Le Pendu

An exploration of Neo-Riemannian Transformations and Euclidean Rhythms

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Euclidean Rhythms

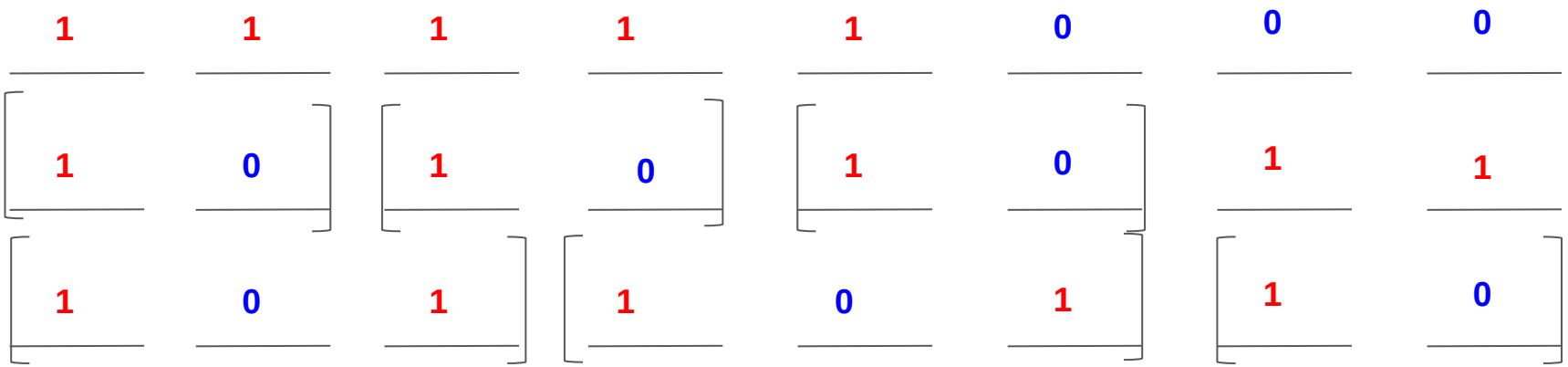
DEMO: https://dbkaplun.github.io/euclidean-rhythm/

What is a Euclidean Rhythm?

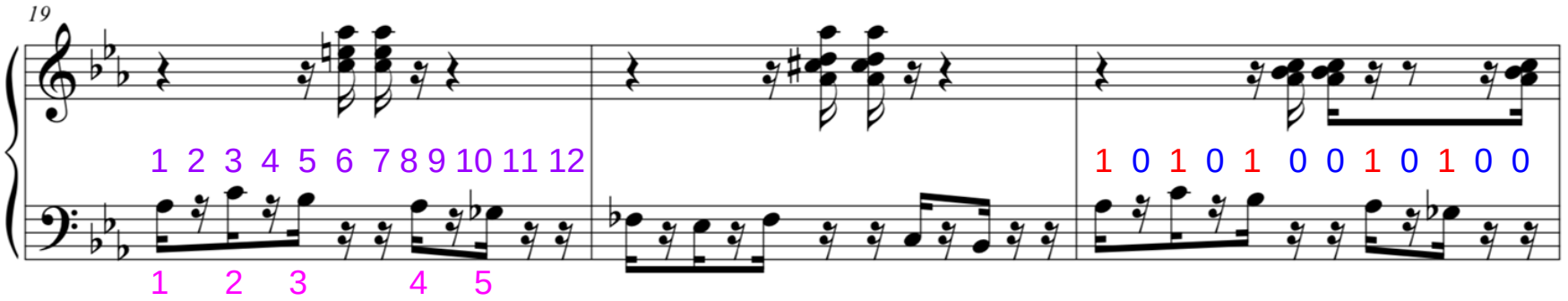
- **Euclidean Algorithm**
  - A way to find the greatest common divisor of two numbers
  - The largest number that divides two numbers without leaving a remainder
- **How does this translate to music?**
  - Here, the numbers we are looking at are number of pulses and number of notes
  - Let us take 8 pulses and 5 notes (1's are on notes and 0's are off notes)

Example: gcd(6,33)
33=(6)(x)+r
33=(6)(5)+3
6=(3)(x)+r
6=(3)(2)+0

So, our greatest common divisor is 3



Euclidean Rhythms in Our Piece



1	1	1	1	1	0	0	0	0	0	0	0
1	0	1	0	1	0	1	0	1	0	0	0
1	0	0	1	0	0	1	0	1	0	1	0
1	0	0	1	0	1	0	0	1	0	1	0

Now onto:

Neo Riemannian Transformations

Music: A mathematical interpretation

A prelude to Neo-Riemannian Transformations

Definition 1 Let <a,b,c> be a **major** chord, then b = a + 4, and c = a + 7 where a, b, c $\in \mathbb{Z}_{12}$.

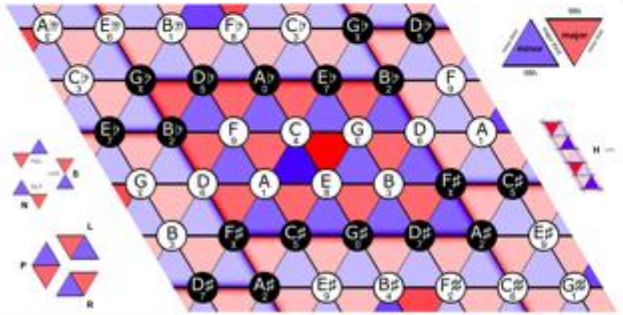
Definition 2 Let <a,b,c> be a **minor** chord, then b = a + 3, and c = a + 7 where a, b, c $\in \mathbb{Z}_{12}$.

Now that we have defined the elements, we will refer to them as *pitch class triads* and will denote the set of these 24 major and minor triads. The entire set is displayed in the table.

Table: Set of all major and minor triads

Major Chords		Minor Chords	
C	<0,4,7>	C	<0,3,7>
C♯/D♭	<1,5,8>	c♯/d♭	<1,4,8>
D	<2,6,9>	D	<2,5,9>
E♭/D♯	<3,7,10>	e♭/d♯	<3,6,10>
E	<4,8,11>	E	<4,7,11>
F	<5,9,0>	F	<5,8,0>
F♯/G♭	<6,10,1>	f♯/g♭	<6,9,1>
G	<7,11,2>	G	<7,10,2>
A♭/G♯	<8,0,3>	a♭/g♯	<8,11,3>
A	<9,1,4>	A	<9,0,4>
B♭/A♯	<10,2,5>	b♭/a♯	<10,1,5>
B	<11,3,6>	B	<11,2,6>

Neo-Riemannian Theory - An exploration of transformations



- Harmonies directly to each other instead of invoking tonal relations
- (Purely Harmonic) Transformations
  - P: Exchange a triad for its parallel
    - Major Triad: Move down a semi-tone
    - Minor Triad: Move up a semi-tone
    - Preserves the perfect fifth interval
  - R: Exchange a triad for its relative
    - Major Triad: Move fifth up a tone
    - Minor Triad: Move root down a tone
    - Preserves the Major third interval
  - L: Exchange a triad for its Leading Tone Exchange
    - Major Triad: Move root down a semi-tone
    - Minor Triad: Move fifth up a semi-tone
    - Preserves the minor third interval

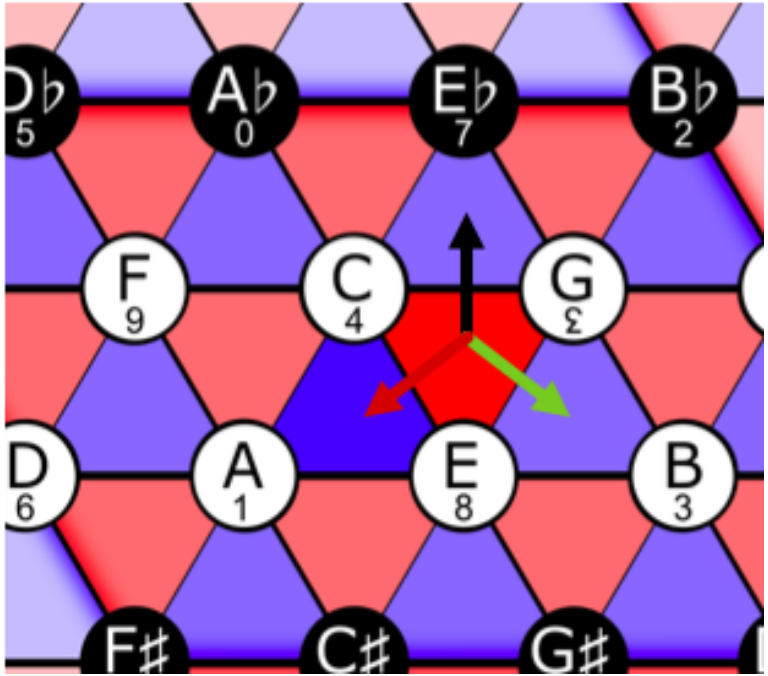
- Can be modelled using Riemannian Tonnetz, where principal transformations are just minimal motion of the Tonnetz.
  - Transformations assume enharmonic equivalence - meaning this can be refashioned into a Torus!

P-L-R Transformations

P - Transformation.
C-E-G → C-Eb-G

L - Transformation.
C-E-G → B-E-G

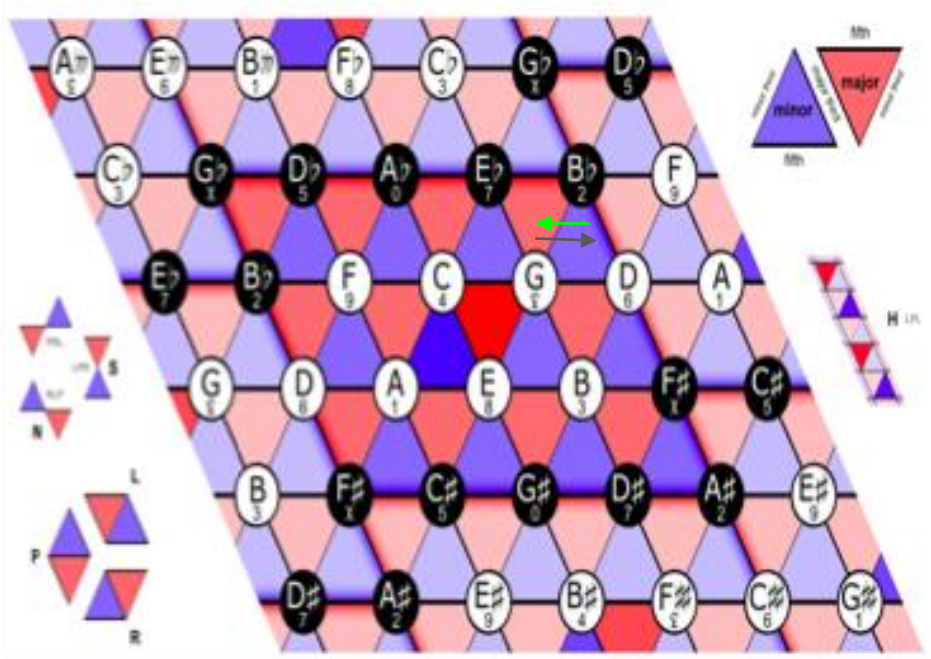
R - Transformation.
C-E-G → A-C-E



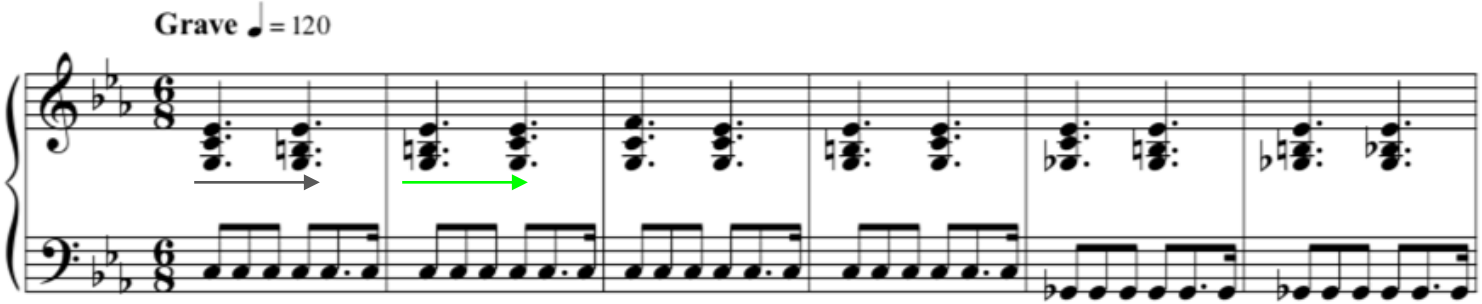
Evolution of the piece in the tonnetz.

The piece: Lependu

1. A-B-A Piece
2. Prelude

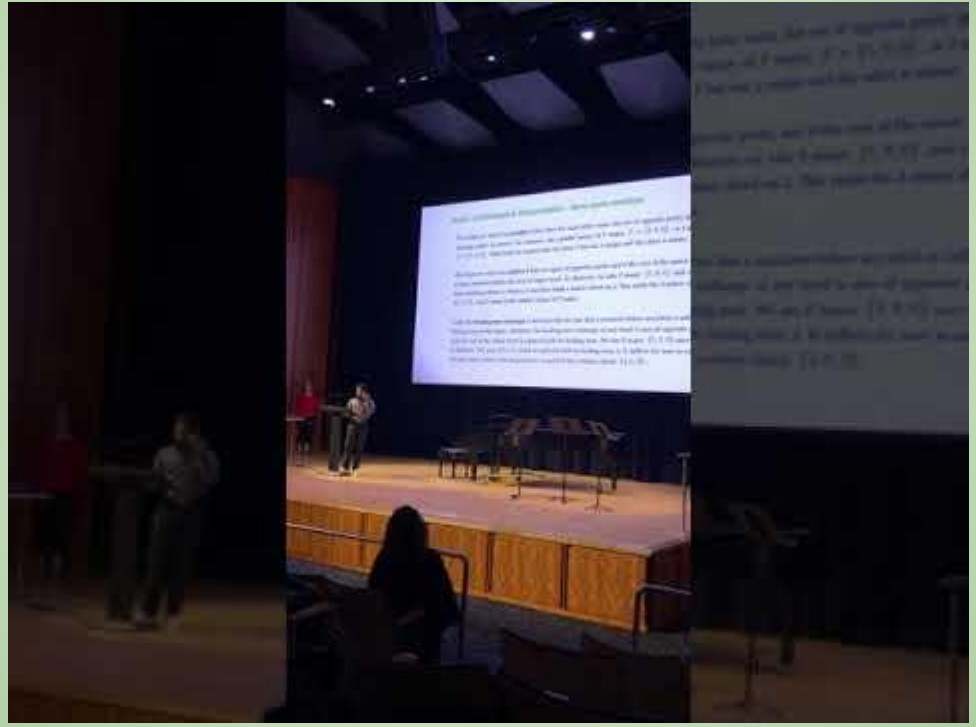


The following is an example of a transformation performed in the piece



Mathematical music composition workshop

Fall 2019



Thank you!