

**Hyperscore**  
by Mary Farbood

Presentation by  
**Reid Swanson**

2-8-2007

### Overview

- How it got started
- The versions
- Conclusion and future work
- Toy Symphony
- Discussion

2

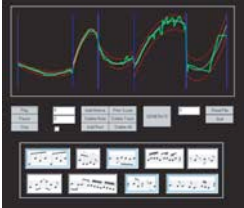
### The Birth of Hyperscore

- Originally conceived as the software component of the “Big Thing”
  - A toy for children to play with and experiment with music
  - Prototype made but never made it of the ground
- Evolved into a stand alone composition tool
- Goal:
  - Let users excel at what they are good at
    - Making short melodies
    - Designing overall structure
  - For beginners and advanced composers

3

### Version 1 (Overview)

- Presents the user with a graphical workspace for composition
  - Drawing area
  - Precomposed Motives
- Low level sounds are handled by MIDI
- High Level structures are organized through ScoreObj objects
  - Motives have one track
  - Complete piece has 5 tracks



4

### Version 1 (Algorithms)

- 5 total voices
- Chose 1 Motive for the backbone/tenor
  - Randomly from user selected motives
  - Continue randomly appending motives until maximum length is reached
- Other 4 voices
  - 3 choices
    - Randomly choose motive
    - A counter-motive
    - Random series of rests
  - The choice is determined by the shape/bumpiness of the curve
- Octave ranges scaled for each voice
- MIDI velocities scaled based on drawing

5

### Version 1 (Vector Analyzer)

- Written by Egon Pasztor
- Used to describe the texture of the curve
- Recursively bifurcates the curve into two segments
  - Fits each half to a parabola
  - Returns a binary tree representing where best to split
  - Flatten the tree to some heuristic depth
  - Texture is the mean-squared error value of the segment containing the x-value
- Algorithm?

$$OPT_j = \min_{1 \leq i \leq j} \epsilon_{i,j} - C - OPT_{j-1}$$

6

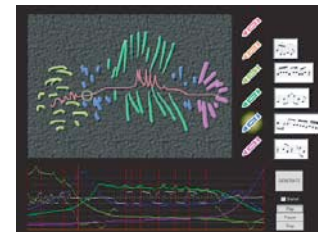
### Version 1 (Analysis)

- Good Textures
- No phrasing
- No harmonic movement

7

### Version 2

- Expanded the drawing capabilities
  - Allow for multiple supporting curves
    - Do this through "pens"
      - Red pen for backbone
      - Other pens for accompanying motives



8

## Version 2

- Algorithm Changes
  - Don't pick motives at random
    - Pen color determines how influential a motive is
  - Let users choose when motives should appear
  - Use a localized texture measure instead of error metric to choose between motive, counter motive and rests
    - Line still stored as 2D array of control points
    - Angles between each line segment computed
    - Create an array of standard deviations from these angles
      - Compute using 10 points at a time

9

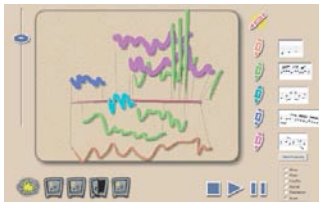
## Version 2

- Introduce a harmony generator
  - Uses hierarchical Markov chains to handle organization layers
    - One layer for harmonic functions
    - One for actual chord generation
- Analysis
  - Harmony generator produces richer sound
  - Still not much structure (30 second pieces max)
  - More confusing than version 1
    - Not clear how the drawing corresponded to the output

10

## Version 3

- Changed model of assumption
  - From: Composer influencing how computer generated music
  - To: Computer dictating what the composer annotated



11

## Version 3

- Annotation Functions
  - Each annotation assigned a start and end point
    - Looped until it reaches end point
  - Average distance from spine determines pitch
  - Bumpiness determines timbre
  - Vertical spikes indicated accented chords
- Other changes
  - More tracks allowed in ScoreObjs
  - Stop playback at any time
  - New harmony types
  - Can save chord progressions
  - Tempo knob
- Analysis
  - Reverse problem: Too much unstructured decision making

12

## Version 4

- New editing model
  - Motives editable
  - Can click and drag curve (instead of deleting it)



13

## Version 4

- New Harmonic Generator
  - Tries to use qualitative input from contour of spine
  - Based on David Cope's SPEAC system
    - **S**tatement: exists "as is"
    - **P**reparation: precedes statements or other identifiers (not independent)
    - **E**xtension: follows an identifier other than another extension or preparation
    - **A**ntecedent: causes a significant implication and requires a resolution
    - **C**onsequent: appears in response to an antecedent
  - New Mappings
    - New motive transformations based on the drawing

14

## Conclusion & Future Work

- User Responses & Complaints
  - Version 3 & 4 the best
    - Previous versions confusing
  - Can't playback small regions
  - People like to draw objects (houses, etc)
  - Musicians tend to want more control
  - Everyone likes the ability to shape at the macro level
  - No way to create traditional score from piece
    - Also what about the other way around
- Some basic questions still unresolved
  - How do graphical features map to musical elements
  - How much should the computer automate
  - How to manipulate between levels of abstraction

15

## Toy Symphony

- International music performance & education project
  - Headed by Tod Machover
  - Goal: introduce kids to creative music making through toys

16

## Toy Symphony

- Major components
  - Music Toys
    - Beatbugs
      - Digital instruments that trades sounds and control each other's output
    - Music shapers
      - Physical objects that react to the contact made
    - Voice transformers
      - Toy for transforming voices
    - Hyperviolin
      - Wireless device in bow and shoe of performer that analyzes and modifies the sound of the violin
  - Hyperscore
    - Primary composition tool
    - Goal to help child create a three minute piece (hmm)

17

## Discussion

- What do you think?
  - What level of control is optimal?
  - Is visual data, i.e. drawing, easier for people to understand?
    - What is the semantics of a drawing in terms of music?
    - Is drawing a house really "misguided"?
  - What next?

18