato* *p* *pp*



rit.

Technician may use some subtle live digital reverb and multi-tap delay [delay settings related to 40 & 60 bpm] -----

[♩ = 48]

accel.

Technician may amplify some of the sympathetic piano resonance [ambient background] -----

42

mf f mp mf

mf mp mf mp

mf p mf

mf p mp



♩ = 60

rit.

Technician may amplify some of the sympathetic piano resonance [ambient background] -----

[♩ = 40]

4.03

TRIGGER 1:
Technician starts
playback on the
last cello note

47

mp mf f pp

p mf mp pp

p mf p pp ppp

p mp pp ppp

Cue ca. 16 seconds

D

[♩ = 40]

accel.

♩ = 60

WAIT for near silence

Clicks & ticks ---

Technician may amplify some of the sympathetic piano resonance [ambient background] -----

52

Violin 1: *mp*, *mf*, *mp*, *mf*

Violin 2: *p*, *mp*, *mf*, *mp*, *mf*, *f*

Viola: *p*, *mp*, *p*, *mp*, *p*, *mf*

Cello/Double Bass: *mp*, *mf*, *p*, *mp*, *p*

E

accel.

[♩ = 76] rit.

♩ = 40

poco rit.

[♩ = 72]

CUE TRIGGER 2:
Technician starts playback
on violin2 high Db

Percussion rhythms -----

Bass
Bell

Low pitch concrete trills -----

Ticking & clicking -----

Bass
Bell

CUE: WAIT for silence

ca. 18 seconds

58

Violin 1: *mp*, *mf*, *mp*, *p*, *pp*, *mp*

Violin 2: *mf*, *mp*, *p*, *pizz.*, *arco*, *ppp*

Viola: *mp*, *f*, *mp*, *mf*, *mp*, *mf*, *ff*, *mp*

Cello/Double Bass: *mp*, *pizz.*, *mp*, *mf*, *p*, *pp*

5.28

5.31.5

5.48

5.53

6.02

6.08

5

F ♩ = 40 ... a lyrical diversion: fluid and expressive ...**CUE TRIGGER 3:**
Technician starts playback
on cello entry

Concrete speckles & percussion -----

CueBass
Bell**Cue**Bass
Bell**Cue**Bass
Bell**Cue**Bass
Thud

65

p *mp* *p* *mp* *p*

arco *p* *pp* *p* *mp* *p*

arco *p* *pp* *p* *mp* *p*



6.13

6.22

6.56

Cue**Cue****Cue**Bass
ThudMetal
click

Scraping builds on tape -----

Ticking -----

poco rit. -----

[♩ = 72]

Concrete speckles -----

Bass Bell [delay]
and Metal click
ca. 6 seconds

72

p *mp* *p* *mp* *p*

p *mp* *p* *pp* *p*

pp *p* *pp* *pp* *pp*

p *p* *pp* *pp* *pp*

6 7.00 7.01 7.08 7.12.6 7.50 8.00 8.04

Cue **G** ♩ = 40 ... a passage of transition ... **H** accel. ♩ = 60

Bass Bell Concrete speckles **Bass Bell** CUE: WAIT for near silence ca. 36 seconds Ticking - - Technician may use some subtle live digital reverb and multi-tap delay [delay settings related to 40 & 60 bpm] - - - - -

80 *rubato*

p *mp* *mp* *mf* *mp* *p* *p* *mp* *pizz.* *mf* *mp*

8.08 8.12 8.16 8.20 8.24 8.28

I ♩ = 60 fluid and positive: skippin' cycles ...

Technician should start to amplify sympathetic piano resonance: mix the sound into and around the volume of the live quartet with subtle variation. Maintain a general mtion towards a reserved crescendo at figure N - - - - -

87

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

8.32

8.36

8.40

8.44

8.48

8.50

8.52

7

J ... evolving natural cycles, not synthetic repetition ...

Amplified sympathetic piano resonance: supporting and enhancing the textures of the live quartet -----

CUE TRIGGER 4:
Technician starts playback
on cello E natural

93

mf *p* *mf* *p* *mf* *p* *mf* *p*

8.56

9.00

9.04

9.08

9.12

K ... changing landscapes and rejuvenating resources ...

Concrete bass pulses, loops and percussion
Amplified sympathetic piano resonance -----

99

mf *mp* *mf* *p* *pizz.* *f* *mf* *p* *mf* *p*

8 9.16

9.20

9.24

9.28

9.32

9.36

L ... as smooth as glass ...

Concrete textures start to gather continual dynamic momentum -----

Concrete bass pulses, loops and percussion

Amplified sympathetic piano resonance -----

104

mf *mp* *mp* *mp*

arco

9.40

9.44

9.48

9.52

9.56

10.00

M

Concrete bass pulses, loops and percussion

Amplified sympathetic piano resonance -----

Subtle feedback sounds on tape [towards crescendo] -----

110

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

pizz. *f* *mf* *mp* *pizz.*

N ... a continuous rhythmic stream trickles to a halt ...

poco rit.

[♩ = 40]

Concrete bass pulses, loops and percussion
Amplified sympathetic piano resonance -----

Subtle concrete crescendo - heterodyning frequencies [feedback type sound] -----

Technician: Fade sympathetic piano resonance

CUE: WAIT for silence

ca. 10 seconds

116

mf *pp* *p*

mf *pp*

mf *pp*

mf *pizz.* *v.* *v.* *p*

10 10.48

10.54.5

11.08

O ♩ = 40 ... a thematic interlude and transition ...

Bass fades

P

accel.

[♩ = 52]

CUE TRIGGER 5:
Technician starts playback
on cello harmonic

Cue: After 3 metal clicks

Ticking -----

Concrete bass sounds start impetus towards subtle crescendo -----

ca. 10 seconds



11.37.5

11.41.5

ca. 11.45.5

11.47

Q ♩ = 60 ... a scurry of activity: the beginning of the end ...

rit.

[♩ = 40] poco rit.

[♩ = 72]

12.15

Concrete bass sounds -----

Thin percussion loops -----

Ticking and basses -----

3 Metal clicks

Bass Bell

R ♩ = 60 ... a poignant reflection upon a sonic journey: heterodyning emotions ...

Concrete speckles - - - - -

Bass
Bell

Cue
Bass
Bell

Cue
Bass
Bell

140

pp *p* *mp* *p*

arco

p

12.56 13.09.5 13.10.5 13.21.5 13.32 13.37.5 13.42 13.52

poco rit. [♩ = 52] **S** [♩ = 52] **poco accel.** ♩ = 60 **poco rit.** [♩ = 40]

Bass Bell Ticking - - - - - Loud Bass Bell Bass Bell Ticking - - - - - Bass Bell Bass Bell Bass Bell Bass Bell

150

p *mp* *pp* *pp* *ppp*

Cue: Wait for silence

T [♩ = 40] poco accel. [♩ = 52] poco accel. ♩ = 60

PAUSE **Technician:** No live effects: dry sound **Technician:** You should consider the possibility of fading the live quartet amplification gradually down until their sound is completely acoustic -----..?

163

p *mp* *mf* *mp*

p *mp* *mf*

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

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



poco rit. [♩ = 52] rit. **U** [♩ = 44] poco rit. [♩ = 40]

171

p *p* *pp*

mp *p* *pp*

mf *mp* *p*

mp *rubato* *p*

pp *pp*

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iancarlpercy@gmail.com

www.ianpercy.me.uk