THE SOUND OF SPACE

MASTER OF SCIENCE
MUSIC AND ACOUSTIC
ENGINEERING

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OUTLINE

CONCEPT

PARAMETERS COMPUTATION

GRAPHICAL IMPLEMENTATION

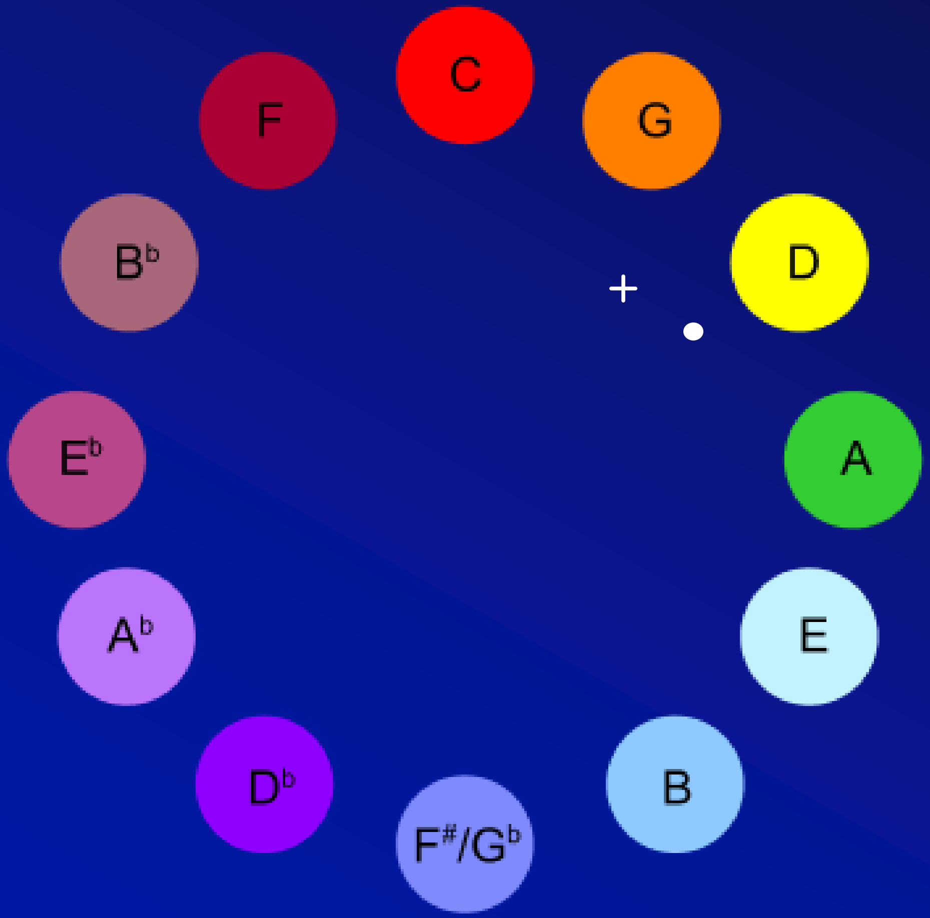
SOUND IMPLEMENTATION

CONCEPT

- Generative computer music system
- Image processing algorithms to extract qualitative visual data from pictures and convert them to musical features
- Themed tri-dimensional graphics
- Solar System as an interactive visualizer

PARAMETERS COMPUTATION

KEY



Average color

- Retrieved from image via a dedicated library
- Calculation of perceptive distance from ***Skryabin***'s **key-to-color mapping**
- **DeltaE2000** algorithm
- Computed key corresponding to minimum perceptive distance

MODE

Brightness

- Average of RGB coordinates to obtain the *grey values* of each pixel
- Compute the total **grey value** of the image
- Normalize by the canvas area to determine the light level
- Label based on a chosen ***threshold***

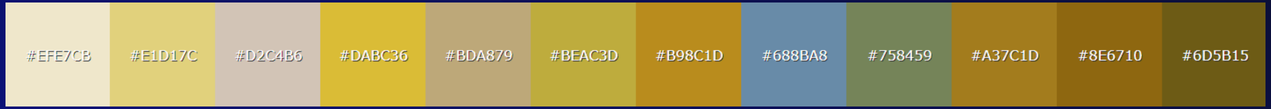
CHORD TYPE

Lightness

- Two possibilities: a ***simple major/minor triad*** or a ***seventh tetrad***
- Algorithm to determine the "*lightness*" of the image
- The idea is to quantify the **number of bright spots** in the picture
- Normalization by the total number of pixels (i.e., the image size)

CHORD PROGRESSION

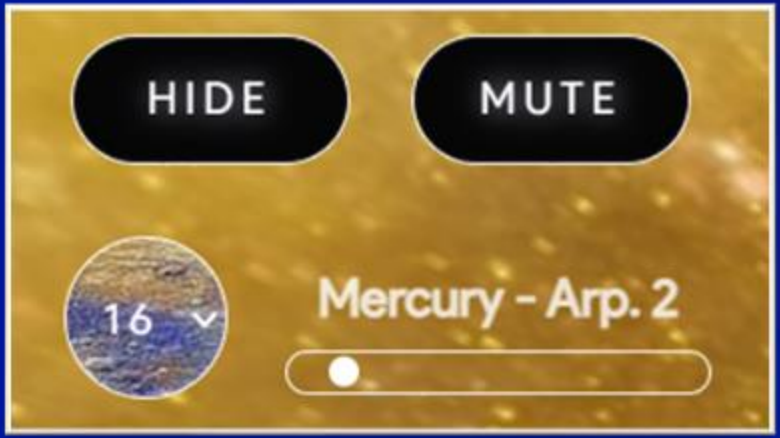
Colour Palette



- ***Colour quantization*** by means of the **Median Cut** algorithm
- The greater the **size** of the palette, the more complex the progression
- The idea is to link the ***chromatic complexity*** of the image to the ***harmonic complexity*** of the generated piece
- The quantized colours are ordered by **luminance** and arranged in a graphical representation

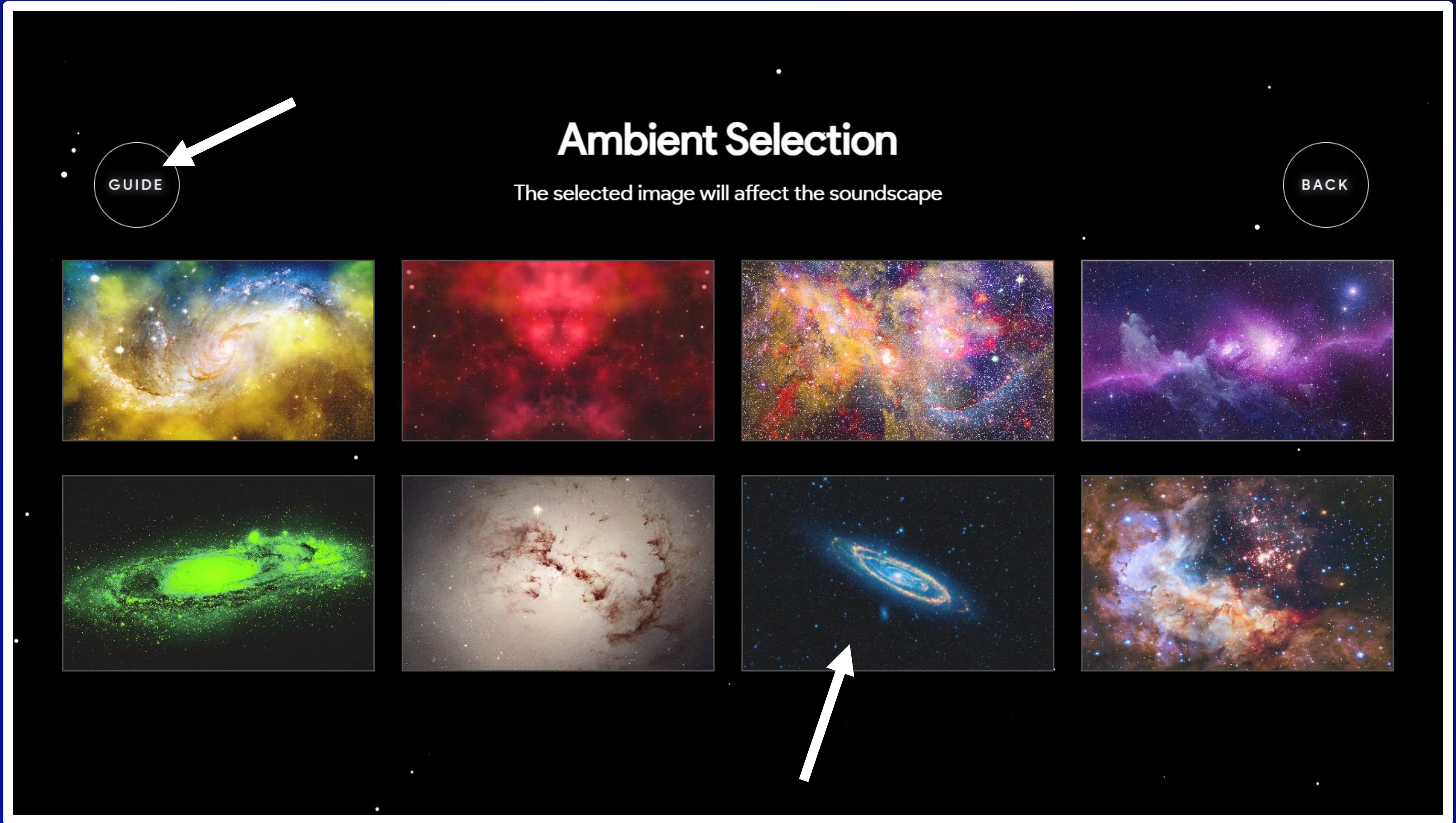
GRAPHICAL IMPLEMENTATION

FRAMEWORKS



- Buttons and sliders personalized with ad-hoc CSS classes
- User-friendly guide implemented with the library sheperd.js
- JavaScript library p5.js for creative coding
- Navigation in a WEBGL 3D environment thanks to p5.Easycam

START MENU



Ambient Selection

The selected image will affect the soundscape

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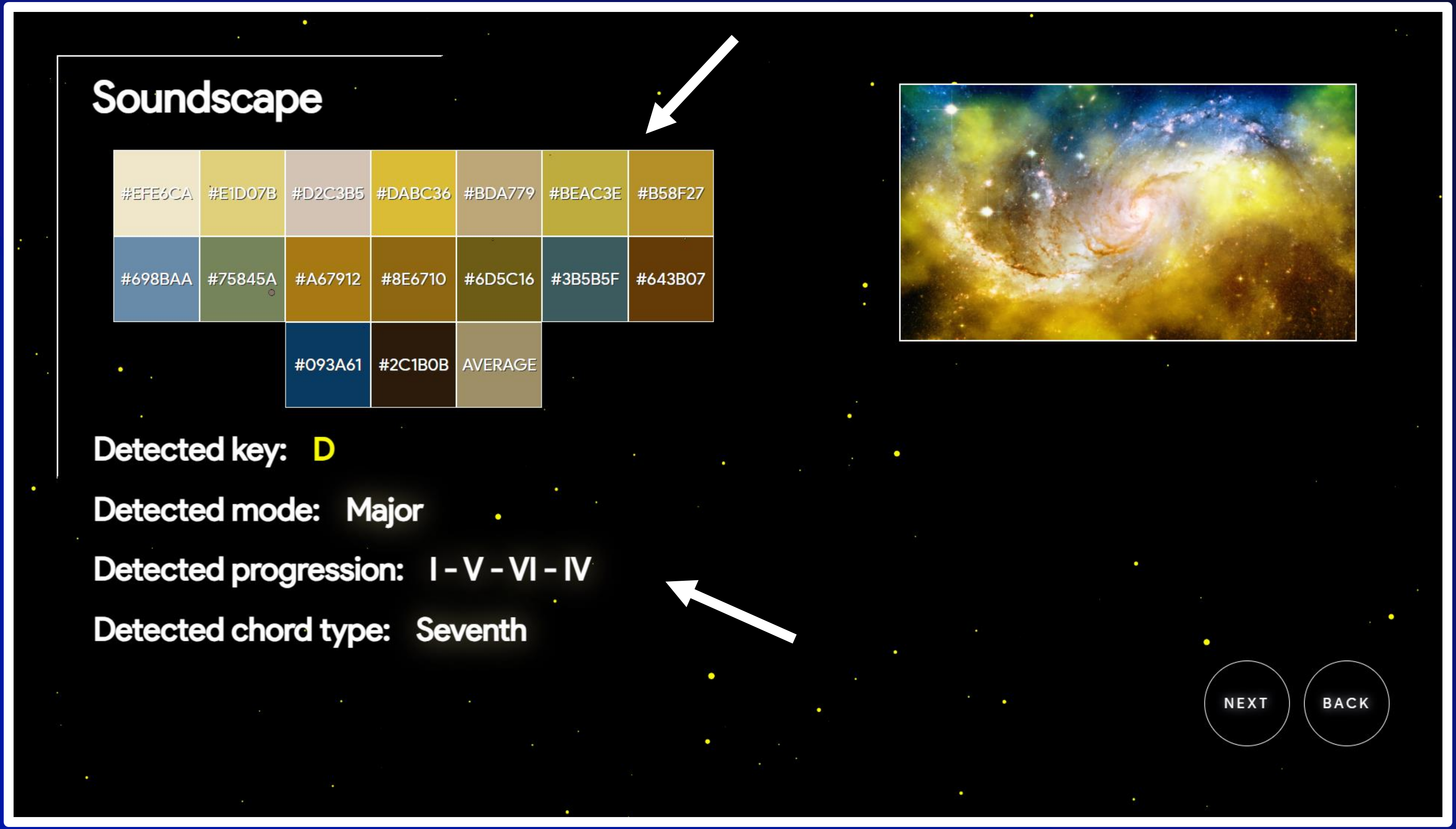
EXTRACTED PARAMETERS



Soundscape

#EFE6CA	#E1D07B	#D2C3B5	#DABC36	#BDA779	#BEAC3E	#B58F27
#698BAA	#75845A	#A67912	#8E6710	#6D5C16	#3B5B5F	#643B07
		#093A61	#2C1B0B	AVERAGE		

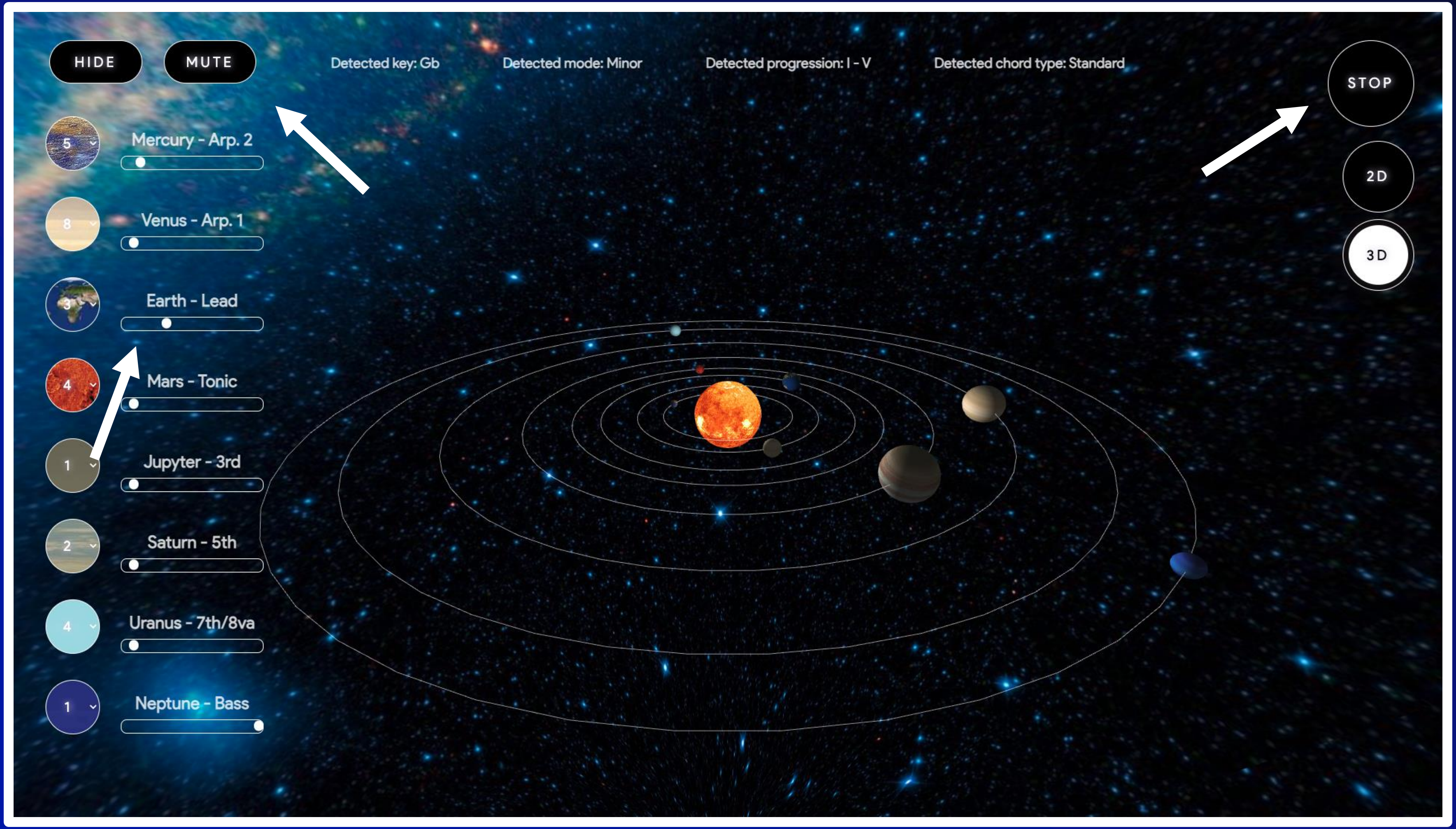
Detected key: D

Detected mode: Major

Detected progression: I - V - VI - IV

Detected chord type: Seventh

3D VISUALIZER



Detected key: Gb

Detected mode: Minor

Detected progression: I - V

Detected chord type: Standard

5 Mercury - Arp. 2

8 Venus - Arp. 1

3 Earth - Lead

4 Mars - Tonic

1 Jupyter - 3rd

2 Saturn - 5th

4 Uranus - 7th/8va

1 Neptune - Bass

SOUND IMPLEMENTATION

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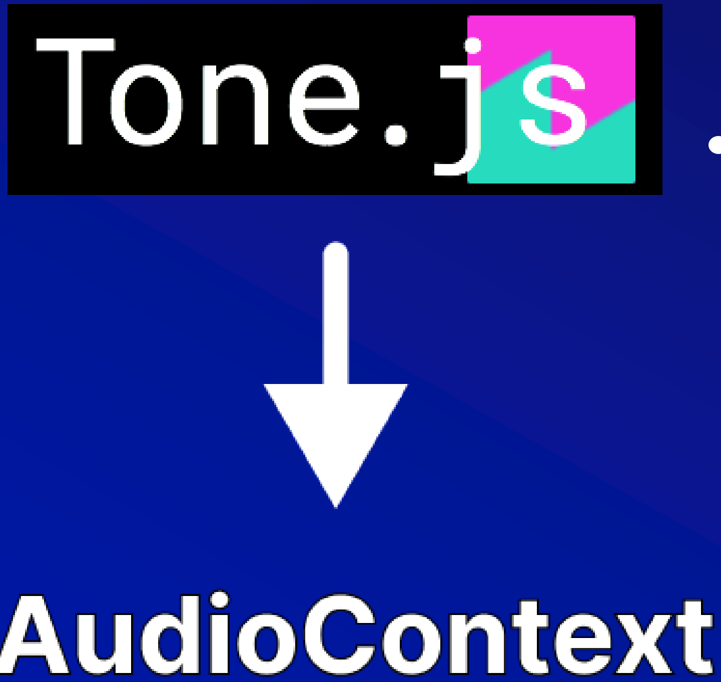
FRAMEWORK CHOICE



Tone.js

AudioContext

- The sound was originally implemented with the library Tone.js
- Tone was very inefficient and heavy on a computational level
- Re-implementation of the sound using the AudioContext

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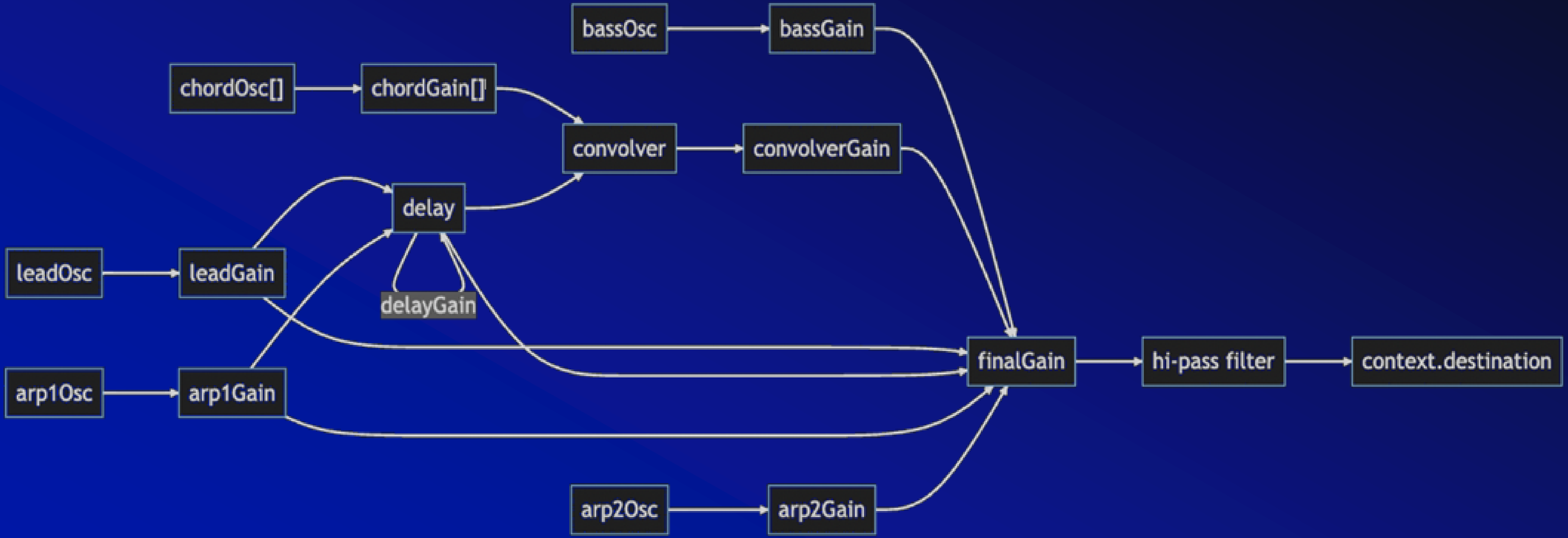
SOUND PATH



SYNCHRONIZATION

- Each planet represents an instrument and is played periodically
- Loops and envelopes run the time schedule of the sound
- Planets synchronize with the music thanks to a loading time slot

CONCLUSIONS

- Improved performance and stability (audio, graphics)
- Interactive 3D user interface
- Advanced image processing algorithms
- Complex and structured sound synthesis chain

- Additional sets of instruments could be added
- Additional customizable controls

THANK YOU FOR YOUR ATTENTION

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