Eikosany: Microtonal Algorithmic Composition with R

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Algorithmic Composition

Overview of Methods (Nierhaus 2009)

- Markov Models / Stochastic
- Generative Grammars
- Transition Networks
- Chaos and Self-Similarity
- Genetic Algorithms
- Cellular Automata
- Artificial Neural Networks

My Main Focus

- Markov Models / Stochastic
  - Pioneered by Iannis Xenakis (Xenakis 1992)
  - (for example, Borasky 2021 - random walks on chord matrix)

Musical Scales

Types of scales

- Standard "western" tuning - 12 equally-spaced tones / octave
  - abbreviated 12-TET or 12-EDO
- Alternative tuning - anything else
  - scales from other cultures
  - "just" scales - scales based on rational numbers
  - scale periods different from the octave
  - scale period divided into more than 12 tones
  - combinations of the above!

Microtonal music

- Usually defined as an octave divided into more than 12 tones
- Common microtonal scales
  - 19-TET
  - 24-TET aka quarter tones
  - 31-TET

Erv Wilson (Narushima 2019)

Ervin Wilson (June 11, 1928 – December 8, 2016)[1]

- Mexican/American (dual citizen)
- Prolific music theorist
- Developed keyboard layouts, scales and lattices
- Primarily known for just microtonal scales

Combination Product Sets

- Focus of the `eikosany` package
- Start with a set of *harmonic factors*
- Take all the combinations of the factors with `N` elements
- Take the products of the combinations
- Reduce the products to ratios in [1, 2) - multiply or divide by powers of two
- Sort

Example: 1 3 5 7 Hexany

- Combination products: `1*3, 1*5, 1*7, 3*5, 3*7, 5*7`
- Raw ratios (divide by smallest product): `1 5/3 7/3 5 7 35/3`
- Reduce: `1 5/3 7/6 5/4 7/4 35/24`
- Sort: `1 7/6 5/4 35/24 5/3 7/4`

Using the package!

```
hexany <- eikosany::cps_scale_table(
  harmonics = c(1, 3, 5, 7),
  choose = 2
)
print(hexany$ratio_frac)
```

```
## [1] 1     7/6   5/4   35/24 5/3   7/4   2
```

Current Outputs / Workflow

Basic Workflow

1. Pick scale - most common are hexanies and eikosonaies
2. Generate scale table

Roadmap

References

References

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Xenakis, I. 1992. *Formalized Music: Thought and Mathematics in Composition*. Harmonologia Series. Pendragon Press.