“The Planetarium as a Musical Instrument”
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HexAtom

- HexAtom is an interactive graphical game designed for play on a planetarium dome.
  - Premiere was Tuesday March 20 at Kutztown U. of PA
- It uses the metaphor of atoms of elements 0 through 11 that players inject into an expanding universe.
- Element numbers map to intervals in the scale used in each of up to 16 MIDI channels.
Atoms Have Stochastic Properties

• Physical probabilities for each element include deflection, escape, and expansion of universe.
• Atomic probabilities include fission and fusion with other atoms.
• Simulated gravity probabilities allow some elements to make tracks which others follow.
• Emergent properties such as element type and physical distribution map to musical properties.
Game play through a mobile GUI and live coding in Python – atom injection and manipulation of probabilities

d1001

dir = ['s','n','nw','sw','ne','se']
for i in range(0,1000):
    a(i%12, dir[i%6], 0)  # add 1000 atoms in a pinwheel configuration

pmt0=1
pmt1-11=0
pmt2=0
pmt1-11=1

# have atoms 1 thru 11 follow 0

pfi12=.01

28: d21

None

14 19 14 14 11 6 4 4 2 1 2 2 TOTAL = 93 (-10,-17) (10,17), d = 21, t = 60.0
Geometric distribution from above
Live Code – with gravity
Geometric distribution from above
Live Code – discarding gravity
HexAtom Game Play

• Players inject Element-Direction-Delay triplets into the game.

• Players can manipulate per-element probabilities for fission, fusion, escape, expansion of universe, etc.

• Players can perform live coding via a Python command-line user interface.
  • Live coding supports semi-automation of play.
Game-to-Music Mapping

• A second GUI + Python command screen provide mapping from game state to musical properties such as tonic, scale (intervals determined by atomic number), tempo, meter, sustain, notes-per-atom, MIDI patch, etc.

• Downstream synthesizers outside the game create tones from generated MIDI data.

• Surround spatialization from sounding atoms used to direct voices in a planetarium.
Stochastic Algorithmic Improv

• A composition is a stochastic state machine.
  • Hidden Markov models are an analytic approach.

• Rather than using a deterministic score, each musical event has an implicit or explicit probability of occurring when performed.

• Event probabilities are interrelated.

• Performance = collapsing probabilities to 0 or 100% by playing with the machine.
load(values2.cfg)

accents16 = [2,1,2,1,1,2,0]

#channel0 = 0
#accents0 = [2,1,1,2,1,2,0]

hold0 = False

loggingoffdelay0 = 0

notes0 = [3]

notesoffmeasure0 = False

octave0 = [-2,-1,0,1,2,1,0,-1]

panrange0 = 0

panrange0 = 0

patch0 = 53

period0 = ["dorian"], "false"

quiet0 = False

quiet0 = False

scale0 = wave

scale0 = wave

tempo0 = 100

tempo0 = 70

velocity0 = 100

volume0 = 100

volume0 = 0

volumerange0 = 0

wordpathdepth0 = -1

wordpathdepth0 = RADIAL

wordpathstart0 = 0

wordpathsync0 = False