

# When Harry Met Iannis

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[AlgoCompSynth.com/](http://AlgoCompSynth.com/)

# Who Am I?

- Mathematician / Computer Scientist
- Computer Performance Engineer
- Neuro-Semantics® Trainer
- Studio Composer
- Karaoke / Folk Singer
- Actor
- Etc.

# Who Was Harry Partch?

- Born 1901, Died 1974
- Composed in a 43-tone Just scale
- Had elaborate theory behind the scale
- Wrote theatrical pieces
- Built his own instruments
- *Genesis of a Music* (1974), Da Capo Press, New York, ISBN 0-306-80106-X

# Partch Concepts in the Piece

- The Tonality Diamond
  - Otonality / Utonality
  - Numerary Nexus
  - Oidentity / Uidentity
  - $1/1 = G\ 392$
- Building your own instruments 😊

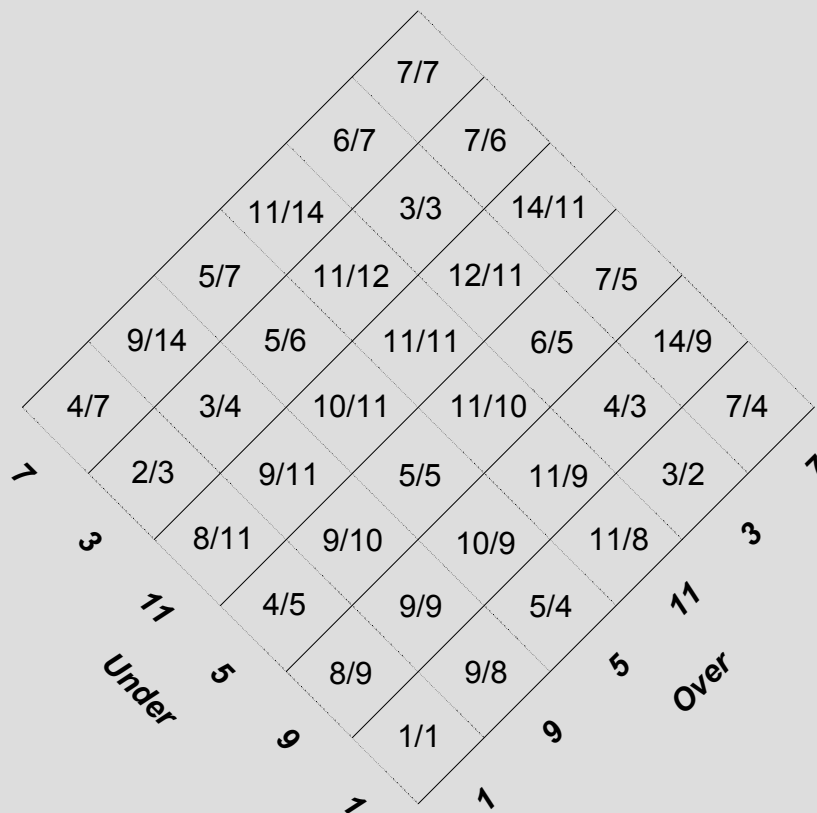
# Who Was Iannis Xenakis?

- Born 1922, Died 2001
- Born in Romania, Greek parents, French citizen
- Most famous work was the Philips Pavilion at the Brussels Worlds Fair
- Composed for both conventional and electronic instruments
- Mostly algorithmic composition
- *Formalized Music* (1992), Pendragon Press, Stuyvesant, NY, ISBN 0-945193-24-6

# Xenakis Concepts in the Piece

- Stochastic algorithmic composition
- Electronic instruments

# The Tonality Diamond for “When Harry Met Iannis”



# Patch Terminology

- A pitch is defined as a ***ratio*** of two numbers
- The numerator is called the ***Over*** number
- The denominator is called the ***Under*** number
- 1/1 has frequency 392 Hz (G below A440)
- 1/2 has frequency 196 Hz (G below A220)
- Etc.



# Conventions

- Differs from the version in *Genesis of a Music*:
  - “lower octave” is pitches **below** G 392!
- Over or under number is multiplied by powers of two to place pitch in the desired octave
- Ratios are reduced to lowest terms
- The numbers 1, 9, 5, 11, 3, 7 are called **Identities**
- **Otonalities** go up to the right between solid lines
  - Pitches increase in frequency
- **Utonalities** go up to the left between dotted lines
  - Pitches decrease in frequency

# Otonality

- An ***Otonality*** is a collection of pitches with a common ***Under*** number
- This Under number is called the ***Numerary Nexus***
- The ***Over*** numbers are called ***Odentities***
- Corresponds to a “major” key in conventional notation
- Six Otonalities in the diamond, going upwards in pitch

# Utonality

- A ***Utonality*** is a collection of pitches with a common ***Over*** number
- This Over number is called the ***Numerary Nexus***
- The ***Under*** numbers are called ***Udentities***
- Corresponds to a “minor” key in conventional notation
- Six Utonalities in the diamond, going downwards in pitch

# Coding of Chords in “When Harry Met Iannis”

- The piece consists of a sequence of chords from the diamond
- A chord has four components:
  - Otonality/Utonality switch:  $+1 = O$ ,  $-1 = U$
  - Octave multiplier relative to G 392
  - Numerary Nexus
  - List of Identities

# Stochastic Composition

- ***Stochastic*** means that it has random elements
- Any or all elements of a stochastic composition may be random
- Examples go back to Mozart's time, using dice
- Modern stochastic composition using computers started in the late 1950s / early 1960s by Hiller, Isaacson and Xenakis
- Hiller and Partch and Borasky ☺ were all at the University of Illinois Urbana at the same time!

# Structure of “When Harry Met Iannis”

- The piece starts with the full six-pitch chord (hexad) in the Otonality with Numerary Nexus 1
  - Bottom Otonality in the diamond
- Each successive chord is generated by a random transformation of the preceding chord
- Durations of the chords are generated at random

# Major Transformations

- Flip the Otonality / Utonality switch
- Go up or down an octave
- Replace the Numerary Nexus with one of the other five
- Add or delete one of the Identities

# Octave Jumps

- Pick a direction (up or down) at random
- If the new octave would be too high or too low, go the other way
- Random walk with reflecting barriers



# Adding / Deleting Identities

- Choose add or delete at random
- If the new list would have too few or too many, do the other one
- If adding, add one that isn't already there at random
- If dropping, delete one at random

# Final Chord Generation

- One of the Identities is chosen at random as the “root” of the chord
- This “root” is placed in the octave between  $1/1$  and  $2/1$  for an Otonality and between  $1/2$  and  $1/1$  for a Utonality
- The rest of the pitches in the chord are placed in the octave up from the root for an Otonality and down from the root for a Utonality
- The whole chord is then transposed according to the octave multiplier

# Where We Are

- What we've described so far is the composition process
- Implemented as a *Perl* script
- Output is a score for a computer sound generation language
- Could be modified to produce scores for other instruments, MIDI with pitch bends, etc.

# Sound Generation In “When Harry Met Iannis”

- Sound is generated with ***sfront***
  - Open source, free software from UC Berkeley
  - Uses MPEG-4 Structured Audio
  - Similar in principle to ***CSound***
  - Has an “orchestra” language (SAOL)
  - Has a “score” language (SASL)
  - Can read MIDI, read and write most common audio files
  - Can process and generate audio in real time

# Basic Instrument

- The basic instrument is a sung vowel emulator
  - ***sfront*** “vowels” example
  - Harmonically rich tones
  - /i/, /u/, /a/, /E/
- Reverb, envelope and stereo panning added from ***sfront*** “vcsine” example
- Doesn’t really sound like sung vowels
  - Probably a bug in my SAOL hacking ☺
- Vowel chosen at random for each pitch in the chord
- Stereo position between full left and full right chosen at random for each chord

# Five Minutes of Music

- <http://AlgoCompSynth.com/WhenHarryMetIannis.html>



# Questions?

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