Cellular Symphonies

Creating Orchestral Music with Cellular Automata

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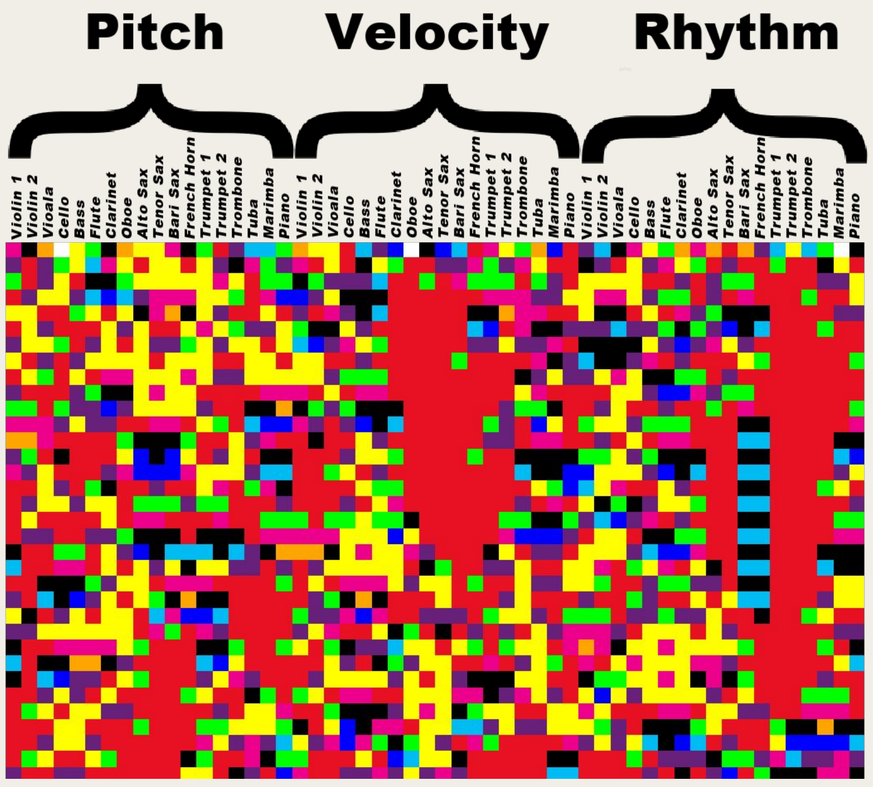
Motivation

- Cellular automata are usually represented visually in state-time diagrams or animations.
- Musical representations can be created by dividing cells into various musical instruments and assigning state values to different pitches, volumes, and rhythmic divisions

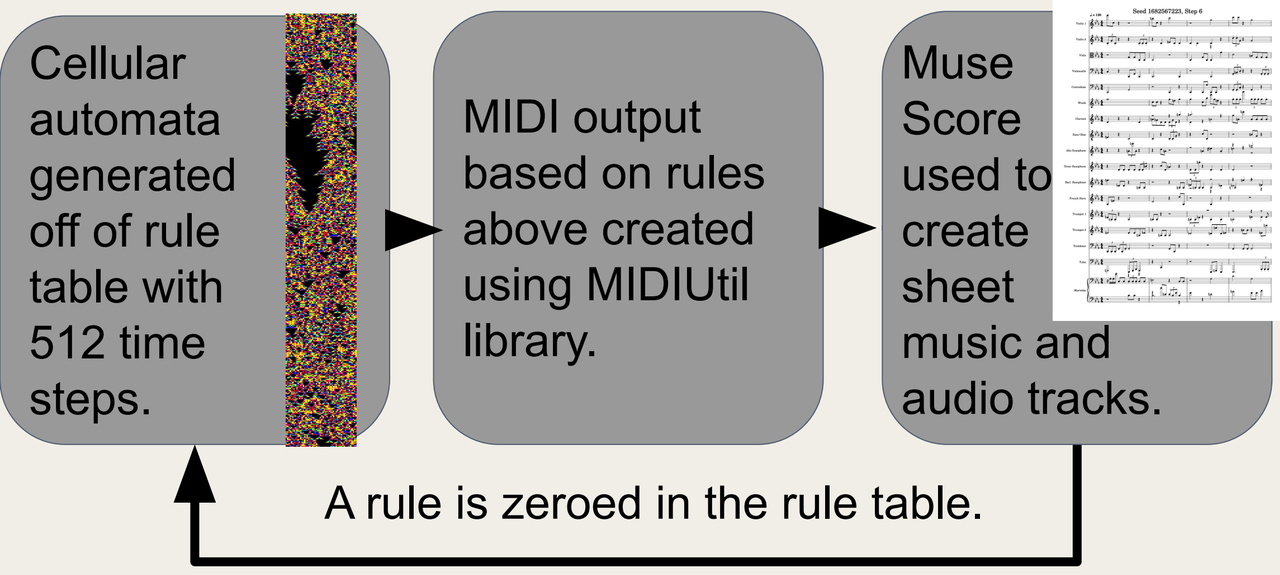
Method

- Cellular automata with 10 states and 54 cells were used



- 18 instruments were used, each with a cell for pitch, volume, and rhythmic division.
- Harmony was determined probabilistically using the seed of the automata.

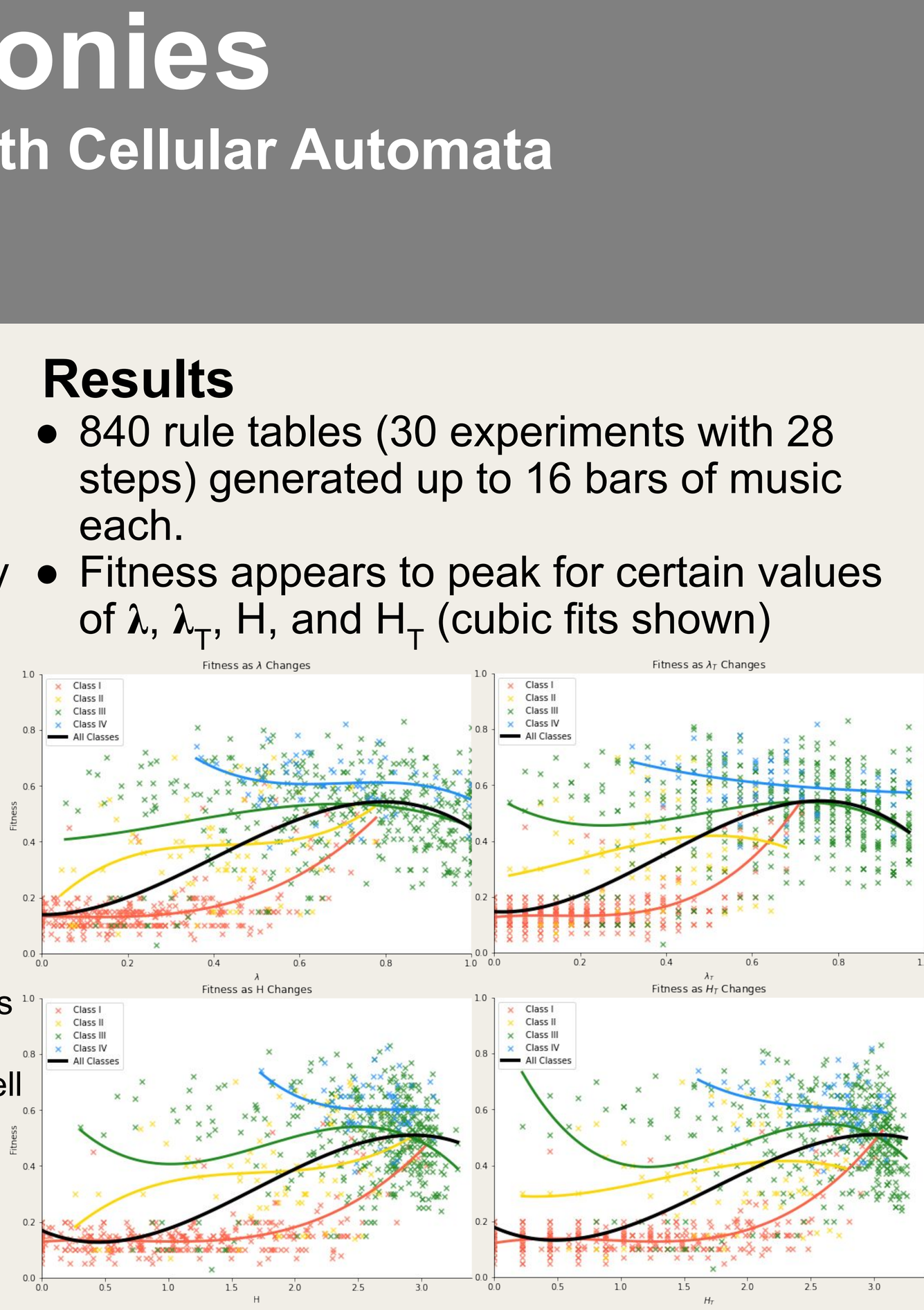
- Rules in the rule table were successively zeroed out with MIDI generated for each new rule table. Values of λ, λ_T, H, and H_T were calculated.



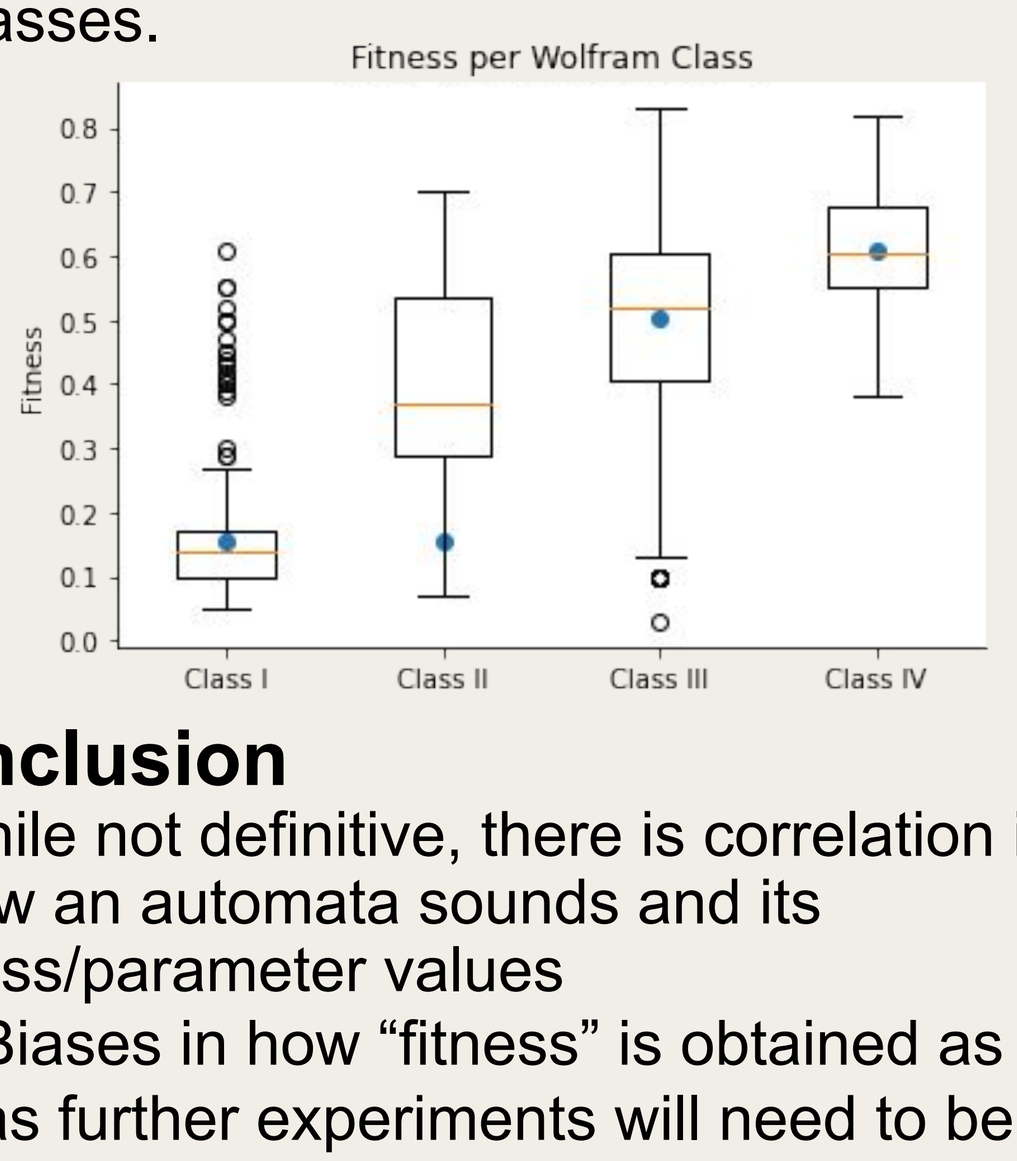
- Every output was listened to and assigned a “fitness” value in [0, 1] based on how much I liked listening to it.

Results

- 840 rule tables (30 experiments with 28 steps) generated up to 16 bars of music each.
- Fitness appears to peak for certain values of λ, λ_T, H, and H_T (cubic fits shown)



- Fitness varies considerably across Wolfram Classes.



Conclusion

- While not definitive, there is correlation in how an automata sounds and its class/parameter values
  - Biases in how “fitness” is obtained as well as further experiments will need to be considered
- Could be used as complementary tool for composition and production, but likely to not be used strictly on its own

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