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Rite of the Earth
composition with frequency-based harmony and ambisonic sound projection.

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Academy of the Sounds of the Earth
Institute of Fine Arts, Artistic Department, University of Silesia in Katowice

- Since 2007
- Artistic director – dr hab. Małgorzata Skałuba-Krentowicz
- Lecturers and students of the Institute of Fine Arts and students of Ethnology
- Over 70 different instruments
- Several exhibitions and concerts
Example instruments
• Trial and error approach of instrument building
• Focus on visual side
• Very soft sound, too soft for an acoustic concert
• Tuning of the instruments doesn't correspond to any particular musical scale
On the other hand...

- Interesting sounds
- Great sound material for computer treatment
- Timbral structures inspiring for harmonic operations challenge
Recording of the sounds

2 methods:

- B-format with 1 omnidirectional and 2 figure-of-eight microphones
- a-b – 2 spaced omnidirectional microphones
Analysis of the sounds

Spectral analysis for studying the inner structure of the sounds

Export to musical notation

Timbre-harmony unity

Musical discourse through transformation of chord structures
Sonic Visualizer analysis
http://www.sonicvisualiser.org/
Spear analysis
http://www.klingbeil.com/spear/
OpenMusic -> SuperCollider

OM uses midicents for pitch

Middle C=60 in MIDI so it's 6000 in midicents

One can easily and with high accuracy convert it back to frequency

Chords were imported as arrays of frequencies in sc
Generating musical gestures

Strengths of Supercollider - combining powerful synthesis engine with flexible control possibilities - envelopes, various random distributions, tendency, routines, patterns...
Ctk - The Composition Tool Kit
by Josh Parmenter (DXARTS)

A set of Supercollider Object classes for creation of fixed pieces through the use of a Score-like structure.

Replacement for the standard SuperCollider classes (Synth, Buffer, Group, and Bus), that can be used in RT and NRT synthesis without changing the syntax.
Problems with the Ctk method

Not all processes may be wrapped into the Ctk system – for example:

- PmonoArtic – patterns that play legato instruments (changing pitch of a sounding note instead of playing several consecutive notes)

- BBCut (a library for algorithmic beat slicing)

- Realtime controllers use

In above cases SuperCollider was used in realtime and its output was connected through jack directly to Ardour.
Instruments

Sampling

Sampling and frequency shifting or ring modulation

Hybrid – sample + additive or FM synthesis

Resonance models + samples as exciters

Ats resynthesis with complex instruments instead of sinusoids

Granular synthesis

BBCut for rhythm slicing
SynthDef(playBufAmb, {arg buffer, freq=440, bfreq=440, dur, att=0.01, rel=0.4, start, pan=0, rho=1, amp=0.1, shift=0, wScale=1;

var w, x, y, z, rate, sig, env;

rate = Lag2.kr(freq/(1*bfreq), 0.03);

env = EnvGen.ar(Env([0, 1, 0.9, 0], [att, dur-att-rel, rel], \sin));

#w,x,y,z = PlayBuf.ar(4, buffer, BufRateScale.kr(buffer) * rate, startPos: start * BufSampleRate.kr(buffer)) * env * amp;

#w,x,y,z = FreqShift.ar([w, x, y, z], shift);

#w,x,y,z = BFManipulate.ar(w, x, y, z, pan);

Out.ar(0, [w*wScale, x, y, w]);
})
// thisThread.randSeed_(171); // SEEDS
repeats=16;
repeats.do({|ix|
  var ind, freqs, pans, offset, durEnv, toffsEnv;
  ind=[0,1,2,4,11,12,13].choose; //buf.size.rand;
  freqs=(intplMatrix[1]);
  offset=ix;
  durEnv=Env([1.0,0.3],[1],\lin);
  toffsEnv=Env([0.33],[1],-1);

  if (0.9.coin, {
    score.add(noteSample.note(toffsEnv[ix/repeats], 14.5)
      .buffer_(buf[ind])
      .freq_(CtkControl.env(Env([freqs[0+offset], freqs[0+offset],
                                freqs[1+offset], freqs[1+offset],
                                freqs[2+offset], freqs[2+offset],
                                freqs[3+offset], freqs[3+offset],
                                freqs[4+offset], freqs[4+offset]],
                               [0.25,0.0,0.25,0.0,0.25,0.0,0.25,0.0,0.25]*durEnv[ix/repeats], \lin)))
      .bfreq_(bfreqs[ind])
      .shift_([(freqs[4+offset]/[0.5,0.25].choose).neg, 0].choose)
      .dur_(rrand(12.5,14.5))
      .start_(0.0)
      .amp_(rrand(0.1,0.4))
      .wScale_(CtkControl.env(Env([-20.dbamp,0.dbamp,-20.dbamp], [3.5,5], \sin)))
      .pan_(pî.rand2)},
  });

  score.play;
  // score.write("/home/boss/Ziemia-cd/Bowls&Bows/Intpl2-8-wxyw.wav".standardizePath,
  //  options: ServerOptions.new.numOutputBusChannels_(4));
)
Spatializing and mixing

The soundfiles generated in SuperCollider are already multichannel, 1-3 order ambisonics.

Micro-scale (notes) positioning/movements was done in sc.

Medium-scale spatial arrangement in DAW.

Distance changes through “w” signal gain modulation. Unmodulated “w” signal for feeding reverb. The soundfiles generated in SuperCollider contain “modulated w”, “x”, “y” (...) and “unmodulated w” signals.
Acknowledgments

Akademia dźwięków ziemi (Academy of the Sounds of the Earth)
http://www.instytutsztuki.us.edu.pl/kr/akademia-dzwiekow-ziemi

Sonic Visualiser
http://www.sonicvisualiser.org/

Spear
http://www.klingbeil.com/spear/

OpenMusic
http://repmus.ircam.fr/openmusic/home

Supercollider
http://supercollider.sourceforge.net/

Fons Adriaensen software
http://kokkinizita.linuxaudio.org/

Reaper
http://reaper.fm/

Ardour
http://ardour.org/