But I Guess, In The End, We Just Moved Furniture Around

by Richard Craig, Angela Guyton and David Pocknee

This is work is a collaboration between myself (David Pocknee - the composer), the videographer Angela Guyton, and the flautist Richard Craig.

This piece exists in 3 versions. The music played by the live flautist in versions 2 and 3 is identical, but the set-up of electronics and stage is different. The flute music for these versions can be found in the accompanying "flute score".

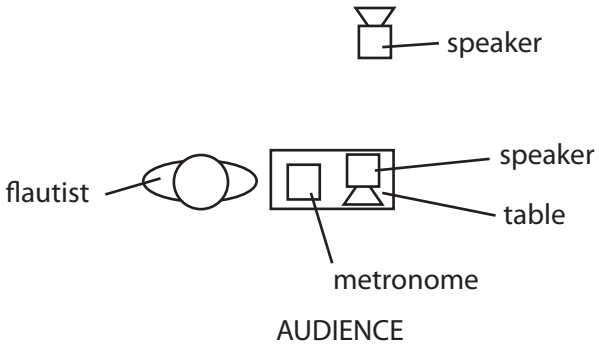
Version 1: Video
This is a fixed-media video version of the work (with stereo audio) that can be watched online or projected for an audience. A high quality version of this video, suitable for large-screen projection, can be obtained by contacting any of the three artists.

Version 2: Live flute, metronome and audio playback (2 channels)
This version is designed for a conventional concert performance. The stage set-up for this can be seen on the right. In this version, a table on the stage contains a metronome and a small speaker. The flautist begins the piece by starting the (mechanical, not digital) metronome (approx. 75bpm) and playing Section 1 to the beat of its clicking. After they have finished playing Section 1, they stop the metronome. After a small pause, playback of the audio file is started (this can be done either by the flautist or by somebody off-stage). This audio file sends a time-stretched MIDI version of what the flautist has just performed out of the speaker set upon the table, and a further time-stretched version of all previous sections out of the other speaker. The audio coming out of the speaker on the table should be used as a click-track for the live flautist to play each section with; it is notated in the flute score as "Click-Track" or "C.T.".

The volume of the speaker on the table should be quieter than the sound of the live flute. It should be oriented such that both the audience and flautist can easily hear it. The speaker at the back of the stage should be balanced such that it appears to the audience to be of a lower volume than both the flute and the other speaker. This should be done primarily through positioning the speaker in the space, i.e. by facing it away from the audience and placing it towards the back of the stage. In the first performance of this version, a thick winter coat was placed over the top of the speaker to dampen some of its higher frequencies, allowing it to blend better with the live performer and other speaker. The precise approach to setting up this speaker is dependent upon the acoustics of the room you are performing in, so this is up to the performer's discretion.

Version 3: Live flute, video and audio playback (4 channels), cube installation, furniture-mover, chair, table and metronome
The rest of this score is dedicated to the complex preparations needed for the performance of this version of this piece.

Version 2 Stage Set-Up



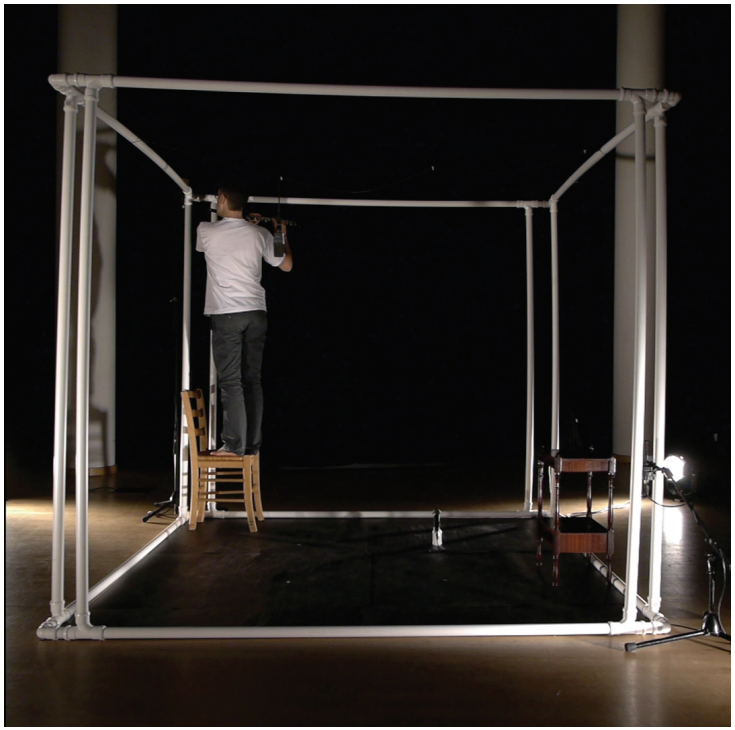


Image of the cube with table and chair
(taken from the video version of the piece)

Version 3: A Description

You are sat in the audience, your chair-feet mere centimeters away from the thick, white, plastic tubing that forms one of the lower vertices of a large 2x2x2m frame of a cube.

Inside the cube sit a table and a chair, and on the chair sits a performer, reading a book, oblivious to the eyes, eagerly watching them, several layers deep, lined around the outside edges of three sides of the cube. Taking up the entire back wall of the cube is a projection screen, blank, white, stretched taut. And then you notice the tiny speakers, four of them, at different points in the cube; one suspended on wires at head height over the table, one in the far top-back-left corner, one sitting upon the shiny black floor, near the back-right, and one front-right, bound to the vertical column of the cube.

Upon the table sits a flute and a metronome. The lighting changes. In the new light, you notice the strange symbols on the flautist's T-shirt. The flautist closes their book. It is a thick book, old and well-worn, yet its cover gives no indication as to its contents. And they stand up and place the book upon the chair. No urgency in their movements, it is as if they had been killing time, bags packed and waiting, and their taxi had just arrived. They walk towards the table, with purpose, as if answering a door-knock. They pick up the flute and start the metronome. The metronome is mechanical, not digital, it faces towards the open front of the cube. The audience see its pendulum swing, that gentle ticking. Its speed is set as close to 75bpm as possible. The flautist starts playing a simple quartertone melody in time with the metronome. After a minute of playing, the flautist stops and halts the metronome.

Then the video starts. The back wall of the cube now shows a recording of what has just happened: the flautist standing up, walking to the table, starting the metronome. The video'd metronome clicks, four beats, the sound ticking out of the top-back-left speaker. Then the video'd flute starts playing the melody we have just heard, this sound coming out of the speaker over the table, right in front of the flautist's head. Four notes come out of the speaker, then the live flautist starts playing, keeping in time with the recorded flute. But something strange is happening in the video and its recorded audio- the speed is changing, slowing down, speeding up, so that the recorded flute becomes not the varied melodic movements of the original, but a single F# pitch at 75bpm - a click-track... and over the top, the live flute plays a new melody to the beat of their re-stretched recording, their video doppelganger.

Then the video and flautist stop, and the back screen changes to a shot of two metronomes at slightly different tempi, ticking together, and, in the darkness of the stage, the table and chair are moved by a black-clad figure.

The video changes and starts playing a recording of the flautist performing the melody you had just heard, but again stretched to become a click-track - a single note at a single tempo, and the live flautist again playing a new melody over the top, but this time, in the back of that recording, the ghost of that first melody click-track - stretched again to become weirder, more electronic. And then video and flautist stop again, and back to those two metronomes, ticking away, but their tempi slightly further apart this time, and maybe you notice a slight slowness in one of the hands, as if this video too had been time-manipulated, and whilst this goes on, that black-clad figure again moves that furniture.

And so it continues. live flautist playing with their digital double, whose melodies have been squashed flat and transformed into the practicality of a click-track. And the metronome interludes. And the furniture re-arrangement. And as the piece goes on, the time-stretching becomes more extreme, and those ghost flutes accumulate into a chorus of the undead, stretched beyond practicality. And sometimes the flautist will change position to elsewhere in the cube, each time standing or crouching or sitting next to one of the speakers, and you see in the video that digital self mirroring those same positions, but see not speakers there, but microphones.

And on the process goes, until you see that live performer seated as before, but listening now, as their recorded sound is compressed now to an insect-like squeal blasting out of the back-left speaker. and blackness. and silence.

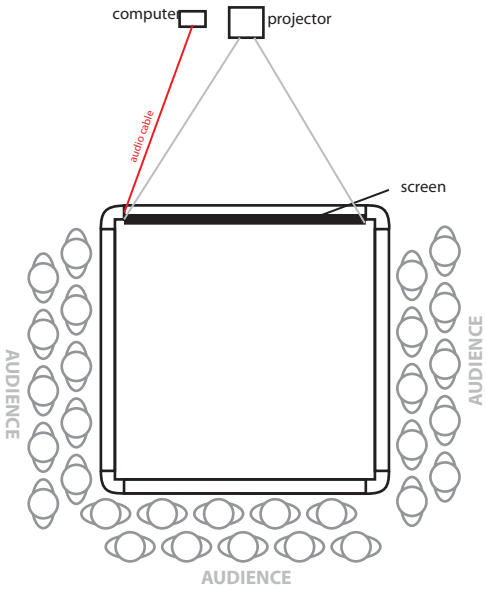
Stage Set-Up for Version 3
For a performance of this version you will need the following equipment:

1 x 2x2x2m Cube (how to build this is described later)
1 x projector
1 x 4 channel audio interface
1 x computer (for video and 4-channel audio playback)

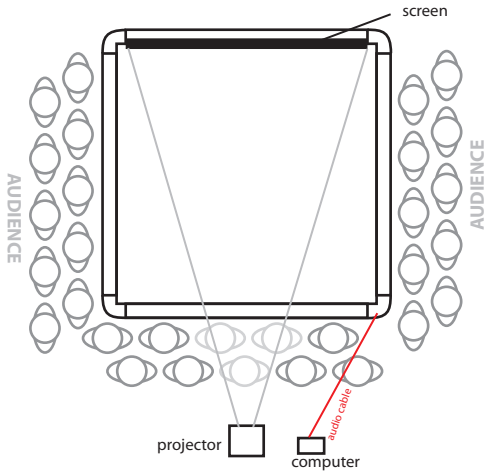
The 2x2x2m cube is a frame constructed from white PVC plumbing supplies. The audience should be arranged close around three sides of the cube, and the back wall of the cube has a screen suspended across it, onto which the video is projected. This screen can be cheaply constructed using a large 180cm x 180cm or 2m x 2m white shower curtain, which you can then suspend by running white rope through eyelets in the edge of the curtain (shower curtains will already have eyelets along one edge to aid hanging them, and extra can be added on the other edges using eyelet pliers).

The projector can be placed in two possible positions, in order so that it can project onto this screen. In large venues, where space is not a problem, it can be set up behind the cube - with most projectors there will need to be several metres of space between the projector and screen in order to create an image that fills the entirety of it (option 1). In smaller venues, the projector can be placed in the front of the cube, either projecting over the audience's heads (preferred) , or nestled in between the audience members (option 2) (see diagrams on the right).

OPTION 1 for projector placement



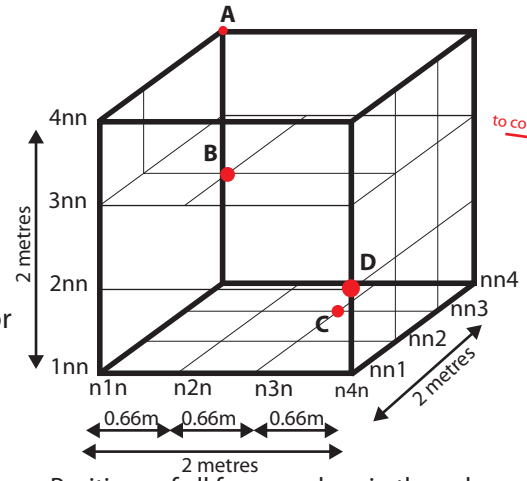
OPTION 2 for projector placement



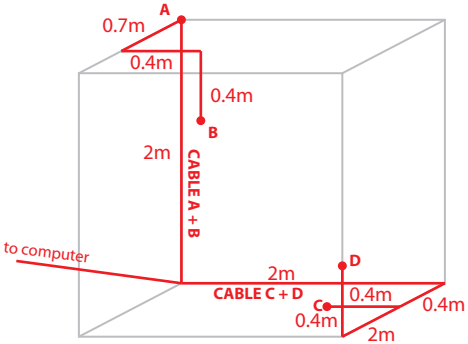
The Speakers
There are four small speakers which are suspended at different positions in the cube. These speakers need not be large, as their loudest sound would be equal to that of the live flautist. These three positions are labled A, B, C and D, and can be seen in the diagram to the right. The area of the cube should be divided up into a 4x4x4 grid and the positions of the speakers lie at specific points on this grid.

Depending on which of the two positions for the projector are used, two different options for attaching cables between the speakers and their amplifier(s) are possible. These are illustrated on the far right of this page. These diagrams calculate the amount of cabling needed. For a neat set-up, holes can be drilled in the corners of the cube and the cables run through the piping.

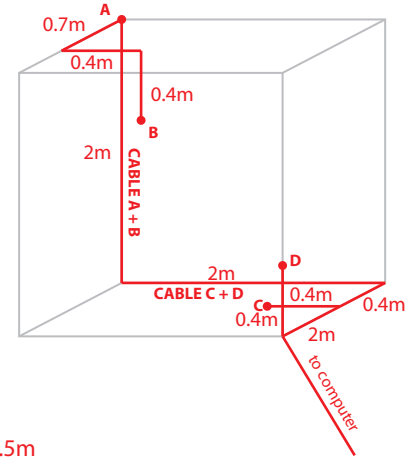
Coordinates:
A = 414
B = 322
C = 133
D = 241



Positions of all four speakers in the cube



Position 1 cable lengths
d = distance from amplifier to cube
Cable A: d + 2m = 2m
Cable B: d + 2m + 0.7m + 0.4m + 0.4m = 3.5m
Cable C: d + 2m + 0.4 + 0.4m = 2.8m
Cable D: d + 2m + 2m + 0.4m = 4.4m



Position 2 cable lengths
d = distance from amplifier to cube
Cable A: d + 2m + 2m + 2m = 6m
Cable B: d + 2m + 2m + 2m + 0.7m + 0.4m + 0.4m = 7.5m
Cable C: d + 0.7m + 0.4m = 1.1m
Cable D: d + 0.4m = 0.4m

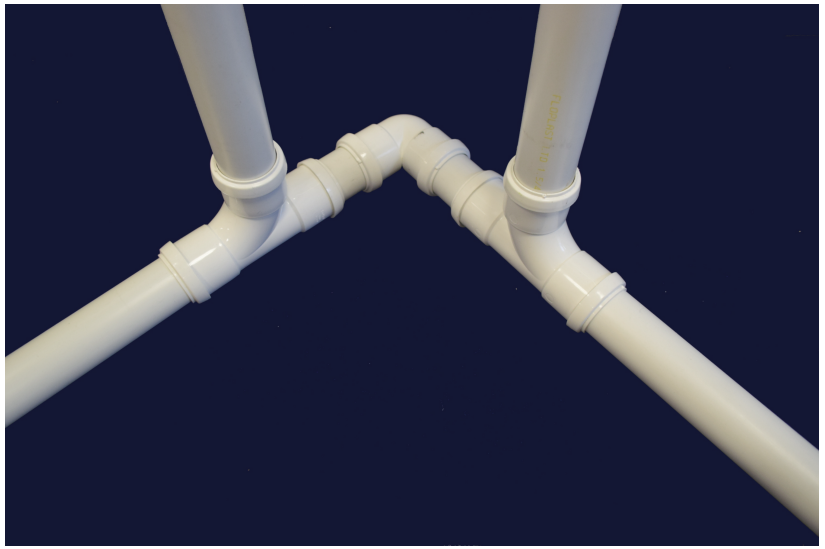
THE CUBE

Construction of the cube

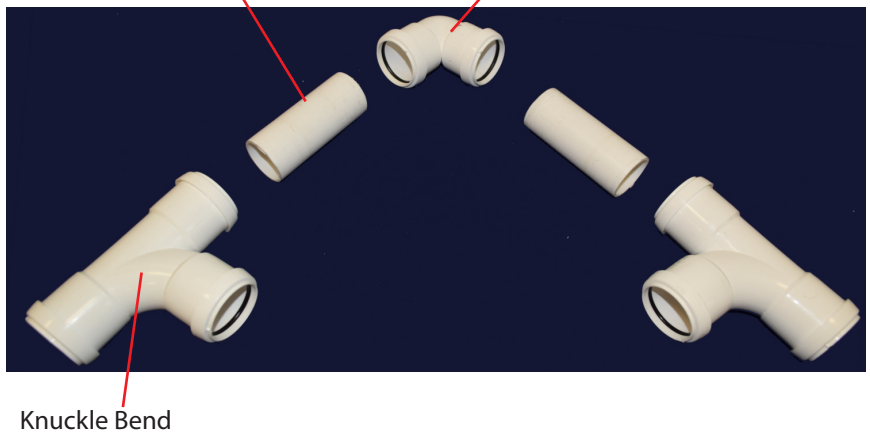
The cube is 2x2x2m large and is created from cheap and easily available plumbing supplies. These can be found in most large hardware stores. The cube can be created using one of two sizes of push fit piping (32mm or 40mm diameter) - both sizes should work, the smaller one will be slightly cheaper.

To construct it, you will need the following equipment, which will cost roughly the following amount (this is based on using a 40mm diameter of pipe):

Item	Purpose	Quantity	Cost	Total
Floplast Push Fit Waste Pipe (Dia)40/32mm, White (2m)	Pipes for vertices of the cube	16	£2.22	£35.52
Floplast Push Fit Waste Pipe (Dia)40/32mm, White (2m)	Pipe to be cut for connecting upright and corner connectors	1	£2.22	£2.22
Floplast Compression Universal Waste Bend (Dia)40/32mm, White	Corner Connectors	8	£1.10	£8.80
Floplast Push Fit Waste Knuckle Bend (Dia)40/32mm, White	Upright Connectors	16	£1.26	£20.16
Antinox (or equivalent) Surface Protection or black tarpaulin	Floor	5	£1.00	£5.00
White Shower Curtain	Projection screen	1	£3.18	£3.18
White Rope	Suspending the screen	1	£5.00	£5.00
Eyelet Pliers	For making holes in the shower curtain for suspension	1	£5.50	£5.50
Eyelets	For making holes in the shower curtain for suspension	1	£3.12	£3.12
			TOTAL:	£88.50

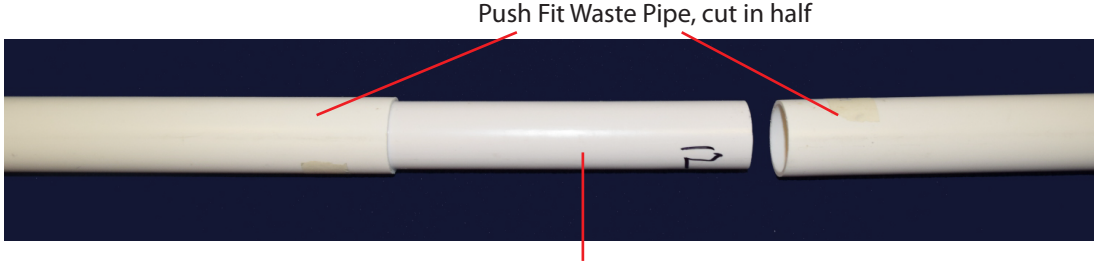


Corner of the cube



Component parts of the corner

You can also reduce the space needed for transportation of the cube by cutting the tubes used for the vertices of the cube in half and glueing pieces of smaller ABS waste piping into one of the halves to allow them to connect together (see below).



ABS waste piping, of slightly smaller diameter than the other piping, glued into one half of the cut pipe
Each set of two tubes should be numbered so that they can be matched up in the cube, ensuring a minimally visible join.

The two pipes can now be slotted together to make a full length pipe. Masking tape can be wrapped around the smaller pipe to make the connection snugger and more secure. The entire cube installation is designed to be relatively cheap, made from easily available components, portable and lightweight.

Flooring
In order to provide a clear separation between the "world" of the cube and that surrounding it, I suggest using some type of corrugated plastic floor protection. I used black Antinox surface protection (see right), cut to exactly fit the floor of the cube. Other alternatives can be used but they should be dark-coloured.

The table and chair move around a 4x4 grid on the floor of the cube. So that the furniture-mover knows where this grid is, without it being obvious to the audience, small stickers should be placed at each of the 16 points in the cube where furniture is moved.

Symbols seen on the T-Shirt worn by the flautist. Each symbol shows the path of the chair, the flautist, and the table around the cube over the course of the piece.

T-Shirt
The flautist should be wearing the T-shirt shown on the left. If front-projection is used for projecting the video, they should also be wearing similarly light-coloured trousers, such that the projection will still show up on their body should they block the screen.

Chair
The chair should look old and used. It should be able to easily and safely take the weight of the flautist standing upon it.

Table
the table should be small, just big enough to accomodate a flute and metronome.

Metronome
The metronome should be mechanical, not digital.

Lighting
Lighting should be low enough to clearly see the screen. Options may be an angler-fish style lighting on the face of the flautist, chair, table, and four speakers. This should keep the light localized. I would suggest the use of the small-style lights seen in the video.

Furniture Movement
Between each section of this work, the table and chair should be moved around. This should be done during the "metronome interlude" or "coloured cube interludes" that occur in the video. Movement of this furniture should be done in as non-distracting a way as possible by a black-clothed individual, possibly seated in one of the front rows of the audience during the non-interlude sections of the piece. They should attempt to do the moving of tabl and chair as efficiently (but not hurriedly) as possible before sitting back down.

Order of Events

The piece consists of 19 short sections in which the live flute plays simple quarter-tone melodies accompanied by video and audio. In each section, the video and audio show a pre-recorded performance of the previous section which has been time-stretched such that all the notes and their durations are the same pitch and length. This time-stretched video and audio is then used as a metronome for the flautist to perform with. This process is then reiterated over and over, with the time-stretching also being applied to the flute-metronomes of previous sections, creating a ghostly electronic background to the piece.

Between each section, a short video interlude of time-stretched metronomes and/or a still shot of the flautist in a coloured cube is played, and the position of the table and chair in the room is re-arranged.

Every few sections the flautist will change the place in the cube where they are playing, moving between four different positions (excluding start and end points). In each of these places, a small speaker is placed, and these are used for distributing the sound of the video.

The Video

The video has been shot in a 1:1 aspect ratio. This should allow it to be projected onto the square screen on the back wall of the cube without overlap.
The video is arranged such that it should be started playing after the live flautist has played section 1, and can be left playing until the end of the piece.
The audio for the work is encoded in the video file in 5.1 format, and should be played back such that each channel goes to a different speaker:

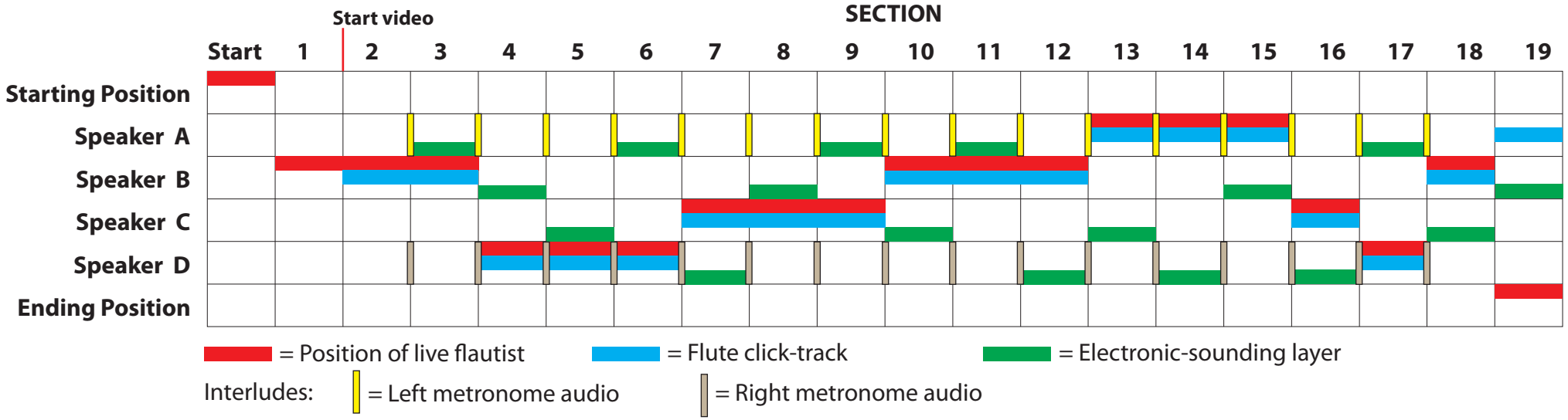
Channel 1 => A
Channel 2 => B
Channel 3 => C
Channel 4 => D
The 5th channel is unused.

The video oscillates between time-stretched recordings of the flute performance which act as a click-track for the flautist, interlude shots of two metronomes which have been time-stretched and, as the work goes on, still shots of the flautist within a cube lit with bright colours.

These interlude shots should be used for moving the furniture around, and if the flautist needs to move between their positions.

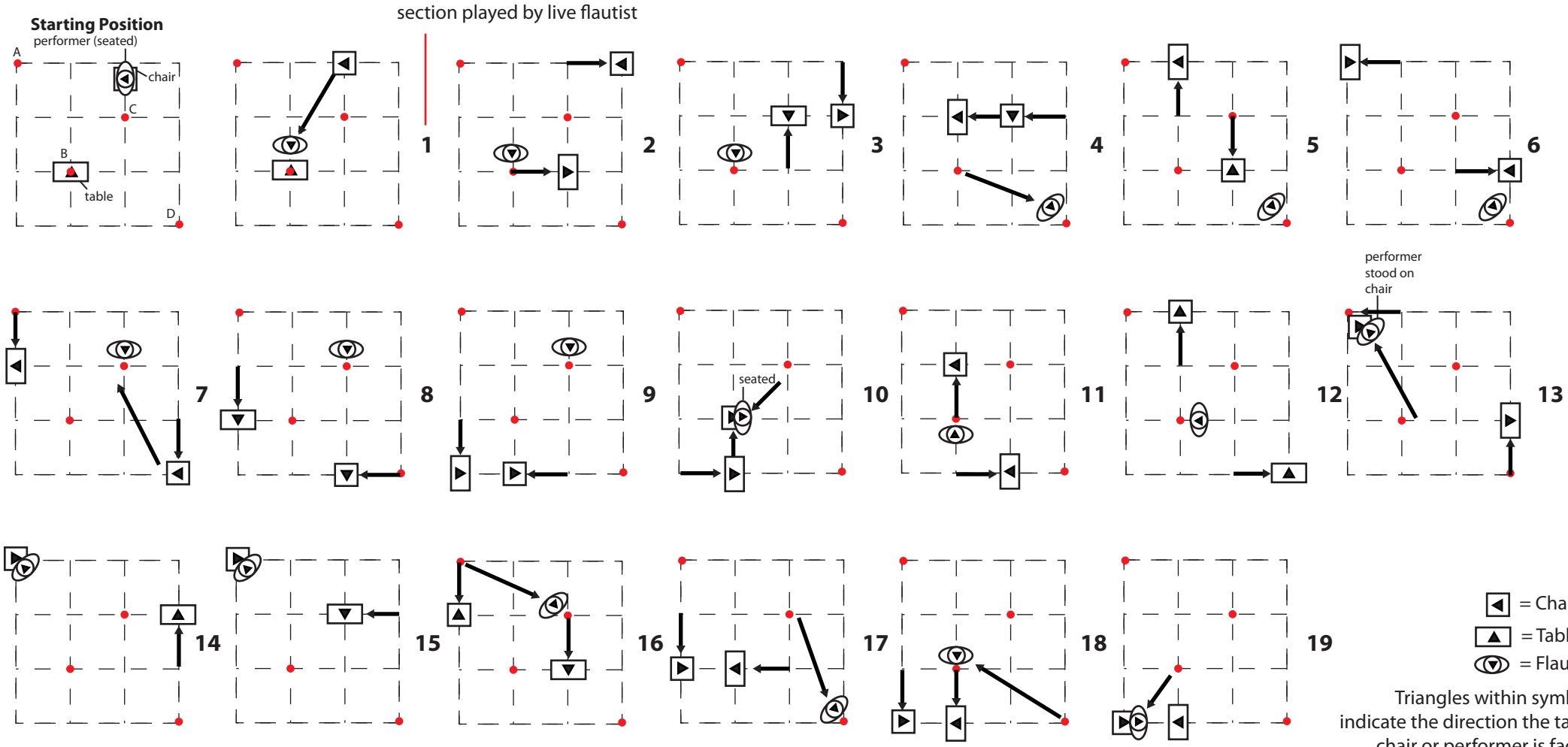
In the interlude shots of the metronomes, some simple processes are in action - most notably a change in aspect ratio of these shots in parrallel with the rhythmic ratios between the two metronomes. This is outlined later in this score.

There are similar, more subtle processes at work in the film in general for example, a movement from close-up to wide-shot and in the use of lighting.



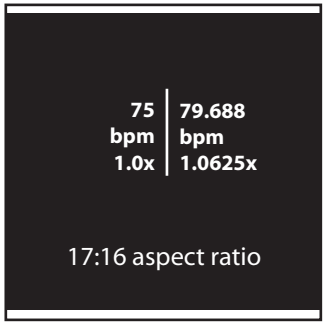
Movement

The following diagrams show where the furniture and flautist should move in the interludes between each section.

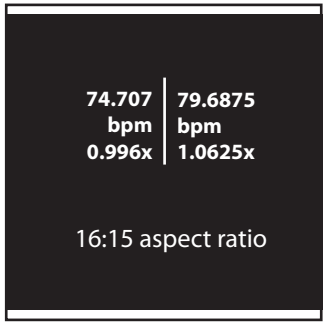


Metronome Interludes

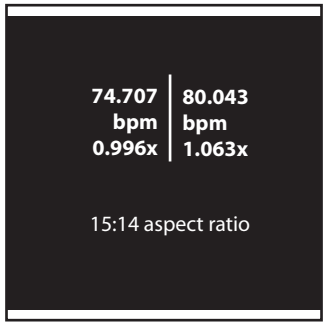
Amount of pulses: 17 | 18
Time: 14s



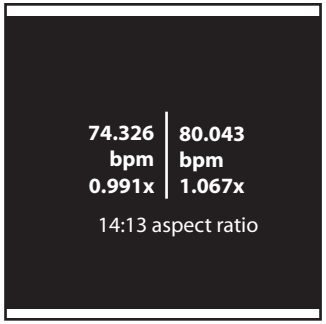
Amount of pulses: 16 | 17
Time: 13s



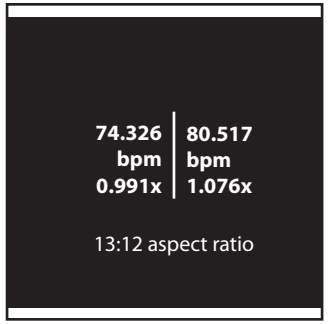
Amount of pulses: 15 | 16
Time: 13s



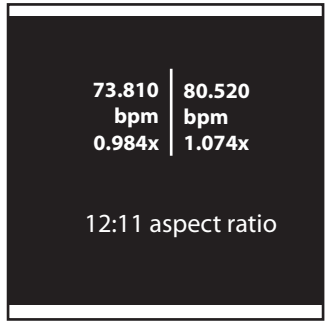
Amount of pulses: 14 | 15
Time: 12s



Amount of pulses: 13 | 14
Time: 11s

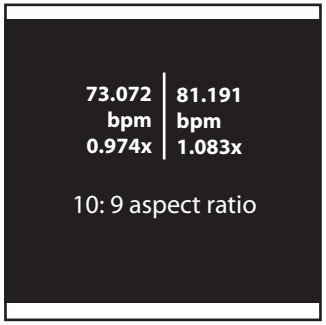


Amount of pulses: 12 | 13
Time: 10s

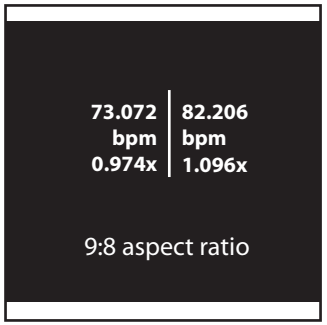


Amount of pulses: 11 | 12
Time: 9s

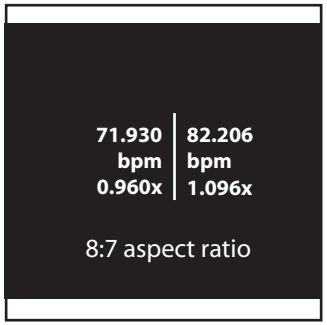
Amount of pulses: 10 | 11
Time: 9s



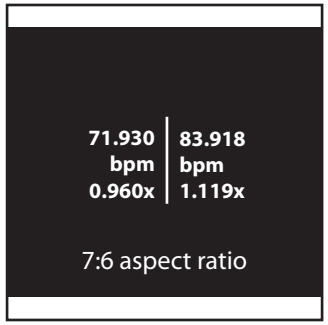
Amount of pulses: 10 | 9
Time: 8s



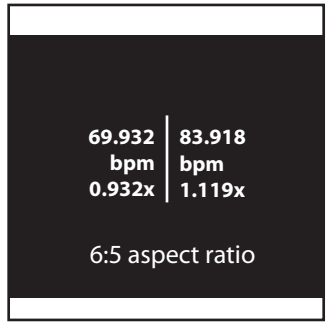
Amount of pulses: 9 | 8
Time: 7s



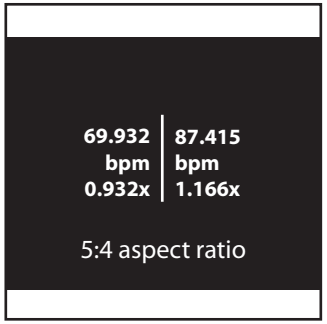
Amount of pulses: 8 | 7
Time: 6s



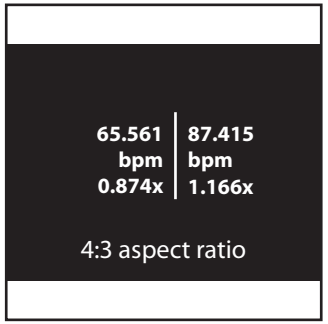
Amount of pulses: 7 | 6
Time: 6s



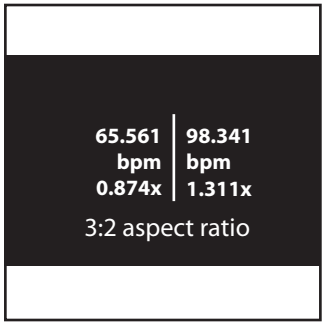
Amount of pulses: 6 | 5
Time: 5s



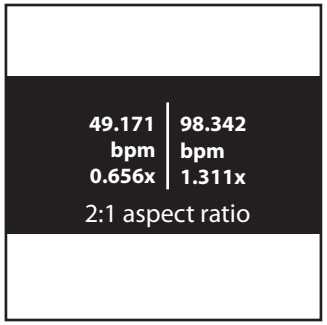
Amount of pulses: 5 | 4
Time: 4s



Amount of pulses: 3 | 2
Time: 3s



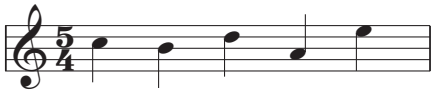
Amount of pulses: 2 | 1
Time: 3s



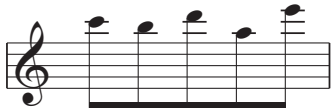
THE MUSIC

Principles of the piece (How it works)
When a video or audio recording of something is sped up or slowed down, the pitch of the recording changes. Pitch is connected to duration.

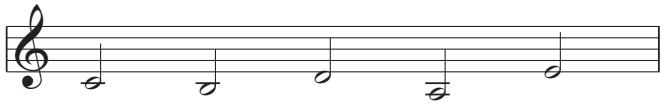
For instance, imagine that we have a melody:



When the speed of a recording of this melody is doubled (2.0x), it becomes:

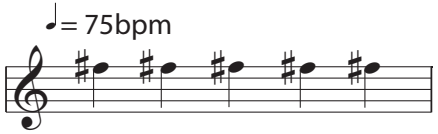


When the recording of the melody is halved (0.5x), it becomes:



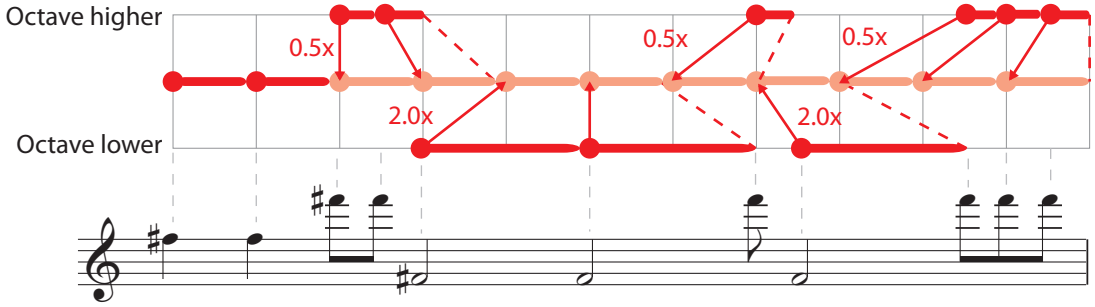
This principle means that, given a particular pitch of specific duration, all other pitches can be slowed down or sped up to reach this pitch. However, the duration of these pitches will be in fixed ratios to the original pitch.

For instance, let us imagine that we wish to create the following melody by speeding up or slowing down the notes of another melody:



We can refer to this as the *Target Melody*.
The duration of each quarter-note in this melody is 800ms and the frequency of the pitch is 739.99Hz.

Below is a diagram showing a graphic and notational representation of a simple melody and the speed changes needed to create a 75bpm rhythm at 739.99Hz from it.



Obviously, this is a simple example involving only speed changes of 2x and 0.5x. This piece uses this principle to generate entire scales of notes and the related speed-changes needed to create a particular target melody.

As each pitch is directly tied to a duration, all of the non-target melodies in the piece are backwards-engineered to create a particular target melody.

Each of these target melodies are a single note at a single pitch, as they are used as click-tracks for the live flautist. Below is a list of the target melodies used in the piece:

	TEMPO		PITCH		
Section	**ms**	**bpm**	**Frequency**	**MIDI**	**Total Notes in Scale**
1	800	75	739.99	78	15
2	800	75	783.99	79	17
3	640	93.75	659.26	76	12
4	960	62.5	880	81	14
5	640	93.75	587.329	74	11
6	480	125	987.77	83	9
7	640	93.75	554.37	73	10
8	1280	46.875	493.88	71	9
9	640	93.75	1046.5	84	16
10	640	93.75	439.004444	69	8
11	800	75	1170.67852	86	23
12	480	125	1317.013333	88	12
13	640	93.75	370.41	66	6
14	1600	37.5	329.253333	64	12
15	640	93.75	1560.90469	91	17
16	480	125	1756.017778	93	12
17	1600	37.5	261.62558	60	10
18	240	250	2341.357037	98	17

This technique was originally trialled in the video work *Part I,* created with Ana Smaragda Lemnaru and Miguel Peres dos Santos in January 2014. However, there were many problems with the initial implementation, mostly resulting from desynchronization between video and audio, occurring from the discrepency between video frame-rate and audio sample-rate and compounded by floating-point errors.

For this reason, all the video for the current work was shot at 25fps, a framerate in which there is a 40ms duration between each frame, as opposed to the more conventional 24fps (41.6667ms) or 30fps (33.3333ms), thus reducing floating-point discrepencies. The speeding up and slowing down is not done via a continuous process (as in the previous work), but by splitting the audio into 40ms chunks and compressing or expanding them by millisecond intervals (the smallest time increment in the software program Max).

i.e. a file at its original speed will keep all its chunks with a duration of 40ms, whilst in a file in which everything is slowed down by half, each 40ms chunk will take up 80ms.

By assigning each of these 40ms chunks to a frame of video, synchronization between video and audio can be ensured.

However, this division of audio into 40ms chunks means that there is a finite amount of possible relationships to the target pitch, all of which are in relationship to the number 40. These limited number of relationships are used to create scales of pitches with their associated durations.

Each scale in this work is then generated in the following way:

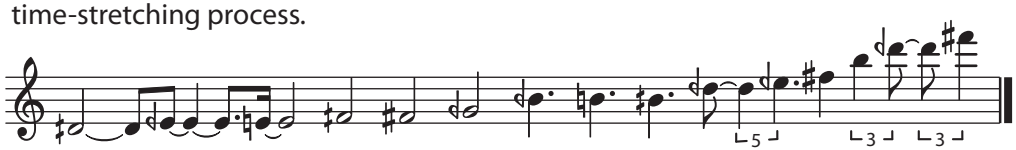
1. Enumerating all possible pitches and their durations that can occur by multiplying the target pitch and duration by (*i*/40), where *i* is an integer.

2. Filtering out any pitches that occur outside the range of the flute.

3. Filtering out all notes whose pitch is more than or less than 10 cents away from a semitone or quartertone.

4. Filtering out all notes whose duration is not a multiple of 40ms.

This filtering increases pitch playability and the rhythmic accuracy of the time-stretching process.

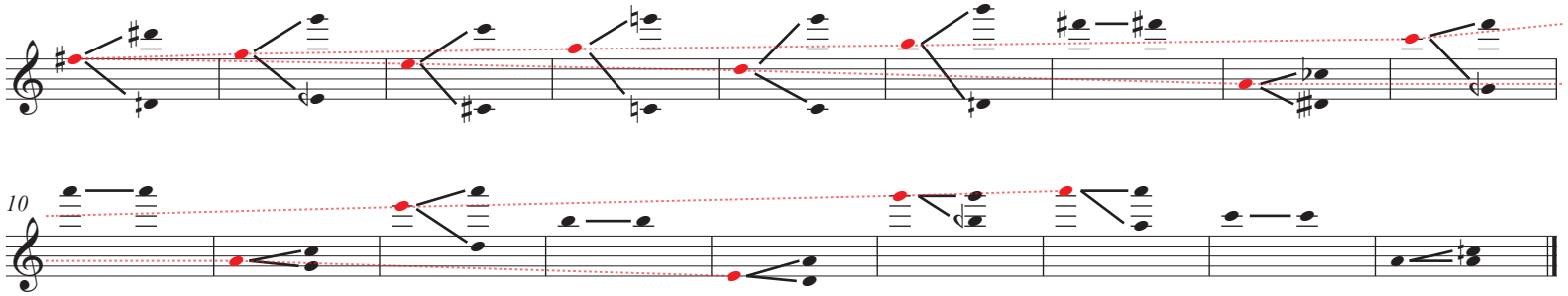


The scale above is the one generated for the first section of the work. The values that it is based on can be seen on the right.

MIDI Pitch	Duration
62.5	1960
63.5	1840
64	1800
65.5	1640
66	1600
66.5	1560
70.5	1240
71	1200
71.5	1160
73.5	1040
75.5	920
78	800
83	600
85.5	520
90	400

It will be noticed that some of the durations in the notation are not what might be expected based on the absolute durations listed in the table - this is due to the notational quantization process that is applied to help make the work rhythmically playable.

Nearly every melody in each section follows the same wedge-shape, meaning that the extremity of time-stretching increases as each section goes on, leading to the click-track sounding stranger and stranger. This wedge-shape is also mirrored in the form of the piece (see below).



Number to divide by 40	Frequency (Hz)	Playback Speed	MIDI No.	MIDI Cents	Close to Semitones or Quartertones	Duration (ms)	Distance from 40ms chunk
15	1973.31	0.375	94	98	S	300	0.5
16	1849.98	0.4	93	86		320	0
17	1741.15	0.425	92	81		340	0.5
18	1644.42	0.45	91	82		360	0
19	1557.87	0.475	90	89		380	0.5
20	1479.98	0.5	90	0	S	400	0
21	1409.50	0.525	89	16		420	0.5
22	1345.44	0.55	88	35		440	0
23	1286.94	0.575	87	58	Q	460	0.5
24	1233.32	0.6	86	84		480	0
25	1183.98	0.625	86	14		500	0.5
26	1138.45	0.65	85	46	Q	520	0
27	1096.28	0.675	84	80		540	0.5
28	1057.13	0.7	84	17		560	0
29	1020.68	0.725	83	57	Q	580	0.5
30	986.65	0.75	82	98	S	600	0
31	954.83	0.775	82	41	Q	620	0.5
32	924.99	0.8	81	86		640	0
33	896.96	0.825	81	33		660	0.5
34	870.58	0.85	80	81		680	0
35	845.70	0.875	80	31		700	0.5
36	822.21	0.9	79	82		720	0
37	799.99	0.925	79	35		740	0.5
38	778.94	0.95	78	89		760	0
39	758.96	0.975	78	44	Q	780	0.5
40	739.99	1	78	0	S	800	0
41	721.94	1.025	77	57	Q	820	0.5
42	704.75	1.05	77	16		840	0
43	688.36	1.075	76	75		860	0.5
44	672.72	1.1	76	35		880	0
45	657.77	1.125	75	96	S	900	0.5
46	643.47	1.15	75	58	Q	920	0
47	629.78	1.175	75	21		940	0.5
48	616.66	1.2	74	84		960	0
49	604.07	1.225	74	49	Q	980	0.5
50	591.99	1.25	74	14		1000	0
51	580.38	1.275	73	79		1020	0.5
52	569.22	1.3	73	46	Q	1040	0
53	558.48	1.325	73	13		1060	0.5
54	548.14	1.35	72	80		1080	0
55	538.17	1.375	72	49	Q	1100	0.5
56	528.56	1.4	72	17		1120	0
57	519.29	1.425	71	87		1140	0.5
58	510.34	1.45	71	57	Q	1160	0
59	501.69	1.475	71	27		1180	0.5
60	493.33	1.5	70	98	S	1200	0
61	485.24	1.525	70	69		1220	0.5
62	477.41	1.55	70	41	Q	1240	0
63	469.83	1.575	70	14		1260	0.5
64	462.49	1.6	69	86		1280	0
65	455.38	1.625	69	59	Q	1300	0.5
66	448.48	1.65	69	33		1320	0
67	441.79	1.675	69	7	S	1340	0.5
68	435.29	1.7	68	81		1360	0
69	428.98	1.725	68	56	Q	1380	0.5
70	422.85	1.75	68	31		1400	0
71	416.90	1.775	68	7	S	1420	0.5
72	411.11	1.8	67	82		1440	0
73	405.47	1.825	67	59	Q	1460	0.5
74	399.99	1.85	67	35		1480	0
75	394.66	1.875	67	12		1500	0.5
76	389.47	1.9	66	89		1520	0
77	384.41	1.925	66	66		1540	0.5
78	379.48	1.95	66	44	Q	1560	0
79	374.68	1.975	66	22		1580	0.5
80	370.00	2	66	0	S	1600	0
81	365.43	2.025	65	78		1620	0.5
82	360.97	2.05	65	57	Q	1640	0
83	356.62	2.075	65	36		1660	0.5
84	352.38	2.1	65	16		1680	0
85	348.23	2.125	64	95	S	1700	0.5
86	344.18	2.15	64	75		1720	0
87	340.23	2.175	64	55	Q	1740	0.5
88	336.36	2.2	64	35		1760	0
89	332.58	2.225	64	15		1780	0.5
90	328.88	2.25	63	96	S	1800	0
91	325.27	2.275	63	77		1820	0.5
92	321.73	2.3	63	58	Q	1840	0
93	318.28	2.325	63	39		1860	0.5
94	314.89	2.35	63	21		1880	0
95	311.57	2.375	63	2	S	1900	0.5
96	308.33	2.4	62	84		1920	0
97	305.15	2.425	62	66		1940	0.5
98	302.04	2.45	62	49	Q	1960	0
99	298.99	2.475	62	31		1980	0.5
100	296.00	2.5	62	14		2000	0
101	293.07	2.525	61	96	S	2020	0.5
102	290.19	2.55	61	79		2040	0
103	287.37	2.575	61	63		2060	0.5
104	284.61	2.6	61	46	Q	2080	0
105	281.90	2.625	61	29		2100	0.5
106	279.24	2.65	61	13		2120	0
107	276.63	2.675	60	97	S	2140	0.5
108	274.07	2.7	60	80		2160	0
109	271.56	2.725	60	64		2180	0.5
110	269.09	2.75	60	49	Q	2200	0
111	266.66	2.775	60	33		2220	0.5
112	264.28	2.8	60	17		2240	0
113	261.94	2.825	60	2	S	2260	0.5
114	259.65	2.85	59	87		2280	0
115	257.39	2.875	59	72		2300	0.5
116	255.17	2.9	59	57	Q	2320	0
117	252.99	2.925	59	42	Q	2340	0.5
118	250.84	2.95	59	27		2360	0
119	248.74	2.975	59	13		2380	0.5

Workflow (Note for composer)