Distributed Composition of Abstract Music

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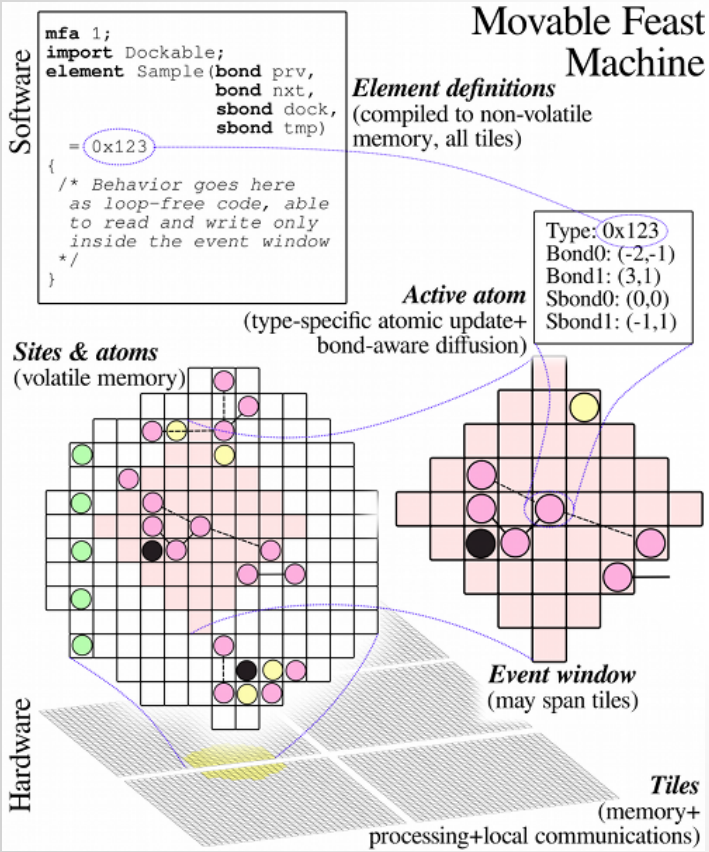
Computer Generated Music

- Mathematical models
  - Stochastic processes
- Grammars
  - Macro-level organization
- Evolutionary models
  - Human fitness functions

The Moveable Feast Machine (MFM)



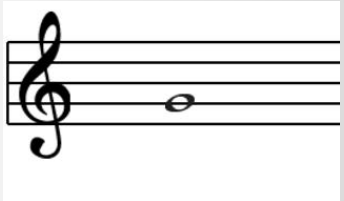
- Robust and indefinitely scalable
- Asynchronous cellular automata
- Grid of hardware tiles made of memory *Sites*
- Programs called *Elements*
- Instances of Elements called *Atoms* are created and run in individual Sites
- Atoms interact with other Atoms around them
- *Event Window* is a von Neumann Neighborhood with distance of 4
- When Atom is given an *Event*, it can affect any of the Atoms in its Event Window

Music in the MFM

- No global communication
- Solution is to have lots of Atoms all working in concert to generate music

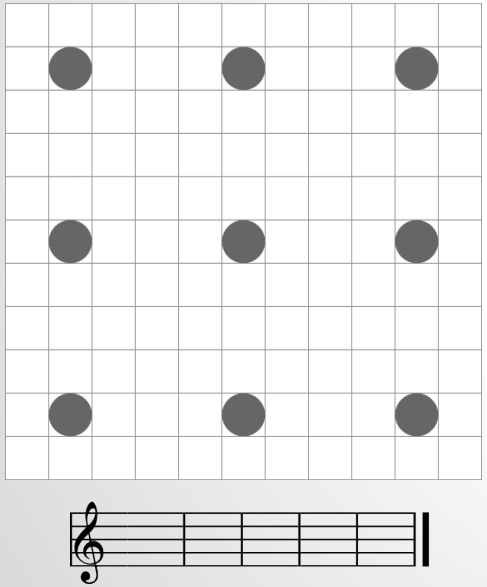
Elements

- Staff
- Note
- Composer

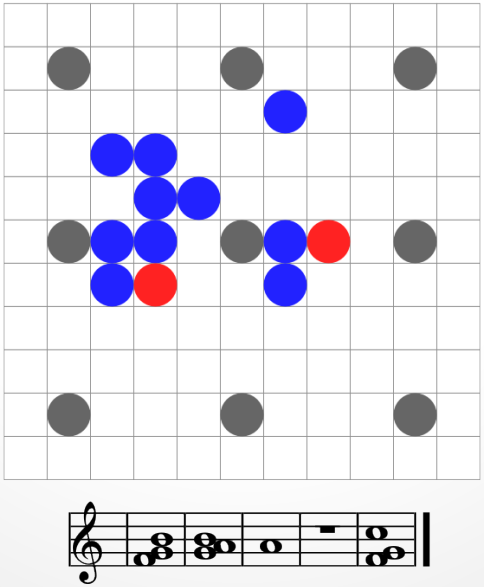


The Model

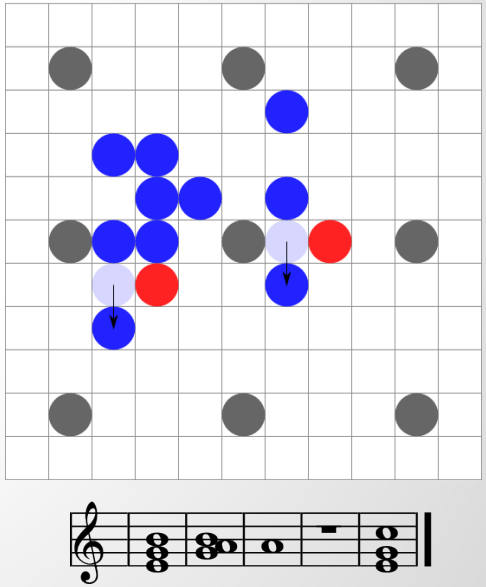
Step 1:
A Staff is created



Step 2:
Notes and Composers are placed



Step 3:
Composers arrange notes to make chords



Demo

The Composer

3 Levels of Behavior

1. Randomly move Notes around
2. Try to make a Triad with the fewest number of moves
3. Move and delete Notes to make an Atom-specific Triad

Measuring our Success

Just Intonation

Note	C	D	E	F	G	A	B
Natural	24	27	30	32	36	40	45

C Major chord - 24:30:36 ≡ 4:5:6

E minor chord - 30:36:45 ≡ 10:12:15

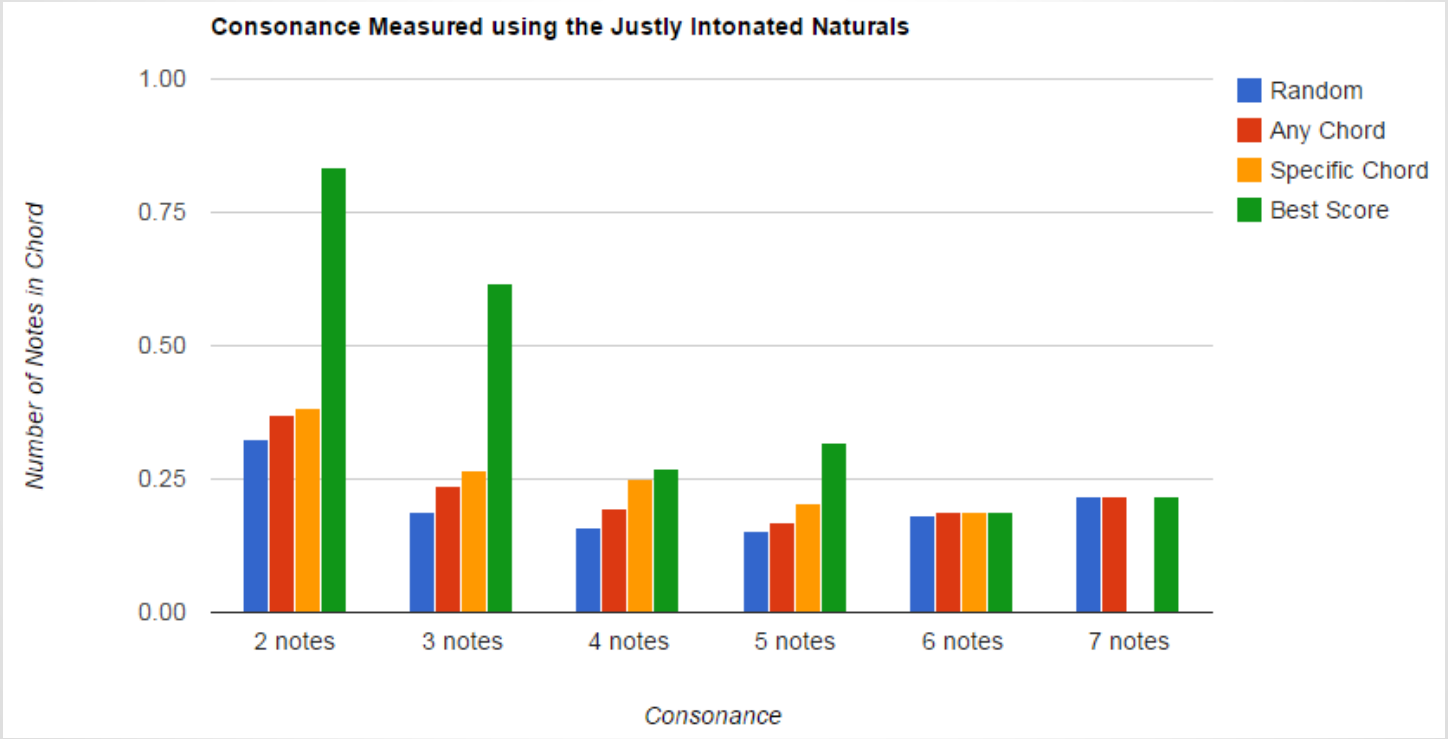
Measuring our Success

$$C(r) = \sum_{i=1}^{n} \frac{1}{r_i}$$

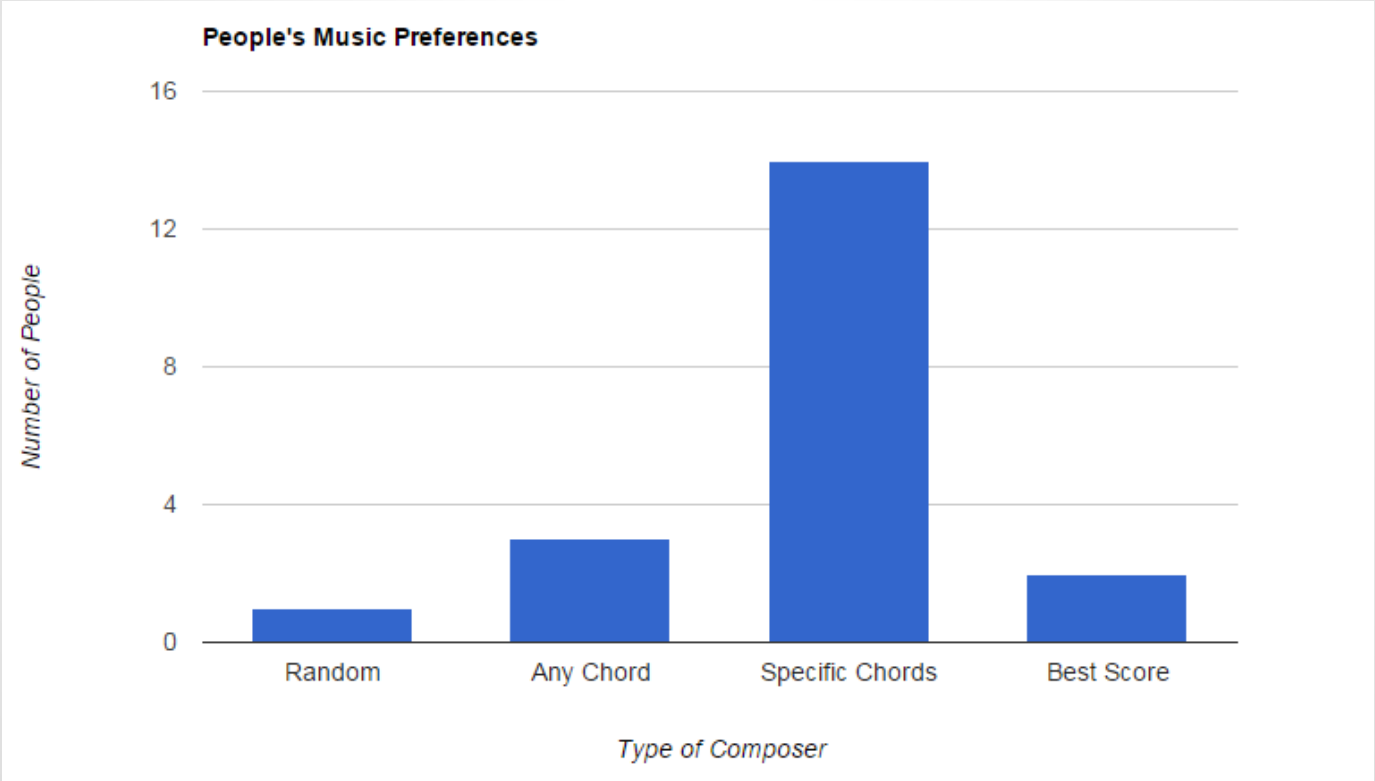
n - how many numbers are in our ratio
r_i - the i^{th} number in our ratio

C(C Major) = C(4:5:6) = 0.6167
C(E minor) = C(10:12:15) = 0.25

Results


Consonance Measured using the Justly Intonated Naturals
1.00
0.75
0.50
0.25
0.00
Number of Notes in Chord
2 notes
3 notes
4 notes
5 notes
6 notes
7 notes
Consonance
Random
Any Chord
Specific Chord
Best Score

Results


People's Music Preferences
16
12
8
4
0
Number of People
Random
Any Chord
Specific Chords
Best Score
Type of Composer

In Summary

- Atoms' limited view presents a major obstacle
- We can work around that by having Composers work together
- People like music that scores somewhere in the middle

Future Work

- More methods and larger survey so our preference graph is higher resolution
- Gives notes specific roles (melody, harmony, etc…)
- Communication between more elements

Thanks for coming today!