

Music and Algorithms

Week 2: Algorithm as Process.

Overview of Course

- 1. What is an algorithm?
- 2. Algorithm as process: composition as system design
- 3. Algorithm as a formalisation of the compositional process
- 4. Algorithms and analytic processes
- 5. Computational approaches to algorithmic composition
- 6. Current application: Algorithmic Methods for a breakbeat science.

Algorithm as process: composition as system design



"Since I have always preferred making plans to executing them, I have gravitated towards situations and systems that, once set into operation, could create music with little or no intervention on my part. That is to say, I tend towards the role of the planner and programmer, and then become an audience to the results" Brian Eno

Brian Eno. Photo provided courtesy of Opal Ltd., U.K., and Capretta Communications in San Francisco.

Approaches to process based composition

- Chance (indeterminacy)
- People
- Contextual
- Repetition
- Machine-based
- Sonification of natural

Indeterminacy

Bringing about 'acts the outcome of which are unknown' Cage



Cage looking for inspiration

The importance of Cage's chance methods lay in the placing of the "*material at one remove from the composer by allowing it to be determined by a system he determined. And the real innovation lies in the emphasis on the creation of a system*" (or process)

Dick Higgins on John Cage

Indeterminacy - examples

- John Cage
 - Use of IChing to organise material
 - *Music of changes* 1951
 - First use of I Ching to organise note characteristics
 - *Mureau* 1971 (x)
 - I Ching used to extract sections of text from Henry David Thoreau's Journals
 - 'Readings' of existing or contrived structures
 - *Atlas Eclipticalis* 1961-62
 - Overlays staves on map of the stars.
 - *Variations I-III and VI* 1958-67
 - - Random overlaying of shapes printed on perspex:
 - Rules sets within externally controlled processes
 - *Imaginary Landscape No. 4* (1951)
 - Written for 12 radio receivers and 24 performers. Score dictates volume and frequency: actual sounds determined by current broadcast.

Indeterminacy – examples cont.



postcard to promote the performance of La Monte Young's Poem for Chairs, Tables, Benches, etc. (January 21, 1960) at the i-punkt skateland, hamburg february 5, 1996

- La Monte Young
 - *Poem for chairs, tables, benches etc.* (1960)
 - Random number tables and telephone directory used to create instructions for moving furniture around a room...
- Christopher Hobbs
 - *Voice Piece* 1967
 - telephone directory used to programme vocal actions for individual people
- George Brecht
 - *Card Pieces for Voices* 1959
 - Shuffled cards

People processes



Morton Feldman

“ the idea of one and the same activity being done simultaneously by a number of people, so that everyone does it slightly differently, 'unity' becoming 'multiplicity', gives one a very economical form of notation - it is only necessary to specify one procedure and the variety comes from the way everyone does it differently. This is an example of making use of 'hidden resources' in the sense of natural individual differences (rather than talents or abilities) which is completely neglected in classical concert music, though not in folk music “ Michael Parsons

People processes - examples



John Zorn

- Morton Feldman
 - *Piece for Four pianos* (1957) (x)
 - Simple figures played by four different pianists at their own speed
- Riley
 - *In C* (1964)
 - “Each member of the ensemble plays the 53 figures of the score in sync with the pulse and moves consecutively from fig.1 to fig. 53. When he moves, where he places his downbeat, and how often and how long he rests is up to him”
- John Zorn
 - Game pieces – Lacrosse, hockey, rugby etc.
 - Single sheet of rules, often a ‘prompter’ holding up instructions such as “Intercut,” “Trans,” “1 Clock Changes” or “4 Trades,” ’

People processes – examples cont.



Pauline Oliveros

"Any number of persons sit in a circle facing the centre. Illuminate the space with dim blue light. Begin by simply observing your own breathing. Always be an observer. Gradually allow your breathing to become audible. Then gradually introduce your voice. Allow your vocal cords to vibrate in any mode which occurs naturally. Allow the intensity of the vibrations to increase very slowly. Continue as long as possible, naturally, and until all others are quiet, always observing your own breath cycle. Variation: translate voice to an instrument."

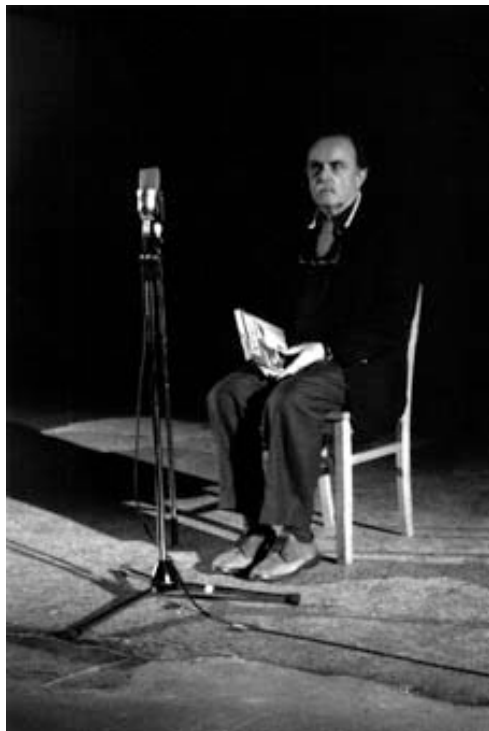
- *Teach Yourself To Fly* (dedicated to Amelia Earhart)

Contextual



Alvin Lucier

Contextual examples



Alvin Lucier (sitting in a room – or on a chair at least)

- Originator: Christian Wolff
 - *Burdocks* (1970)
 - Sonic environment
 - Orchestral players play chosen sounds according to when other players play their sounds
- Alvin Lucier
 - *I am sitting in a room* 1970 (x)
 - Physical environment
 - Sentence is recorded and played back in room, and re-recorded until resonant frequencies of room dominate and speech dissolves.
- Cornelius Cardew
 - *The Great Learning Paragraph 7*
 - Sonic environment
 - no of repetitions of a number of scored fragments is fixed, each person chooses note to start next section according to notes currently being sung.

Repetition



Steve Reich

"I am interested in perceptible processes. I want to be able to hear the process happening throughout the sounding music."

Steve Reich

Repetition - examples

- Terry Riley
 - *In C* (1964)
 - Repetition + 'people process'
 - (each person repeats scored section for however long they wish)
- Cardew
 - The Great Learning Paragraph 7
 - Repetition + people process
- Steve Reich - Gradual process music
 - *Its Gonna Rain* (1965)
 - Early 'phase' experiment 2 tape loops of same vocal sample running at slightly different speeds.
 - *Phase Patterns* (1970) (x)
 - Instrumental explorations (entirely scored) of repetition.
- Brian Eno
 - *Music for Airports*
 - Tape loops. Uses loops of different lengths that will never coincide.
 - Interested in generation of infinite material from minimal instructions

Electronic processes



Gordon Mumma and Robert Ashley, at Ashley's section of the Cooperative Studio for Electronic Music. Ann Arbor, MI, circa 1960.

"... I consider that my designing and building circuits is really 'composing'. I am simply employing electronic technology in the achievement of my art".

Gordon Mumma

Electronic processes - examples

- Steve Reich
 - Pendulum Music 1968 (X) (recording by Sonic Youth)
 - Electronic/ physical

“2, 3, 4, or more microphones are suspended from the ceiling by their cables so that they can all hang the same distance from the floor and are all free to swing with a pendular motion. Each microphone’s cable s plugged into an amplifier which is connected to a speaker. Each microphone hangs a few inches directly above or next to it’s speaker.

The performance begins with performers taking each mic, pulling it back like a swing, and then in unison releasing all of them together. Performers then carefully turn up each amplifier just to the point where feedback occurs when a mic swings directly over or next to its speaker. Thus a series of feedback pulses are heard which will either be all in unison or not depending on the gradually changing phase relations of the different pendulums.

Performers then sit down to watch and listen to the process along with the audience.

The piece is ended sometime after all mics have come to rest and are feeding back a continuous tone by performers pulling the power cords of the amplifiers.” Steve Reich 8/68

Electronic processes – examples cont.

- Gordon Mumma
 - *Hornpipe* (1967)
 - ‘Cybernetic horn console’ – essentially an analogue computer
 - Monitors horn resonance (according to performance space)
 - Adjusts itself to ‘complement’ resonances
 - In doing so becomes unbalanced and produces purely electronic responses
 - Final sonic output =
 - Horn sounds in ensemble with electronic responses
 - Solo electronic responses
 - Electronic responses articulated by sounds made by the horn.
- Alvin Lucier
 - *Music on a long thin wire* 1979 (x)
 - Oscillator drives ‘long thin wire’, vibrations picked up by contact mics.

Sonification of Natural Processes



Charles Dodge

People are organs of a living earth - and the cells of its body. The symphony of the cosmic concert is the music of nature - the natural "free music". If you pay attention to this art and laws of its development, everybody knows that the noises of the sea, wind, thunderstorm, makes a symphony as well as the music of birds - but right now, people exploit the music of nature according to the old laws - if they were paying more attention, they would be enlightened more - It would turn out that water, air and birds, don't sing according to our notes, but using all the notes that they find pleasure in - and with that, the laws of the natural music are observed exactly.

- Nikolai Kulbin, "Free Music" manifesto published in *Der Blaue Reiter Almanach* (1910).

Natural processes – examples

- Ancient mechanical devices
 - *aolian harps, windchimes etc.* (x)
 - most basic form of automated composition. driven by wind.
 - Designed to a degree - tunings, lengths, numbers etc.
 - Gunte - Hindu for bell have adorned temples for centuries at least
 - Feng-ling in China
 - Furin in Japan
 - Khew in burma
 - Religious?
 - Functional use
 - Bali - placement of bamboo tubes along irrigation channels. When full they would tip over, each tuned to different pitch, so when one fell over, farmer could identify which channel was blocked by which note was missing.



Natural processes – examples

- Biological
 - Alvin Lucier
 - *Music for Solo Performer (1964-65) for Enormously Amplified Brain Waves and Percussion.*
 - Arguably first live performance using brain waves
 - John Dunn (x)
 - DNA music
 - Mapping values in mitochondrial DNA to pitch values
- Environmental
 - Charles Dodge
 - ‘The Earths magnetic fields’

Implications

- Composing
 - how does the score differ from traditional scores ?
 - How does the 'end product' differ ?
 - How does this effect the value of a recording ?
- Composer – performer – audience
 - How are these relations changed?
- Performers
 - How do demands on performer (if any) differ ?

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