Representation of musical notation in Haskell

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September 9, 2017
Motivation

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Representation of musical notation in Haskell
(Notated) musical pitches are the points on a lattice
(Notated) musical intervals connect the points, forming a ‘free Abelian group’ with two generators
Theory

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• ‘Syntonic’ temperaments assign two frequency ratios to the two generators
• ‘Equal’ temperaments project the two dimensions down to one
Theory

- Pythagorean
  
  \[ P5 \rightarrow \frac{3}{2}, \quad P8 \rightarrow 2 \]

- ‘Quarter-comma meantone’
  
  \[ M3 \rightarrow \frac{5}{4}, \quad P8 \rightarrow 2 \]
Theory

- Pythagorean

  \[ P_5 \rightarrow \frac{3}{2}, \quad P_8 \rightarrow 2 \]

- ‘Quarter-comma meantone’

  \[ M_3 \rightarrow \frac{5}{4}, \quad P_8 \rightarrow 2 \]

- 12-equal temperament

  \[ d_2 \rightarrow 1, \quad P_8 \rightarrow 2 \]

- 19-equal temperament

  \[ dd_2 \rightarrow 1, \quad P_8 \rightarrow 2 \]

- 31-equal temperament

  \[ dddd_3 \rightarrow 1, \quad P_8 \rightarrow 2 \]
Implementation

- Flexibility (via typeclasses) in what counts as a Pitch, Interval or Duration
- A Note is an ordered pair (Pitch, Duration)
- A Phrase is just a linked list, [Note]
- A piece of music consists of a Rose tree of musical phrases
- Internally the preferred lattice basis is (A1, d2)
- Have to invert a 2 * 2 matrix to calculate tuning map