Une visite de l’expo LaLaLaLab
‘The Mathematics of Music’

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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
Vue d’ensemble des stands/modules disponibles
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.
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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 intervals 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.

Author of this Exhibit: JÜRGEN RICHTER-GBERT, TECHNICAL UNIVERSITY OF MUNICH
Sound Engine: Patrick Wilson and Aaron Montag / Based on CindyJS.org
Text: JÜRGEN RICHTER-GBERT (TU MUNICH)
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.

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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.

AUTHORS OF THIS EXHIBIT: MORENO ANDREATTA AND CORENTIN GUICHAOUA (SMIR PROJECT). SUPPORTED BY CNRS/IRCAM/SORBONNE UNIVERSITY, USIAS (UNIVERSITY OF STRASBOURG INSTITUTE FOR ADVANCED STUDY), IRMA/UNIVERSITY OF STRASBOURG. ADAPTED BY PHILIPP LEGNER. TEXT: DANIEL RAMOS (IMAGINARY)
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plus.maths.org

La La Lab: A tour through maths and music

(durée : 24:55)