Une visite de l'expo LaLaLab 'The Mathematics of Music'

PAF - Lyon

19-20 mai 2022

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LaLaLab
Ausstellu[ng]
DIE MATHEMATIK
DER MUSIK

Präsentiert von:
HEIDELBERG
LAUREATE FORUM
FOUNDATION

THE TONNETZ

The Topos of Music
I: Theory

Guerino Mazzola

Computational Music Science

Geometric Logic, Classification, Harmony,
Counterpoint, Motives, Rhythm

Second Edition

la.la.lab
THE MATHS OF MUSIC
May. 17, 2019 to Dec. 2020

IMAGINARY
open mathematics

HEIDELBERG LAUREATE FORUM FOUNDATION

`https://imaginary.org/`

La.La.Lab brings the visitor to an interactive exploration and discovery of music from a mathematical perspective. The exhibition pivots over three axis:

- **Music theory.** Learning what tools build music, and how these tools are used to create art. Basic concepts and historical comments.

- **Current research.** The latest trends of research in the connection of maths and music. Artificial Intelligence, theoretical and new instruments, classification and composition tools.

- **Art and entertainment.** A joyful display of artworks from artists and mathematicians in the field. Talks/concerts at scheduled events

EXHIBITION BOOKLET

La La Lab
THE MATHEMATICS OF MUSIC
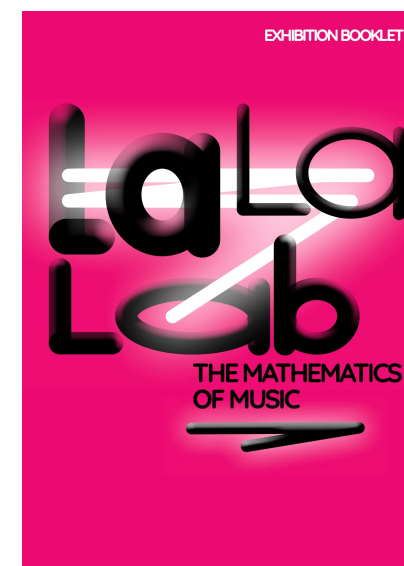
Vue d'ensemble des stands/modules disponibles

Pink Trombone
Program

The Spectrum of Sound - Synthesizer
Program

Scale Lab
Program

Tonnetz
Program

Con Espressione!
Program

The Graph Composer
Program

Show me music
Program
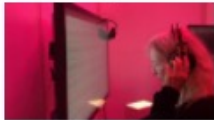
Musical bench
Physical Exhibit / Hands on

Whitney Music Box
Program

Beat Box
Program

NSynth
Physical Exhibit / Hands on

AI Jam
Program

Mind and Music Jukebox
Program

The Harmonic Series #3 - 3D display
Program

The Harmonic Series #1 - Laser
Physical Exhibit / Hands on

Lissajous figures
Gallery
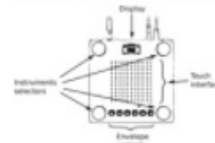
The Harmonic Series #2 - 3D sculptures
Physical Exhibit / Hands on

The Sound of Sequences
Program

The Spectrum of Sound - Analyzer
Program

Gerhard Widmer on Expressive Music Performance, the Boesendorfer CEUS, and a MIDI Theremin
Film

Pentatonic Scales
Program

Note Compass
Program

JSBach333 - canone permutativo al triangolo from BACH333 - Canon Composition Competition 2018
Film

Algebraic Vibrations
Film

EXHIBITION BOOKLET
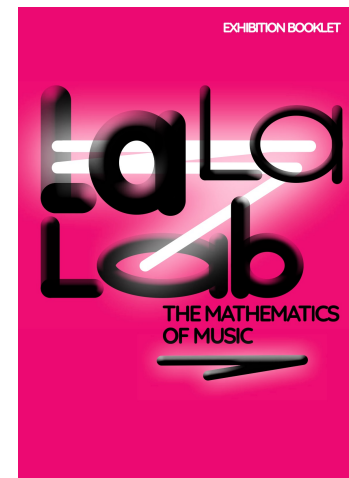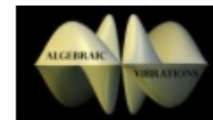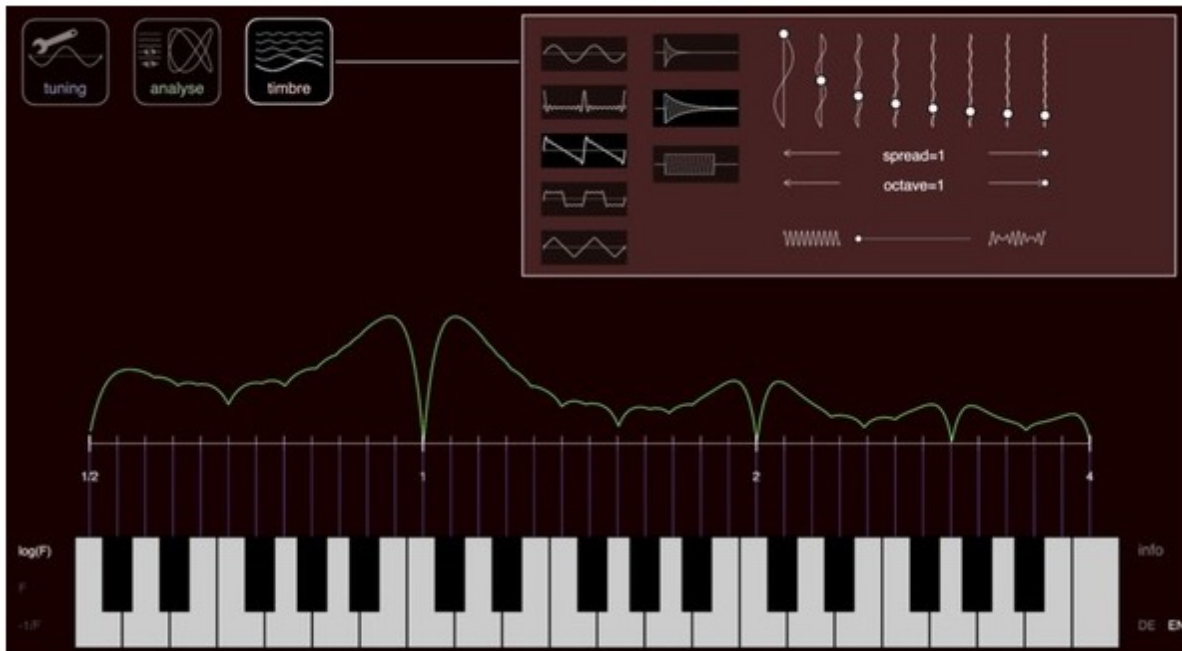
LaLaLab
THE MATHEMATICS OF MUSIC

Scale Lab

see all files ↓

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Source code: CC BY-NC-SA-4.0
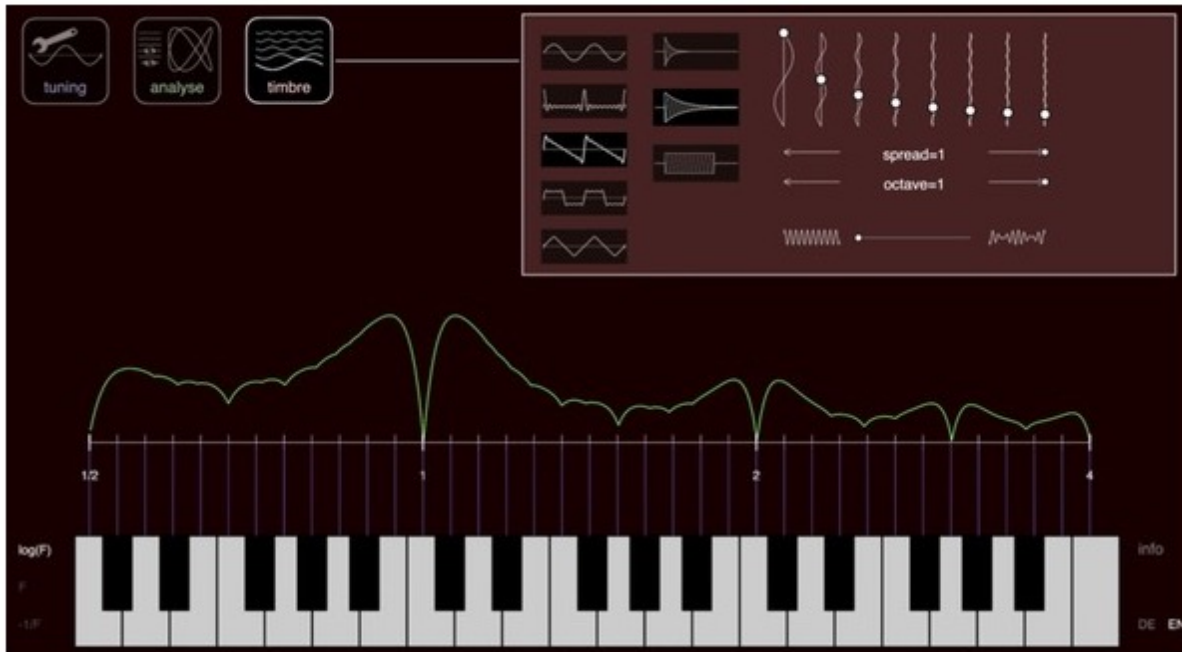
Submitted by

IMAGINARY

This program is part of
La La Lab - The Mathematics of Music

Credits

Author of this exhibit: Jürgen Richter-Gebert, Technical University of Munich / Sound Engine: Patrick Wilson and Aaron Montag / based on CindyJS.org

Which sounds can be called "notes", and used to create music? This exhibit is an experimental platform to explore the characteristics of sound and scales.

We can hear a wide range of sound frequencies, but we don't use them all to make music. We select some discrete set of them as our notes to form what we call a scale. We try to build scales in such a way that combinations of notes on the scale are harmonious and can be played together. Scale Lab allows you to explore, measure, create and modify both individual sounds and musical scales. This exhibit covers the fundamentals of sound, perception of consonance and dissonance and the creation of scales from single tones.

for fifth: $(\sqrt[12]{2})^7 = 1.498\ldots \sim 1.5 = \frac{3}{2}$ for thirds: $(\sqrt[12]{2})^4 = 1.26\ldots \sim 1.25 = \frac{5}{4}$

Which sounds can be called "r ... his
exhibit is an experimental plat ... of sound
and scales.

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Experiment: Open the tuning box and experiment with different
Western tunings. The colors shown in the Tonnetz indicate how close
an interval is to a perfect one. It is also very instructive to analyze
the different tunings with the ratio tool. It shows the ratios of inter-
vals if they are played on the keyboard. The picture below shows the
frequency ratios for a major C chord.
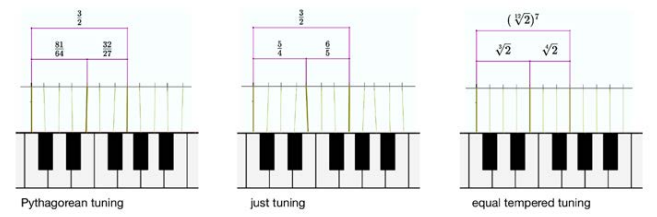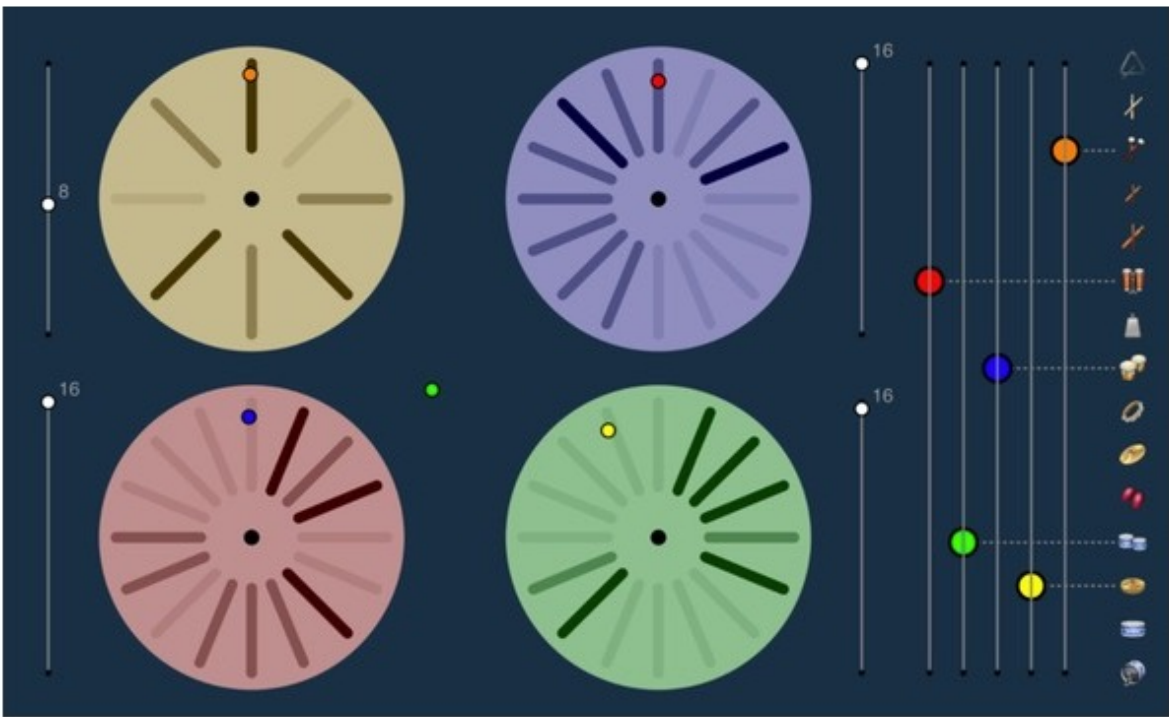
Select an animation, press the "play" button and experiment with the parameters. Try to clap along.

Along with melody and harmony, rhythm is one of the most important components of music. This exhibit explores various ways to create and analyze rhythms by mathematical methods. No instrument is required to play a rhythm, clapping your hands is enough. However, even simple structures may be difficult to perform. In this exhibit, you can explore the relation of fractions and rhythms. See how pixelated lines can be used to create drum patterns. Explore intriguing minimalistic ways to create rhythms and much more.

program

Beat Box

SEQUENZER   EUKLIDISCHER RHYTHMUS

N ÜBER M RHYTMEN   FIBONACCI RHYTHMUS

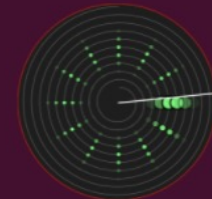CLAPPING   GITTER RHYTHMUS

Raum der 3-notigen Akkorde

Show me music

MOZARTS WÜRFEL

SHEPARD TONE

DUR-MOLL KANON

PACHELBALLS

Dive into a multitude of topics that visualize the complex interrelations of melody, harmony and mathematics. Push the "play" button in each visualization and experience the effect of parameters.

Each of the animations looks at a certain musical piece or pattern from a special mathematical viewpoint. Aspects of symmetry, both in time and space help to understand musical ideas. If you look at an animation of a Chopin Prelude, it unveils hidden structures and helps you to understand the music better.

AUTHOR OF THIS EXHIBIT: JÜRGEN RICHTER-GEBERT, TECHNI-
CAL UNIVERSITY OF MUNICH / SOUND ENGINE: PATRICK WILSON
AND AARON MONTAG / BASED ON CINDYJS.ORG
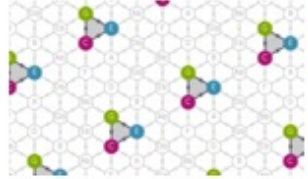TEXT: JÜRGEN RICHTER-GEBERT (TU MUNICH)
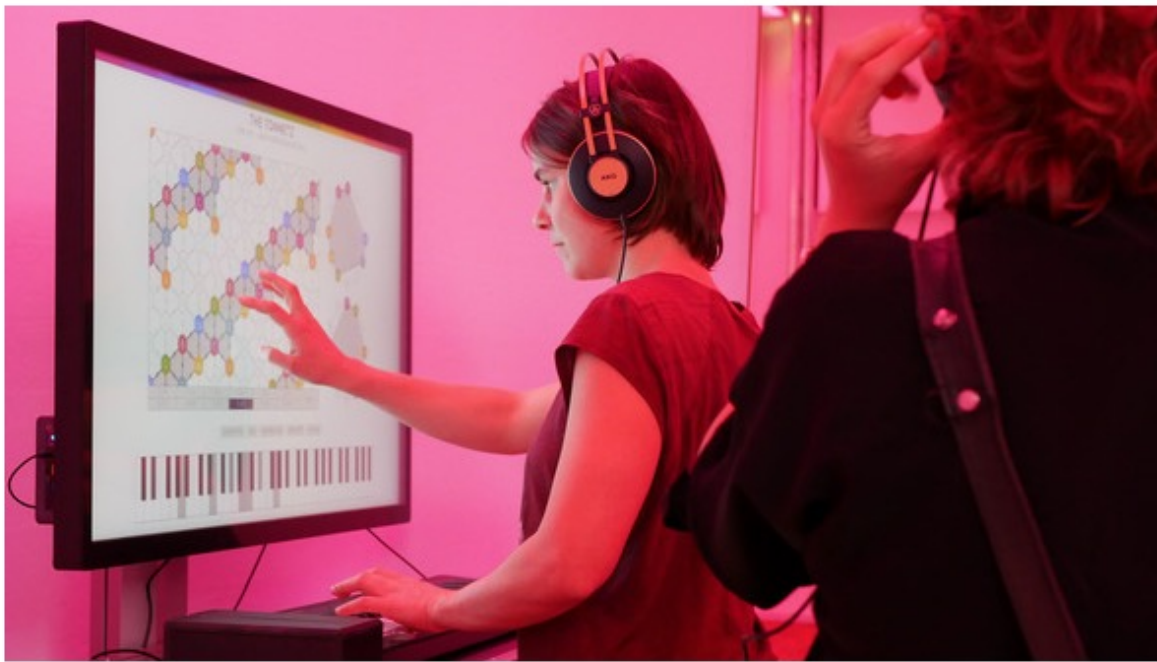
Explore how we can represent the notes in a logical and useful way! The Tonnetz is a pictorial representation of the notes in the plane that reveal affinities and structures between notes and on concrete music pieces.

Written scores and keyboard instruments order notes by pitch. However, notes with close pitch tend to sound bad together, but notes separated by intervals such as the octave (12 semitones), the perfect fifth (7 semitones) or the major third (4 semitones) are more harmonic. The different types of Tonnetz display close together notes by specific intervals. Musicians also use the chromatic circle (ordered by semitones) and the fifths circle (ordered by fifth intervals) as useful tools to compose music.

THE TONNETZ
ONE KEY – MANY REPRESENTATIONS

1, 1, 10	1, 2, 9	1, 3, 8	1, 4, 7	1, 5, 6	2, 2, 8	Dual
2, 3, 7	2, 4, 6	2, 5, 5	3, 4, 5	3, 3, 6	4, 4, 4	

Load Midi File | Play | Start Recording | Rotate 180° | Translate

➔ **https://guichaoua.gitlab.io/web-hexachord/**
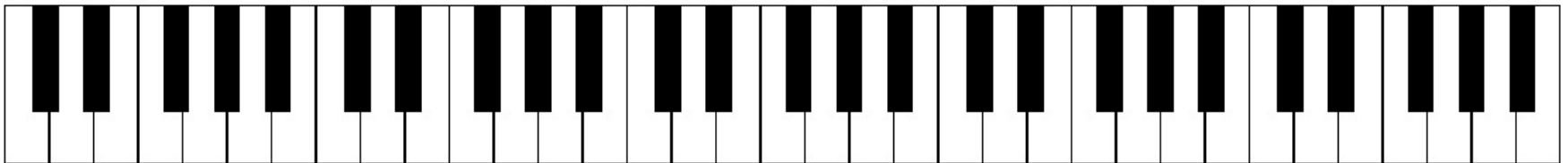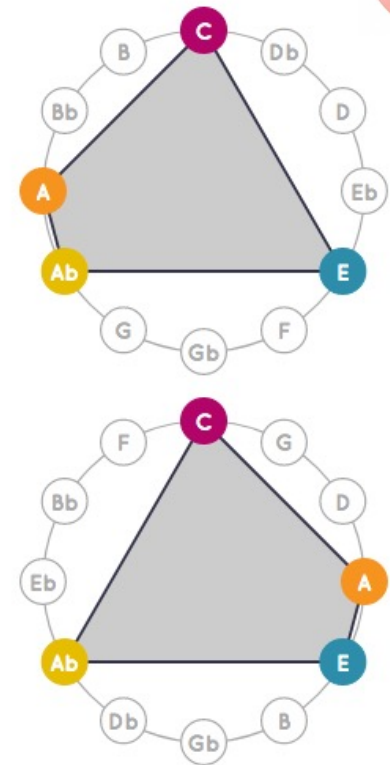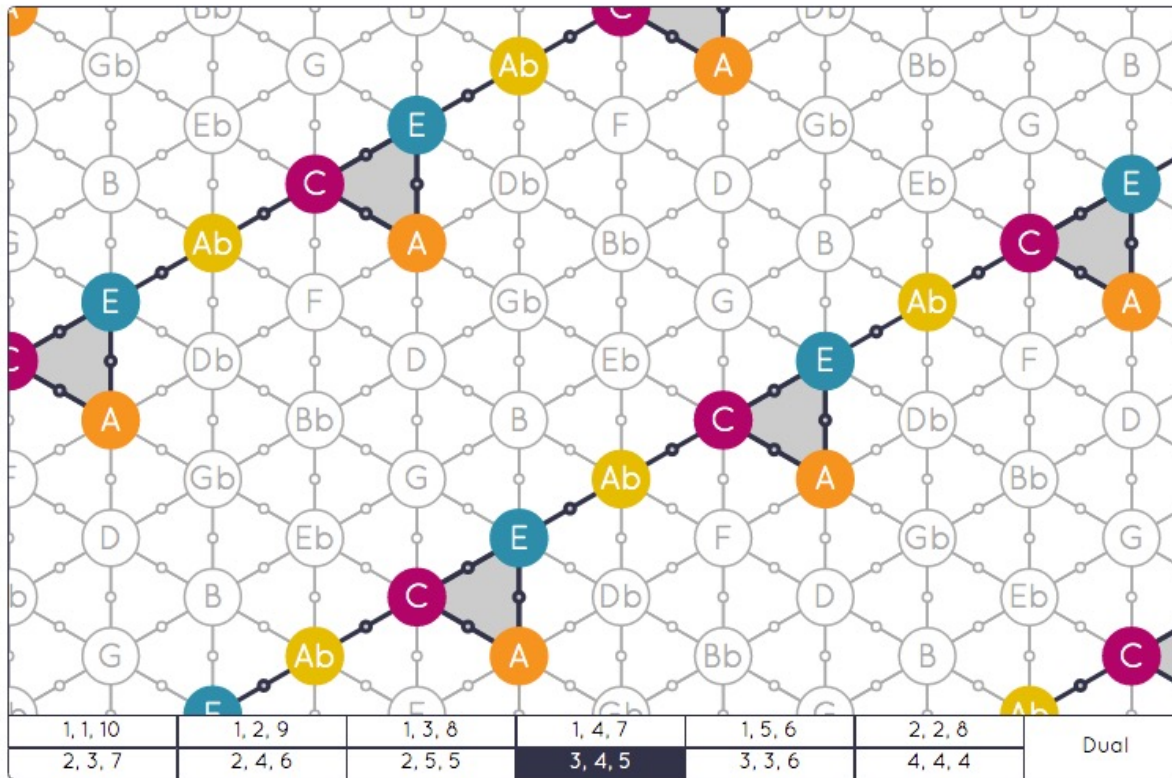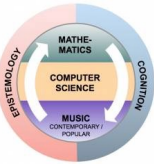
Pour d'autres visites guidées…

plus.maths.org

La La Lab: A tour through maths and music

(durée : 24:55)

➔ **https://ms-my.facebook.com/plusmagazine/videos/la-la-lab-a-tour-through-maths-and-music/527087055621264/**