# Introduction to Algorithms

"What I cannot **create**, I do not **understand**."

Richard **Feynman**, on his blackboard at time of death in 1988

Richard Hoadley

rhoadley.org/pres/Algorithm-Introduction.pdf

v0.1b001

# Introduction to Algorithms

- Dionysus and Apollo

Baby Dionysus –
Reny

# Dionysus/Bacchus

- rude, boisterous

- god of wine

- he stood for a whole system of art and a whole notion of civilization

- Dionysus represented the life strenuous

- god of life in process of actual being

- stood for those forms of art which are not mere records or reflections of past existence, but brief snatches of present existence itself - dancing, singing, music and the drama.



Dionysus – Hieron

# Bacchus

- Michelangelo 1497

# Apollo

- inventor of music, poems and oratory

- god of all art

- contemplative and subjective

- depicted, not so much things as they were, as things as they had been

- exhibited repose as its chief quality as sculpture, architecture, painting or epic poetry: a painting of a man running, no matter how vividly it suggests the vitality and activity of the runner, is itself a thing inert and lifeless.

- "Architecture is itself a thing immovable."

- "Poetry, so long as it takes the form of the epic and is thus merely a chronicle of past actions, is as lifeless, at bottom, as a tax list."

Poussin – Apollo and the Muses at Parnassus (1632)

**The Philosophy of Friedrich Nietzsche** Henry Louis Mencken 1908

# Dionysus/Bacchus?

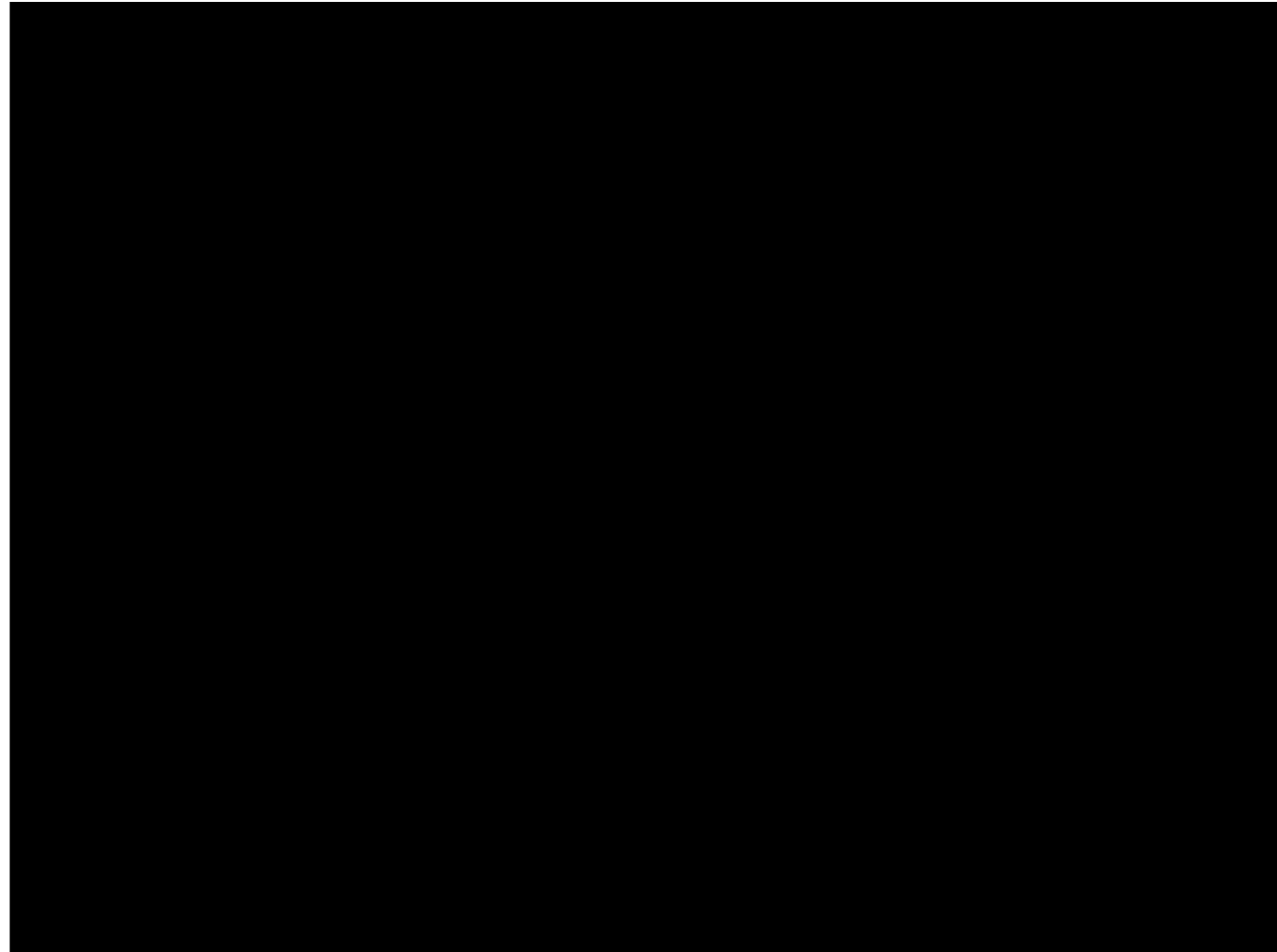- Hendrix *Star Spangled Banner* Woodstock 1969

# Apollo?

- Bach *Brandenburg Concerto No 5* BWV1050 Michael Behringer: Cembalo
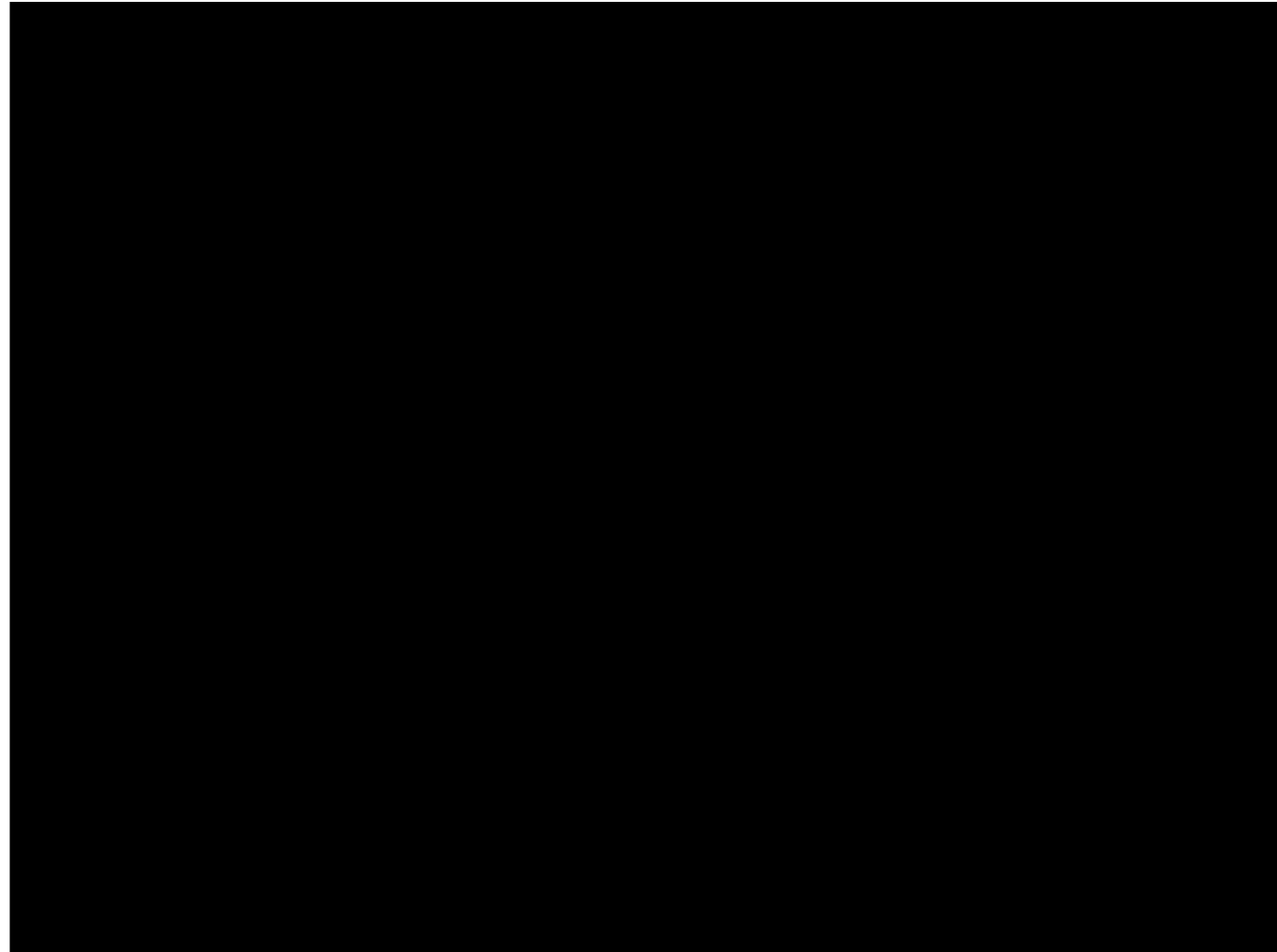
# Apollo?

- Kraftwerk *The Robots* 1978

# Algorithm: Definition

[a. OFr. augorisme, algorisme, augorime; ad. med.L. algorism-us (cf. Sp. guarismo cipher), f. Arab. al-Khowrazm, the native of Khwrazm (Khiva), surname of the Arab mathematician Abu Ja'far Mohammed Ben Musa, who flourished early in the 9th c., and through the translation of whose work on Algebra, the Arabic numerals became generally known in Europe. (Cf. 'Euclid' = plane geometry.) Algorisme being popularly reduced in OFr. to augorime, English also shows two forms, the popular augrime, ending in agrim, agrum, and the learned algorism which passed through many pseudo-etymological perversions, including a recent algorithm in which it is learnedly confused with Gr. 'number.']

   1. a. The Arabic, or decimal system of numeration; hence, arithmetic. numbers of algorism, the Arabic or Indian numerals. cypher in algorism, the figure 0; a 'mere cipher,' a dummy.



...And that, in simple terms, is how you increase your ranking on search engines."

# Algorithm: Definition

2. Math. A process, or set of rules, usually one expressed in algebraic notation, now used esp. in computing, machine translation and linguistics.

3. Med. A step-by-step procedure for reaching a clinical decision or diagnosis, often set out in the form of a flow chart, in which the answer to each question determines the next question to be asked.

Generation 1
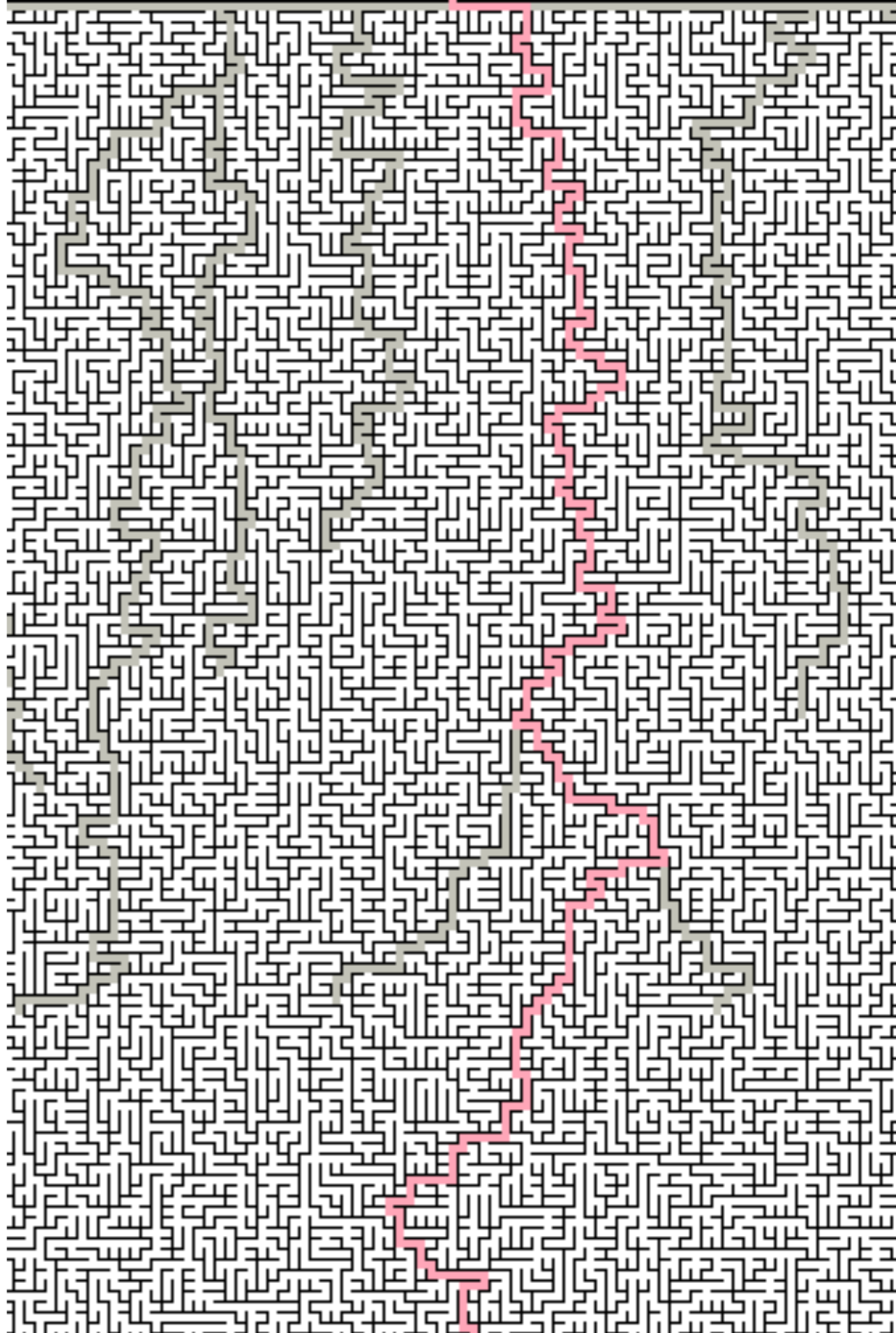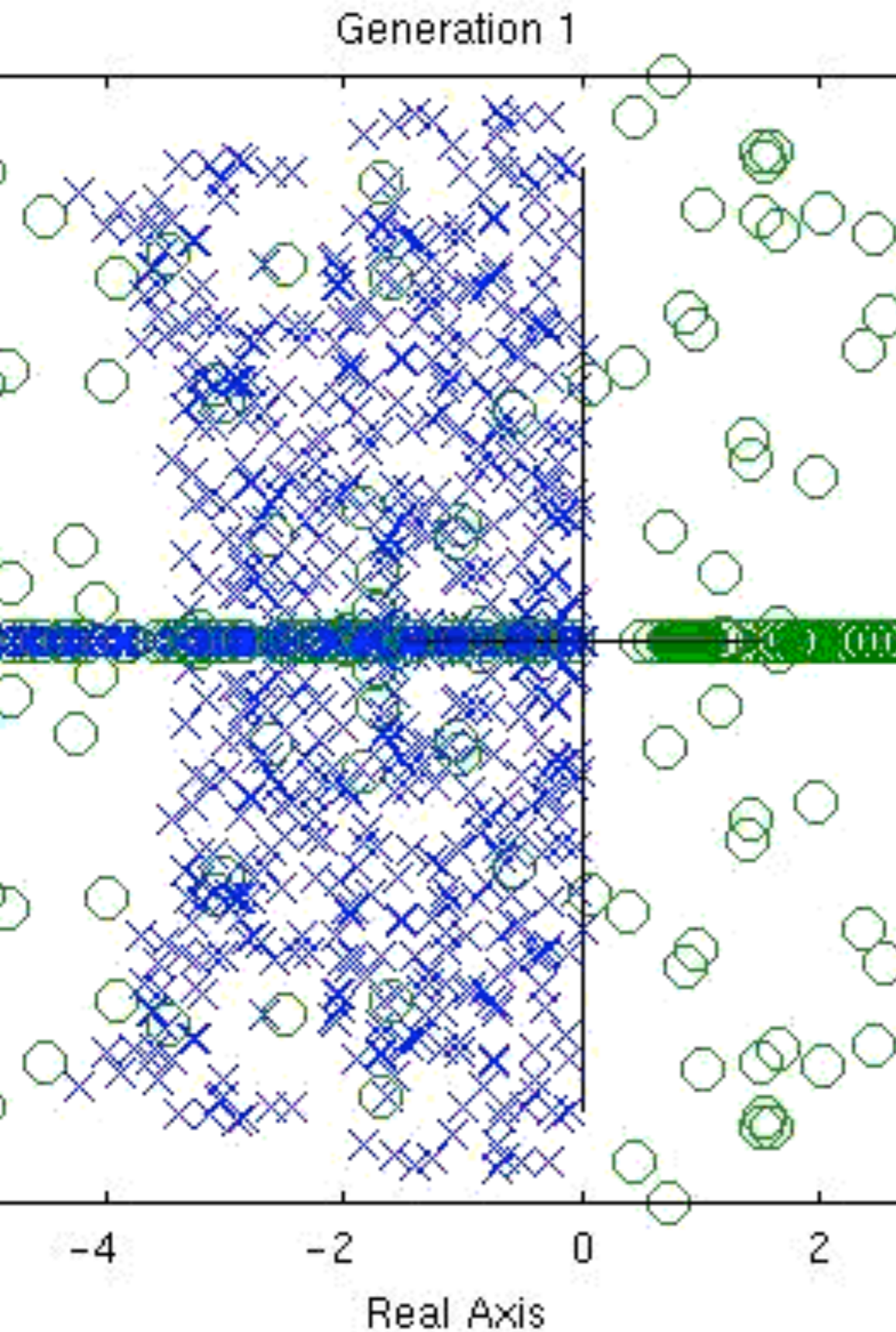
# Algorithms: Other Historical Aspects

- Gutenburg and the Printing Press
- Industrial Revolution and Automation
- The Jacquard Loom
- Babbage and Lovelace
- Time and Motion Studies
- Robots
- Issues in Computability and Recursion: Wondrousness

# Types of Use

- Purely automatic

- Semi-automatic via interface: the interface then plays a big part...



http://www.interdisciplinary.co.uk/content/chall5_details.html
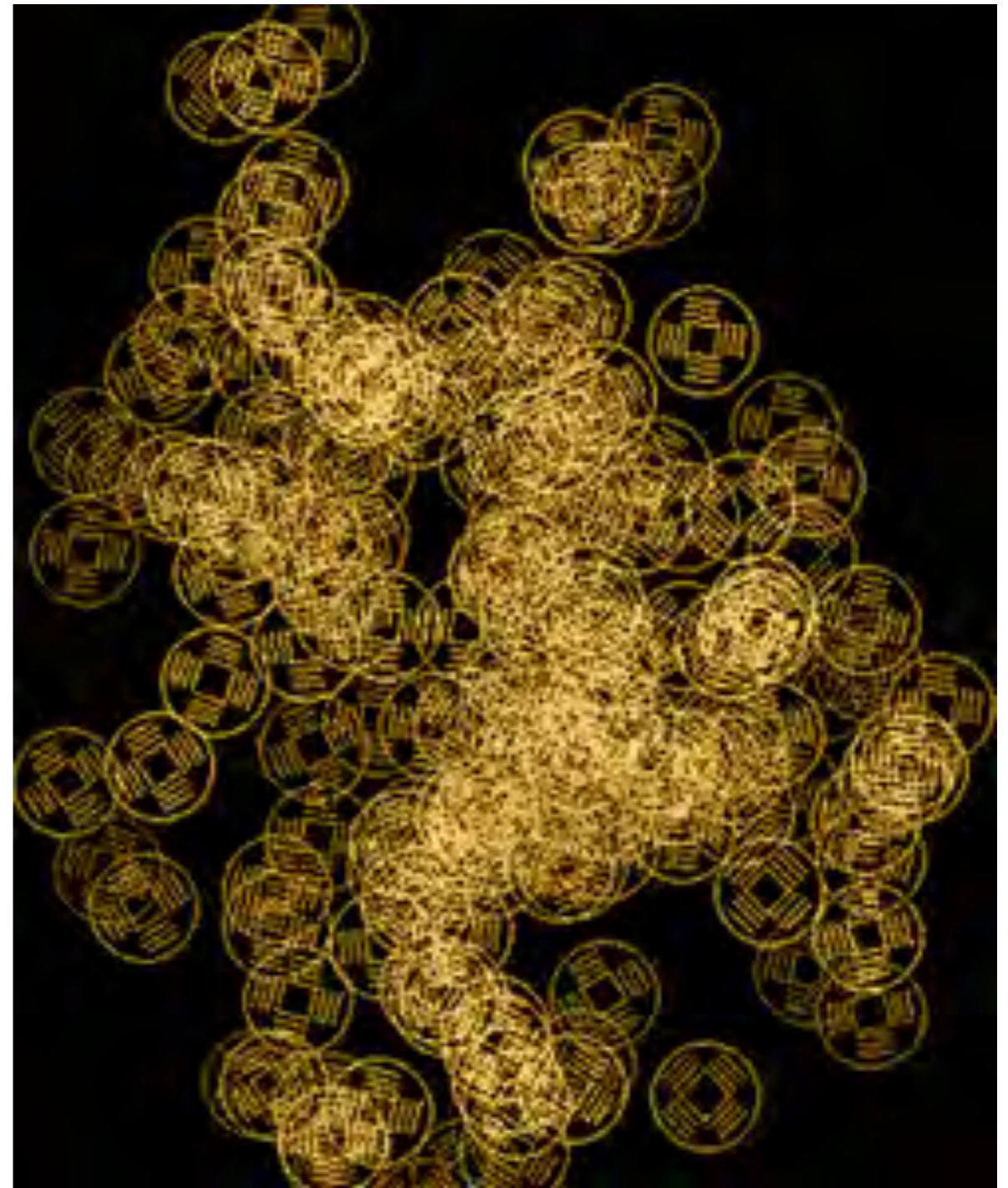
# David Cope

Experiments in Musical Intelligence:

- 'Bach' Invention

- 'Beethoven' Sonata Movement

- 'Chopin' Mazurka

- 'Joplin' Rag

# Douglas Hofstadter on Cope's EMI

"But the day when music is finally and irrevocably reduced to syntactic pattern and pattern alone will be, to my old-fashioned way of looking at things, a very dark day indeed.

"What worries me about computer simulations is not the idea that we ourselves might be machines; I have long been convinced of the truth of that. What troubles me is the notion that things that touch me at my deepest core -- pieces of music most of all, which I have always taken as direct soul-to-soul messages -- might be effectively produced by mechanisms thousands if not millions of times simpler than the intricate biological machinery that gives rise to a human soul.

# Douglas Hofstadter on Cope's EMI

"This prospect, rendered most vivid and perhaps even near-seeming by the development of EMI, worries me enormously, and in my more gloomy moods, I have articulated three causes for pessimism:

"(1) Chopin (for example) is a lot shallower than I had ever thought.
(2) Music is a lot shallower than I had ever thought.
(3) The human soul/mind is a lot shallower than I had ever thought."

# Cage/Essl: Fontana Mixer

10 transparent sheets with points, 10 drawings having six differentiated curved lines, a graph (having 100 units horizontally, 20 vertically) and a straightline, the two last on transparent material.

Place a sheet with points over a drawing with curves (in any position). Over these place the graph. Use the straight line to connect a point within the graph with one outside.

Measurements horizontally on the top and bottom lines of the graph with respect to the straight line give a 'time bracket' (time within which the event may take place).

Measurements vertically on the graph with respect to the intersections of the curved lines and the straight line may specify actions to be made. Thus in case of tape music, the thickest curved line may give sound sources. (...) Intersections of the other lines may specify machines for the alteration of original material. Amplitude, frequency, overtone structure may be changed, loops and specific durations introduced.
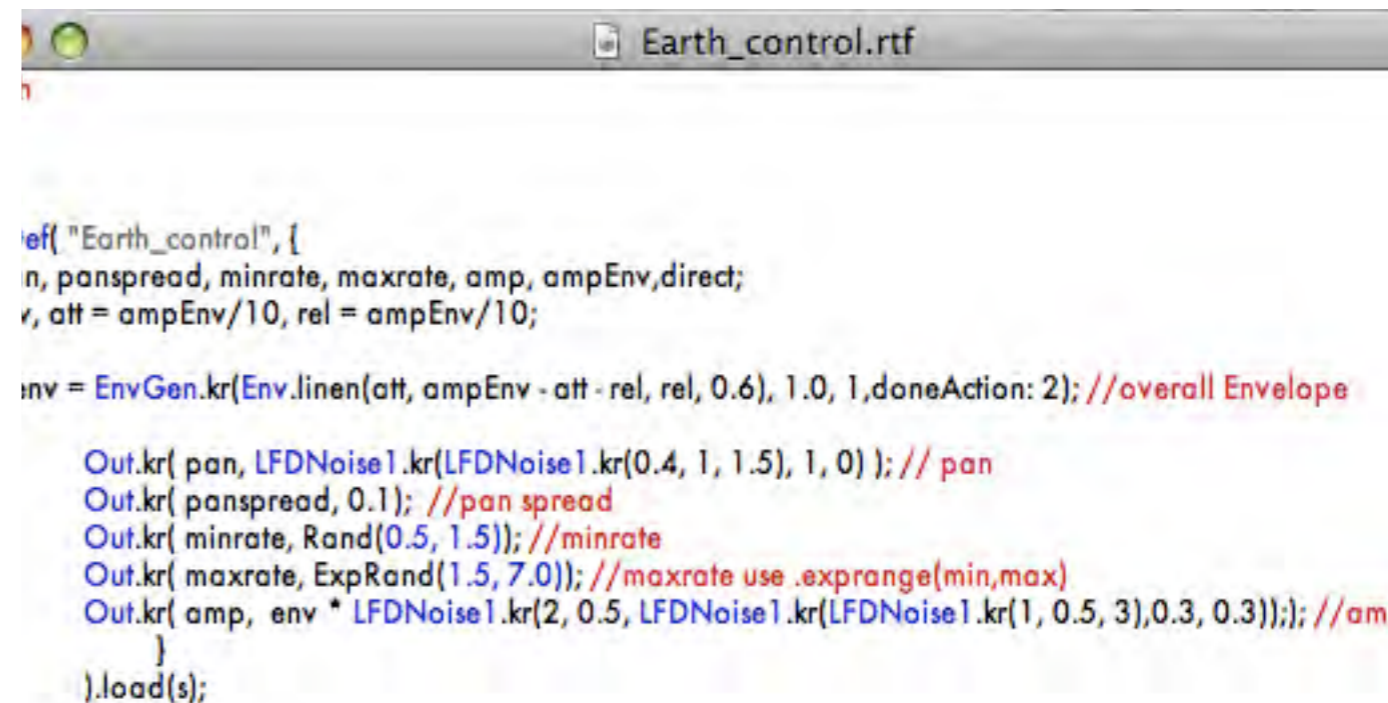
John Cage: Fontana Mix (1958) - Preface
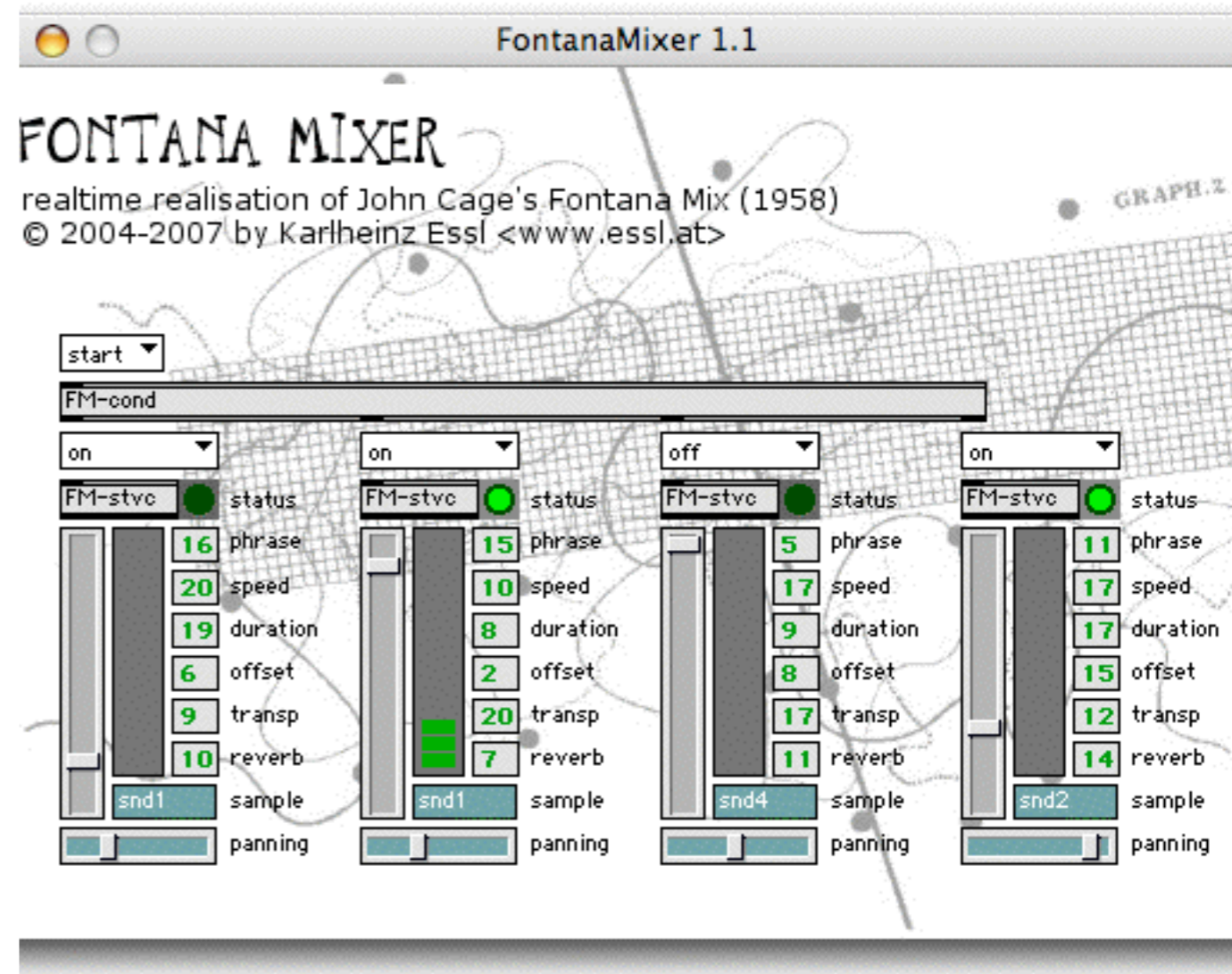
# Dionysius Athinasiou: Sound Sculpture

Dionysius, who graduated in 2007, undertook for his major project a study in algorithmic composition. The result was a sonic installation that provides an infinite number of combinations of provided sounds. While the music sounds recognisable, it is different at all times.   Or at least the probability of it producing precisely the same sequence of notes is very remote.
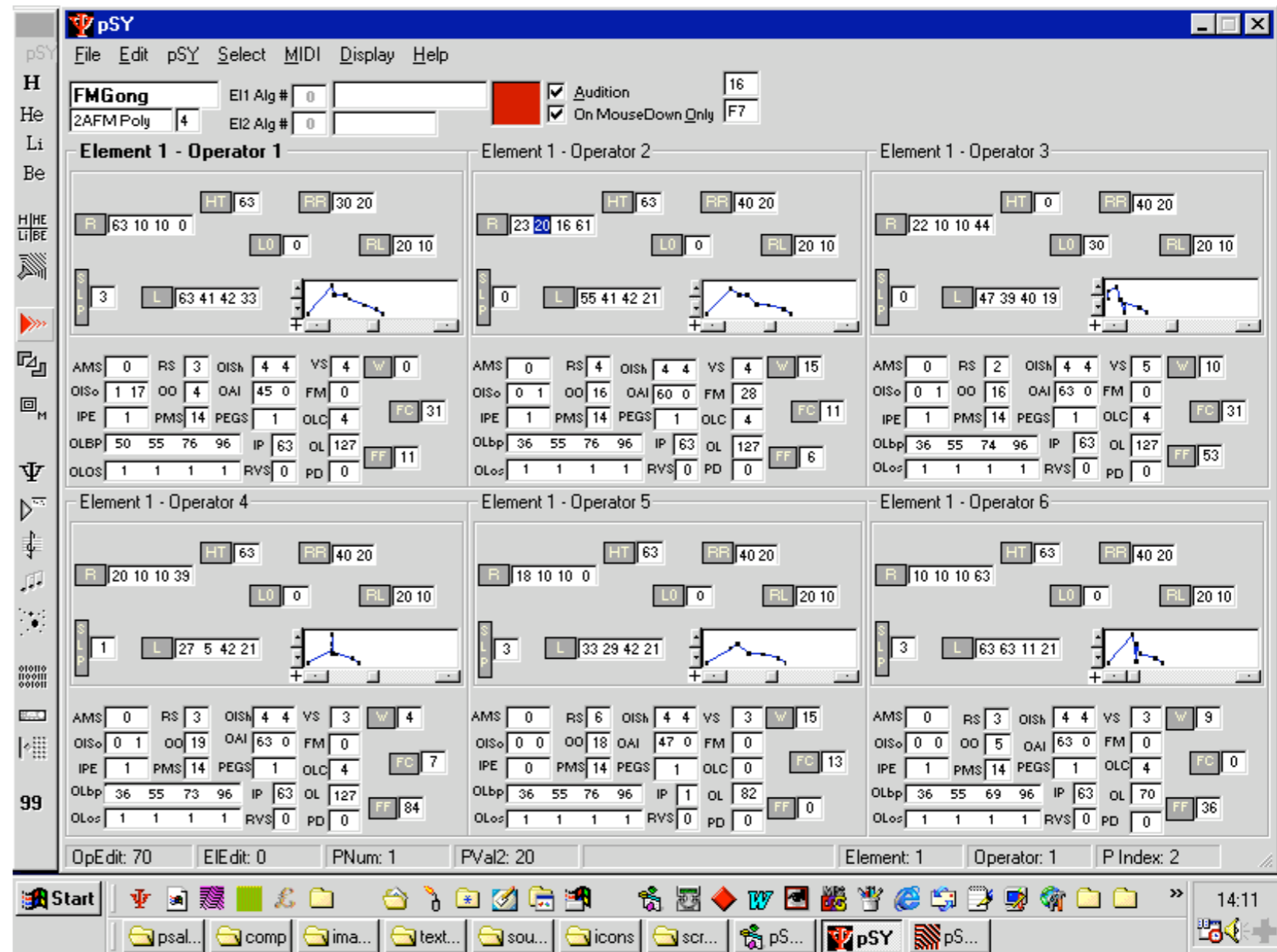


```
                                    Earth_control.rtf

ef( "Earth_control", {
n, panspread, minrate, maxrate, amp, ampEnv,direct;
, att = ampEnv/10, rel = ampEnv/10;

nv = EnvGen.kr(Env.linen(att, ampEnv - att - rel, rel, 0.6), 1.0, 1,doneAction: 2); //overall Envelope

    Out.kr( pan, LFDNoise1.kr(LFDNoise1.kr(0.4, 1, 1.5), 1, 0) ); // pan
    Out.kr( panspread, 0.1);  //pan spread
    Out.kr( minrate, Rand(0.5, 1.5)); //minrate
    Out.kr( maxrate, ExpRand(1.5, 7.0)); //maxrate use .exprange(min,max)
    Out.kr( amp,  env * LFDNoise1.kr(2, 0.5, LFDNoise1.kr(LFDNoise1.kr(1, 0.5, 3),0.3, 0.3));); //am
        }
).load(s);
```

# Telephony (2007)

Automatically chooses, processes, mixes and outputs samples from a sample bank

# The Copenhagen Interpretation (1998)

Algorithmic control over (four)
Yamaha SY77/99 synthesisers

# Long Player (1999)



Longplayer (Jem Finer) is a 1000 year long piece of music which started to play on the 1st January 2000 and will continue to play, without repetition, until the 31st December 2999, when it will come back to the point at which it began - and begin again...

**http://longplayer.org/what/overview.php**

# Floodtide (2008)

Sonification of the Thames, by
John Eacott