Computer Music: Representations and Models

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Introduction:

Creation of a self-generating music environment initiated by user interaction through the combination of different melodic and rhythmic music styles and different instruments.

Combining different components the user can build a visual and musical environment.

Problem statement

- The generative model to develop has to present the following characteristics in order to work with the **Computer music system** to be integrated in**:**
  - It must be able to generate melodies starting from an high level of abstraction user input
  - It must create different styles of music following user preferences
  - It must translate the music created into some notation readable by the system
- Main musical components needed:
  - Harmony
  - Melody
  - Bass
  - Rhythm

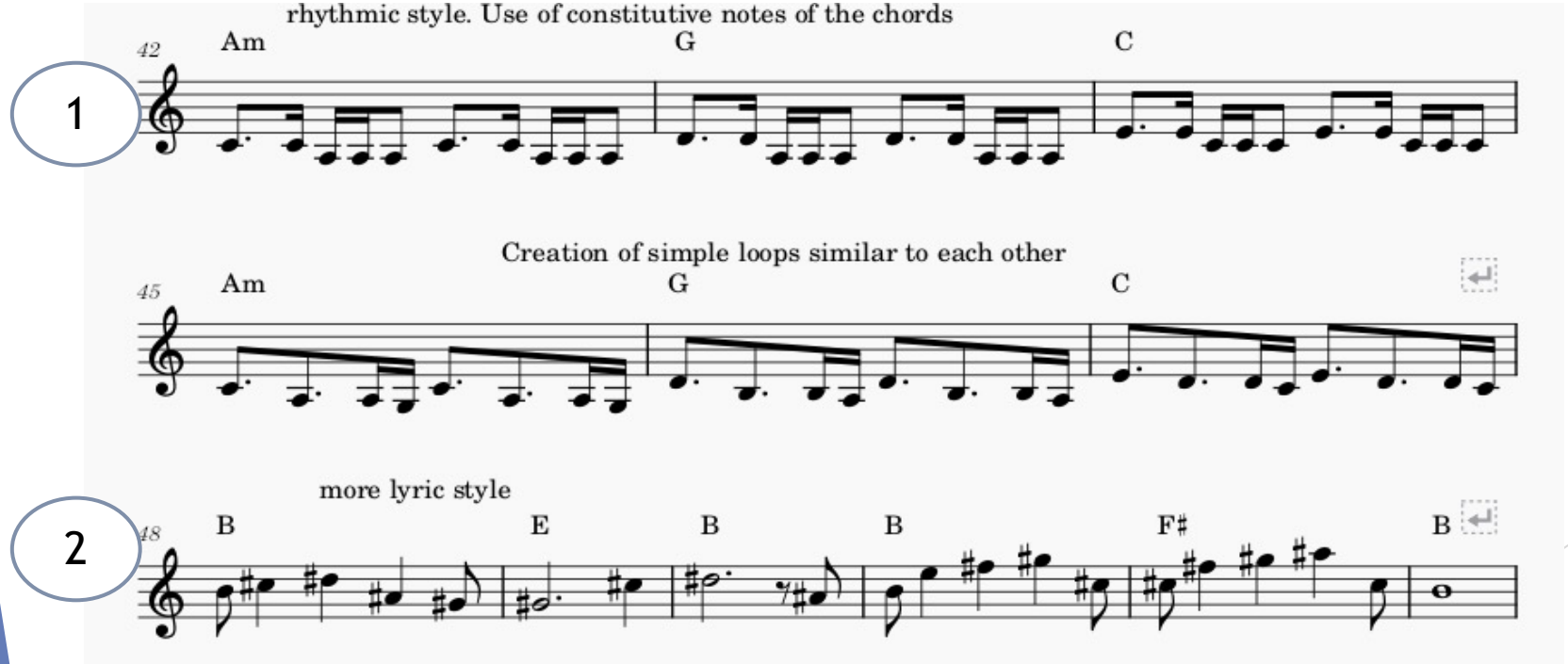
Our solution

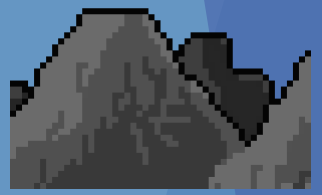
- Music source based on the work of a human composer
- Subdivision in four different music styles that follow specific compositive rules
- Generative model based on Markov Chain
- Match musical styles to graphical elements

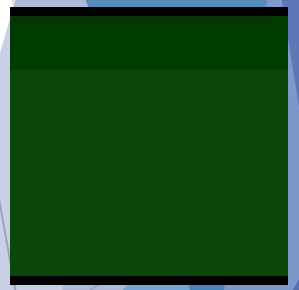
Adopted styles

4 ENVIRONMENTS:

- 1. Mountain
  - predominant use for melody of constitutive notes of the chords
  - use of a more rhythmic style and a more lyric style alternated
  - large use of VI-V-I turnarounds, with some modulations

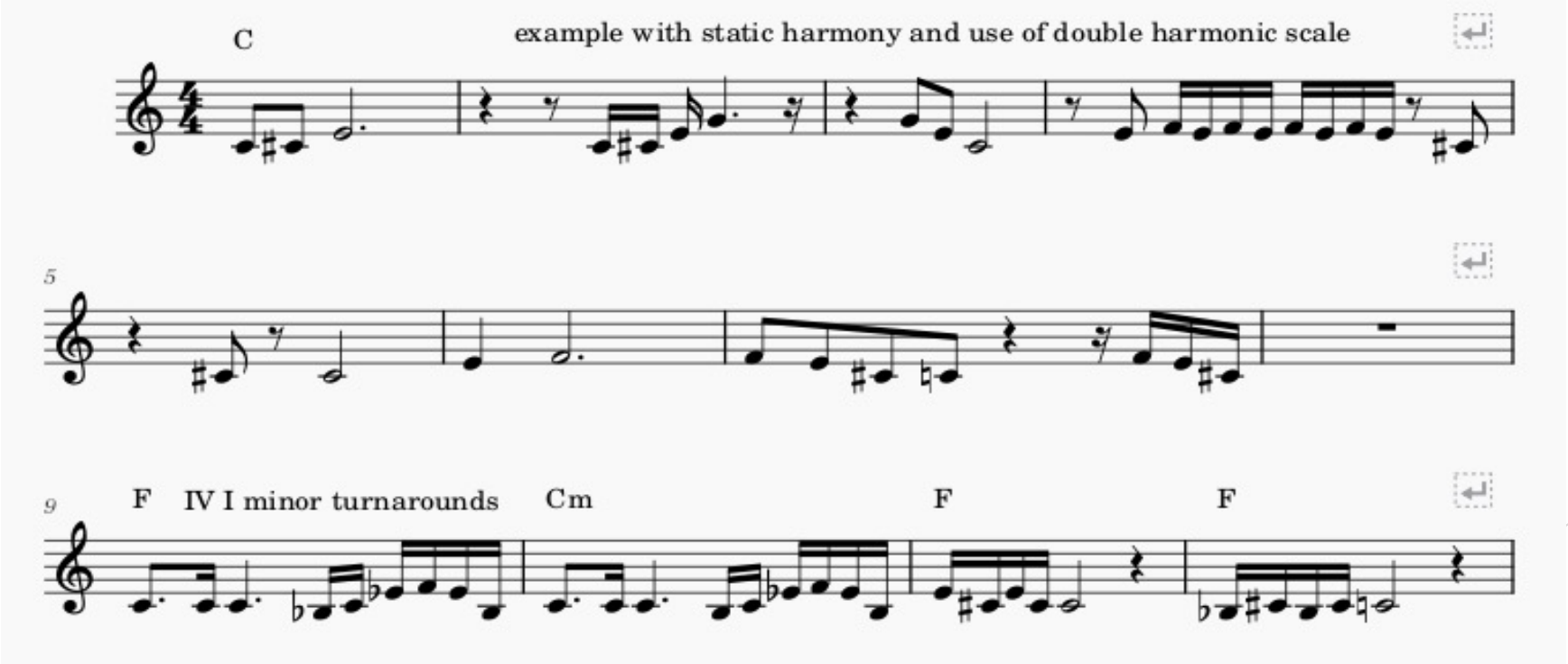


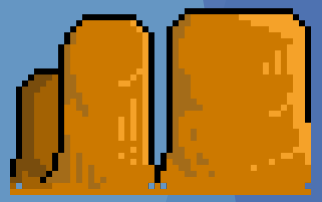


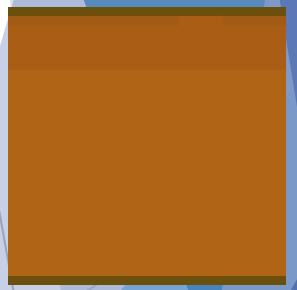


Adopted styles

- 2. Desert
  - use of harmonic, phrygian, dominant phrygian and double harmonic scales
  - large use of fourth turnarounds
  - musical syncopations

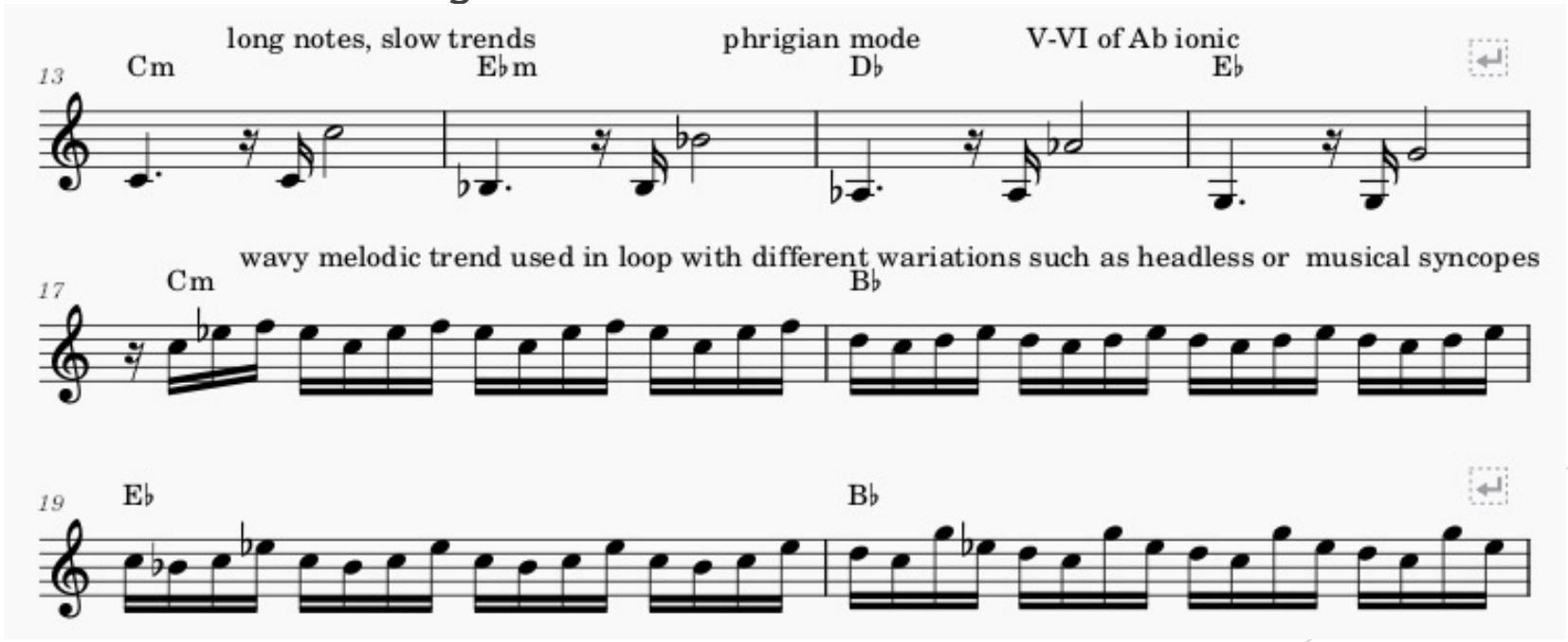


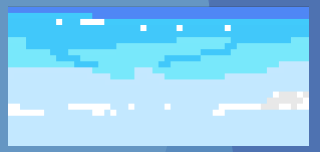


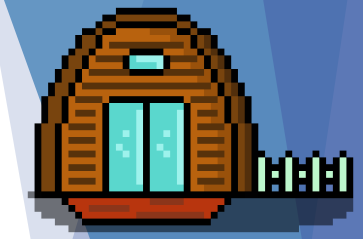


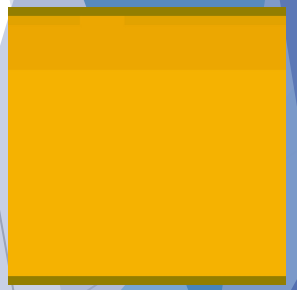
Adopted styles

- 3. Seaside
  - lot of emphasis on current harmony notes
  - creation of loops similar to each other, one can be the variation of the other, for example one with the same melody but headless
  - large use of minor harmonies, use of weak cadences
  - Use of static long notes



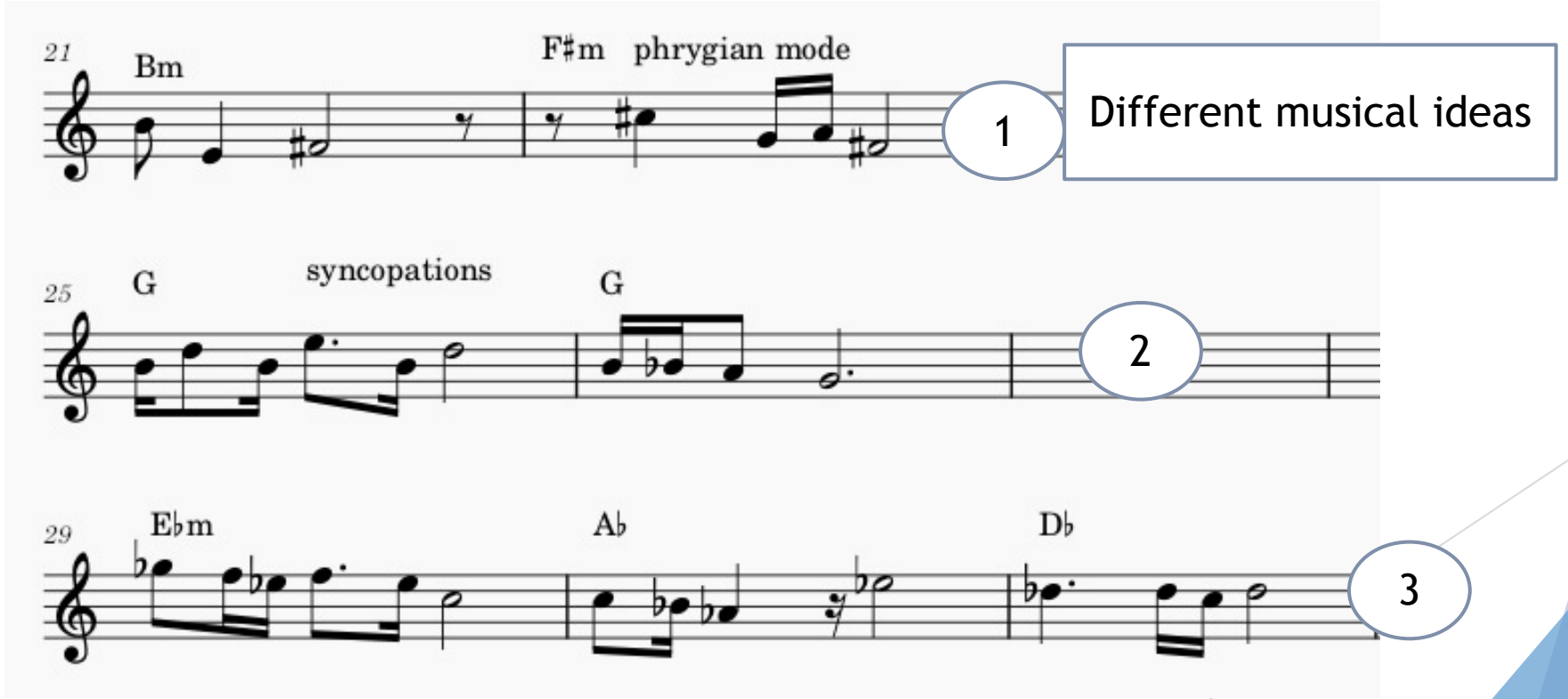


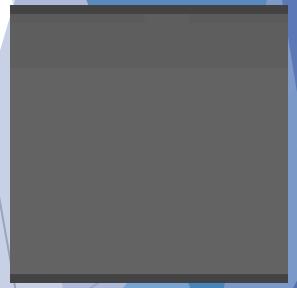




Adopted styles

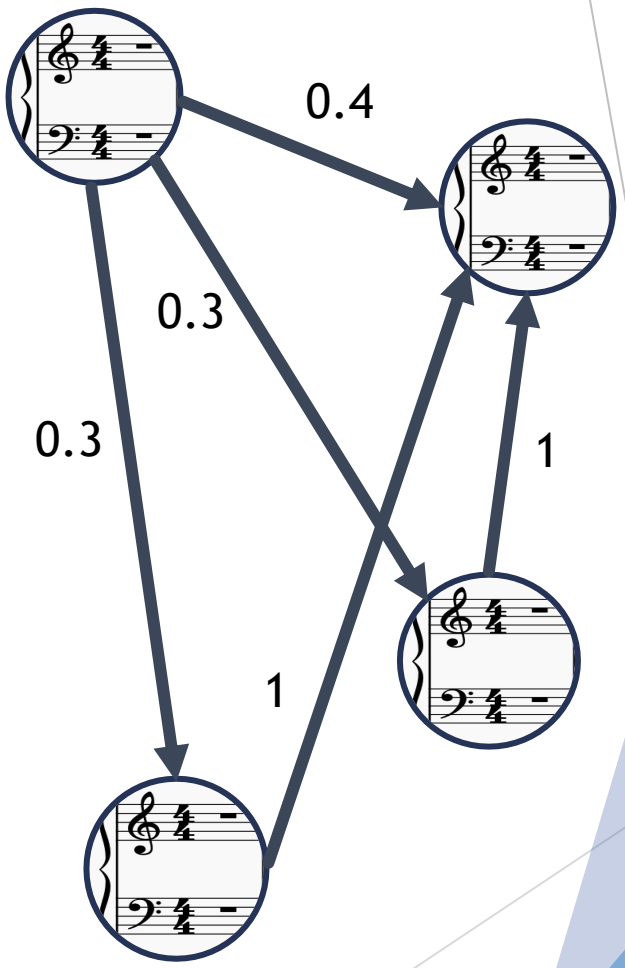
- 4. City
  - use of syncopations and rhythmic lags
  - melodic phrases similar to lo-fi music, industrial music, psychedelic
  - use of phrygian mode, with recurrent minor harmonies





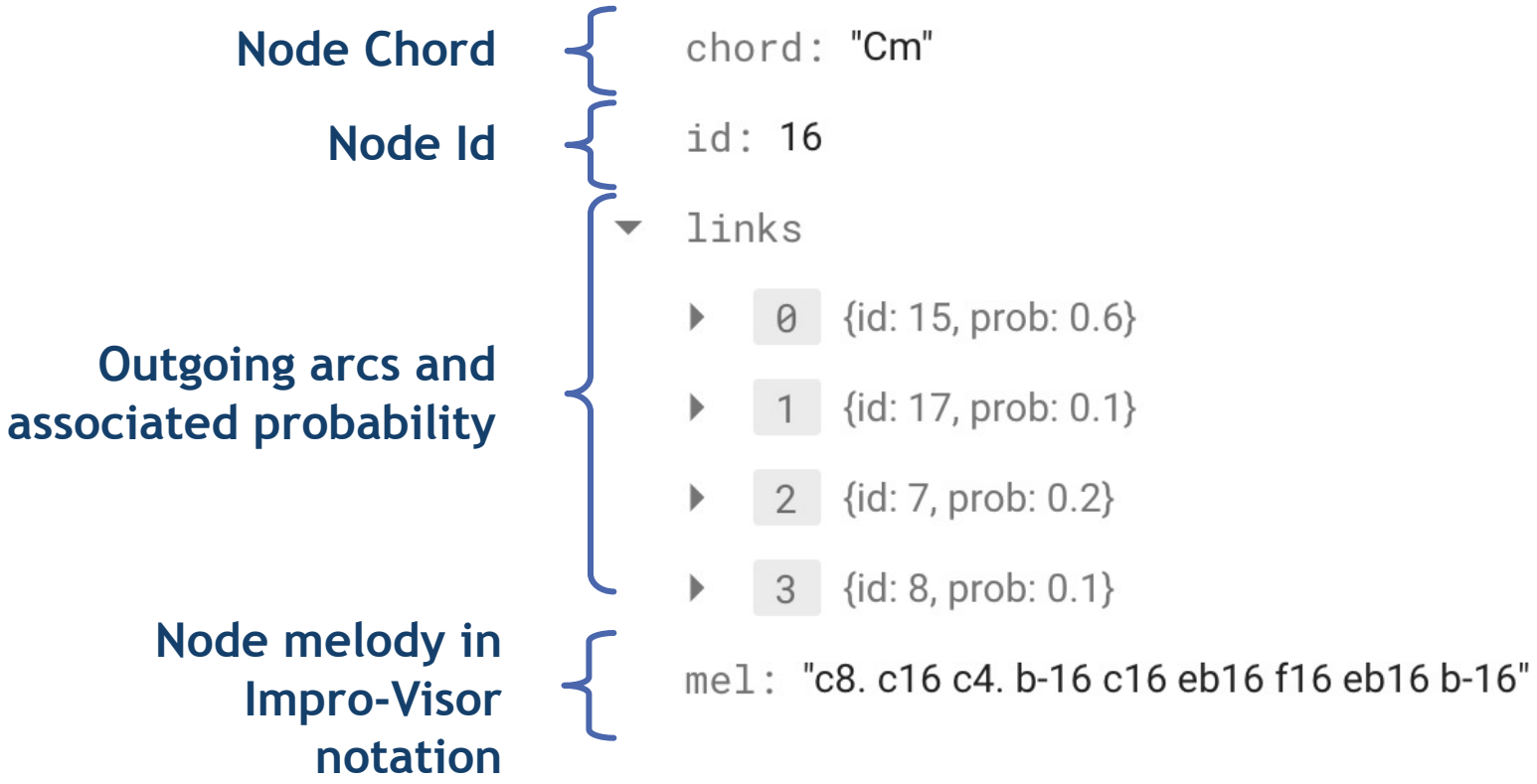
Markov Chain

- Generative Model
- Weighted Arcs connect bars and specify the probability of transition between states
- Stochastic model allows to create melodies
- Each node is a basic component and contains all the information that constitute one bar



Nodes

- Musical Nodes represented as database elements



Leadsheet grammar

IMPRO-VISOR LEADSHEET NOTATION

MELODY

NOTE	OCTAVE	DURATION
Lower-case letter	**+** octave above the middle one	**1** 4/4 note
	- octave below the middle one	**2** 2/4 note
		4 1/4 note
		8 1/8 note
		16 1/16 note

Leadsheet grammar

IMPRO-VISOR LEADSHEET NOTATION

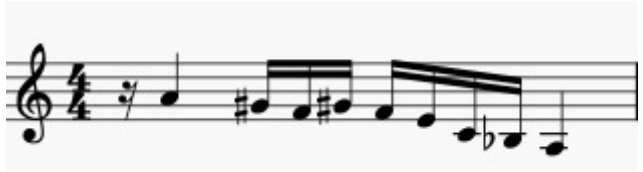
CHORDS

CHORD

upper-case letters
m minor

EXAMPLE

Chord: Am
Melody: { r16 a4 g#16 f16 g#16 f16 e16 c16 bb-16 a-4}



Music generation and scheduling

Musical Nodes are composed into a melody through the generation algorithm

Melody is parsed and turned into a list of schedulable musical events

Musical events are played by the selected instrument when scheduled to the Transport Time of the system

Chords: | Am | G | C |
Melody: { c8. c16 a-8 a-4. a-8 a-8\n
b-8 b-8 b-8 b-2 r8\n
c2 r4 e4\n}

Notes Scheduling

duration: "8n." note: "c3" time: "0:0:0"
duration: "16n" note: "c3" time: "0:0:3"
duration: "8n" note: "a2" time: "0:1:0"
duration: "4n." note: "a2" time: "0:1:2"
duration: "8n" note: "a2" time: "0:3:0»
duration: "8n" note: «a2" time: "0:3:2"
duration: "8n" note: "b2" time: "1:0:0"
duration: "8n" note: "b2" time: "1:0:2"
duration: "8n" note: "b2" time: "1:1:0"
duration: "2n" note: "b2" time: "1:1:2"
duration: "2n" note: "c3" time: "2:0:0"
duration: "4n" note: "e3" time: "2:3:0»

Chords Scheduling

duration: "1n"
notes: ["A2", "C3", "E3"]
time: "0:0:0"

duration: "1n"
notes: ["G2", "B2", "D3"]
time: "1:0:0"

duration: "1n"
notes: ["C3", "E3", "G3"]
time: "2:0:0"

Conclusions and Future Development

- The project implemented aims at two categories of users:
  - The listener who passively enjoys the generated music
  - The composer who can exploit the developed system to project generative musical environment starting from his composition
- Possible improvements:
  - More nodes in music generation
  - More styles associated with graphical elements
  - Possibility of changing musical database allowing different composers to exploit the same creative concept

THANKS FOR THE ATTENTION

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