3,141

Programme Notes:

Title: “3.141”
Description: “A composition/installation/performance for 16 channel hemispheric dome, recorded viola (fixed media), cor anglais and violoncello”

Part I, “E pur si muove”
Part II, “irrational transcendental”
Part III, “an ePilogue”

3.141, a composition/installation/performance for 16 channel hemispheric dome, recorded viola (fixed media), cor anglais and violoncello, uses musical material consisting of a series of intervals loosely based on the number Pi. The fixed media creates a spherical universe in which the two improvising performers (on cor anglais and cello) have to find their place in the sound world revolving around them. However much the universe’s regular harmonic movements, churning their foreseeable paths across the firmament, inscribe themselves on us - loving and fighting in the midst of it, we lose sight of how the simplicity of the circle too, contains in it an irrational transcendental (the number Pi) the last decimal point of which will always elude us. Here, in this performance we try to pause and find an inner peace we could share, while the world churns on - and a computational machine somewhere finds the next decimal point of Pi, as we meditate on the circle. Maybe peace is an irrational transcendental? The piece ends in a (scored) ePilogue for cor anglais and cello, an individual account of what it might feel like to find a place of peace, a pause...

Performers:

Sergio Castrillon: Cello
Saku Mattila: Cor Anglais
Dominik Schlienger: Tontechnik/Fixed Media (Viola)

Players Guide:

Material

The musical material is a series of intervals loosely based on the number Pi, hence the name 3,141.
The full series of intervals is 31414131419 but the completing 9 is rarely used.

From this material I isolated the two chords of 10 pitches each which are the most different. (based on a transposition by 2 semitones) From these chords I chose 7 pitches each, played on the viola, recorded and processed so that bow-changes are not audible. These 14 distinct pitches constitute the material for the "fixed media".

Spatialisation

The two chords of the fixed media (14 pitches) are spatialised in two clusters on points on a *sphere* consisting of 32 locations generated by a Matlab script.

In the Dome, a *hemispherical* arrangement of 16 loudspeakers represents 16 of those locations at any point in time. Using vector based amplitude panning (Matlab script), the two clusters travel across the dome's hemisphere like constellations of stars travel across the sky, and continue through the "dark side" of the Dome, the non-audible 16 positions not represented by loudspeakers, but calculated by the script.

Further, the rotating axis of this rising and setting motion itself travels across the dome. The pitch constellations' appearance thus travels on a two fold trajectory: They "rise and set", but the ascendant and descendant locations change with the change of the rotational axis. From a particular point inside the dome - where the audience is, the spatialisation itself creates a narrative, as the order of the pitches are thus reorganised on the timeline.

Last not least, to fill a missing link between the acoustic instruments and the acousmatic loudspeakers, the acoustically performed instruments are also broadcast over a pair of wireless loudspeakers which are being handed around among the audience.

Structure

In Part I, called "*E pur si muove*" the fixed media plays in the Dome alone.

In Part II, *"irrational transcendental"* an english horn and a cello improvise over the fixed media. Their material is based on one chord cluster each. (See details below)

In Part III, *"an ePilogue"*, the two acoustic instruments play (See score for details), diffused via wireless loudspeakers handed to the audience to pass around.

Players Guide for Part II, *“Irrational Transcendental”*

Chord I is the cor anglais chord; Chord II the cello chord. Both start in the lowest playable octave.

Chord I	Chord II
(Eb)	C#
E	D
G#	F#
A	**G**
C#	B
D	**C**
F	Eb
F#	E
Bb	G#
B	A

These are the guidelines for the players:

The audience is inside the Dome, the players are outside of it. If you feel like it during the performance, change your location and play from a different spot around the dome, and also further away or closer to the audience and or the other player.

1.) Both player have a chord to base their melodic material on.

2.) Due to the spatialisation, the chords are not always both audible and not always in the same place. If you can hear your own chord distinctly, take it as a cue to play along with it.

3.) The notes in bold are unique for each chord.

4.) You can play on once the fixed media ended, but you don’t have to.

The public is handed 2 wireless loudspeakers which replicate the solo instruments. The idea is that the Loudspeakers are handed about during the performance by members of the audience This should help to melt the acoustic with the acousmatic sounds and adds an additional spatio-dynamic layer of interaction to the performance.

Players Guide for Part III *“an epilogue”*

This part has a written score. It segues from the last notes of part II, and from the spatial positions you found yourself in when part II ends. Play it very slow. The tempo shall depend on the cor anglais’ breathing phrases. The note values are just to indicate changes in tempo and relative lengths. They also indicate which pitches change for both instruments at the same time, and which ones don’t. (See score for details.)

Technical Remarks

The spatialisation of 3.141 uses a Matlab® script, applying spherical rotation to 32 points on a sphere. These positions are used as panning angles in a Max MSP patch using Vector base Amplitude Panning (VbAP). Of the 32 points, 16 are audible, as in a hemisphere, represented by the individual channels of the 16 channel surround system on a geodesic dome with a 3 m radius.

The fixed media is a recording of 14 fixed pitches, played on an acoustic viola. The recordings have been edited in the time domain only, namely, all bow-changes have been erased, making the notes seemingly "endless".

In respect to the musical material, the spatialisation script is generative in the sense that, on the one hand, the algorithm of spherical rotation provides a dynamic *on the timeline* . On the other, due to the fact that individual pitches are faded in and out, the algorithm generates *harmonic* content. The choice of pitches, and their clustering, however are *arbitrary,* from a mathematical point of view, but *composed* from a musical perspective.

Thanks

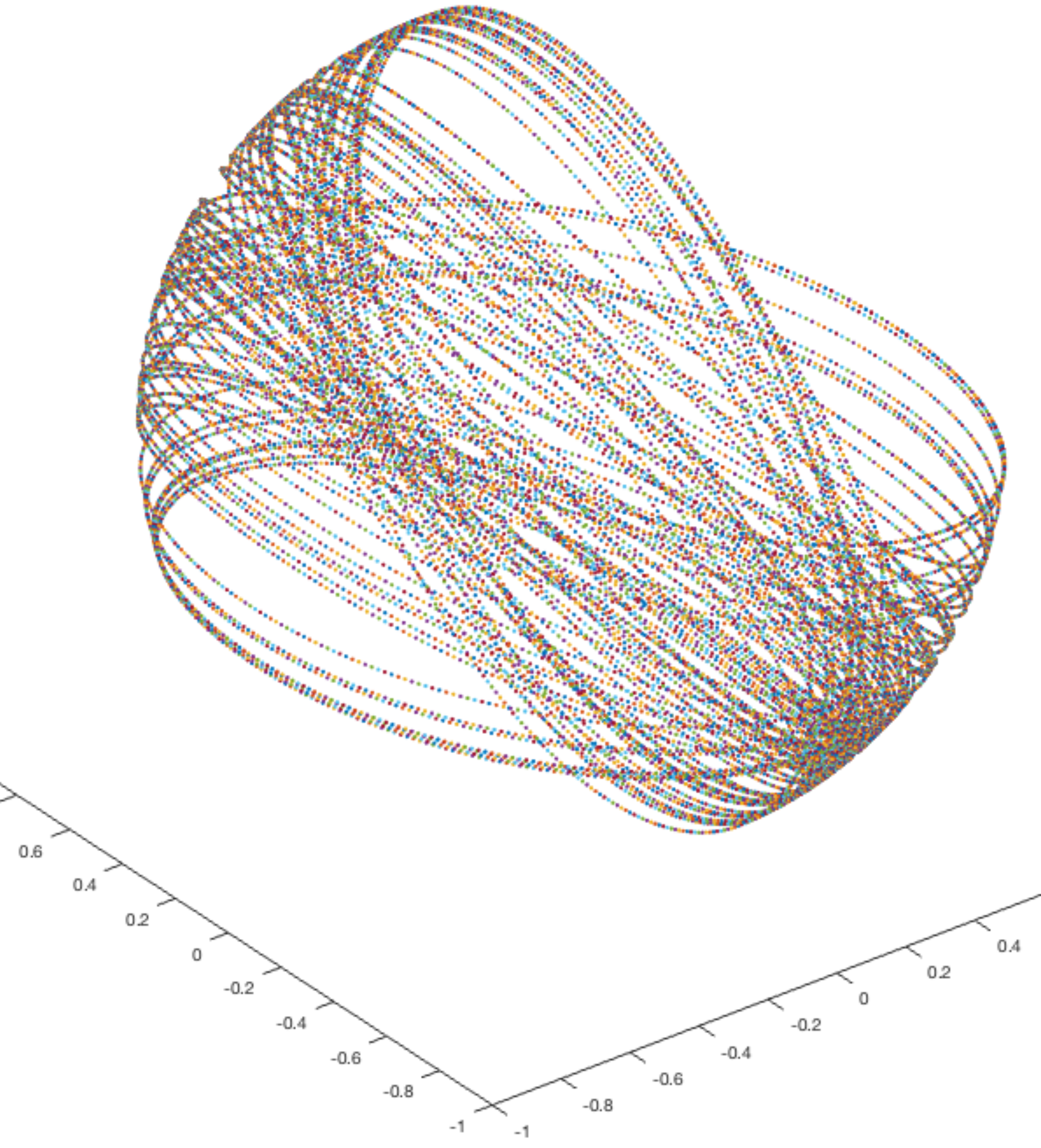
I would like to thank…

- Tapio Nevanlinna who was fundamentally involved in the development of the material and its underlying series. Also for his inspirational tangential *and* integral musings on so many aspects of the 3.141 micro-universe

- Dr Sakari Tervo for help with the code

The Matlab spatialisation code for the fixed media:

```
% alpsRotateSpherPan calculates panning trajectories of 32 sounds as fixed
% points on a rotating sphere around an arbitrary axis. Azimuth and
% elevation angles are sent as pairs via udp port 74 for the use in Max MSP

close all
% Get local IP address
address = java.net.InetAddress.getLocalHost;
receivingIP = char(address.getHostAddress);
port = 7374; % default port for Max MSP, change if needed.
% Create UDP Object
udpSender = udp(receivingIP,port);
fopen(udpSender);

% The initial positions of sources in the sound clusters are:
az = deg2rad([-090;-087;-087;-085;-082;-082;-080;090;087;087;085;082;082;080]);
el = deg2rad([-005;-005;005;000;005;005;-005;-30;-30;-25;-20;-25;-30;-30]);
[X(1,:),X(2,:),X(3,:)] = sph2cart(az,el,1);

% The initial pointing direction
AZc = 000/180*pi;
ELc = 000/180*pi;
axAngle = [0;0;0];
pauseTime = .075;

[axAngle(1,:),axAngle(2,:),axAngle(3,:)] = sph2cart(AZc,ELc,1);
% The amount added to achieve a 180 degree shift of the axis in 6 minutes.
axAngElShift = 0.05/180*pi;
[Y, R, t] = AxelRot(X, 1, axAngle, [0, 0, 0]);
[pan(1,:),pan(2,:)] = cart2sph(Y(1,:), Y(2,:), Y(3,:));
pan = rad2deg(pan);
oscsend(udpSender,'\test','ffffffffffffffffffffffffffff',...
    pan(1,1),pan(2,1),pan(1,2),pan(2,2),pan(1,3),pan(2,3),pan(1,4),pan(2,4),...
    pan(1,5),pan(2,5),pan(1,6),pan(2,6),pan(1,7),pan(2,7),...
    pan(1,8),pan(2,8),pan(1,9),pan(2,9),pan(1,10),pan(2,10),pan(1,11),pan(2,11),...
    pan(1,12),pan(2,12),pan(1,13),pan(2,13),pan(1,14),pan(2,14));
    pause(24);

for y_add = 0:3200

    [axAngle(1,:),axAngle(2,:),axAngle(3,:)] = sph2cart(AZc,ELc,1);

    [Y, R, t] = AxelRot(X, y_add, axAngle, [0, 0, 0]);
    [pan(1,:),pan(2,:)] = cart2sph(Y(1,:), Y(2,:), Y(3,:));
    pan = rad2deg(pan);
    oscsend(udpSender,'\test','ffffffffffffffffffffffffffff',...
     pan(1,1),pan(2,1),pan(1,2),pan(2,2),pan(1,3),pan(2,3),pan(1,4),pan(2,4),...
     pan(1,5),pan(2,5),pan(1,6),pan(2,6),pan(1,7),pan(2,7),...
    pan(1,8),pan(2,8),pan(1,9),pan(2,9),pan(1,10),pan(2,10),pan(1,11),pan(2,11),...
     pan(1,12),pan(2,12),pan(1,13),pan(2,13),pan(1,14),pan(2,14));
            plot3(Y(1,:),Y(2,:),Y(3,:),'.')
            xlim([-1 1])
            ylim([-1 1])
            zlim([-1 1])
            hold all
            axis square

    pause(pauseTime)
    ELc = ELc + axAngElShift;
end
fclose(udpSender);
delete(udpSender);
clear receivingIP receivingPort udpSender;
% [x(1),x(2),x(3)] = sph2cart(AZc(1),ELc(1),1);
% plot3([0 x(1)],[0 x(2)],[0 x(3)],'r-')
% plot3([0 x(1)],[0 x(2)],[0 x(3)],'ro')
% toc
clear X
```


0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4