

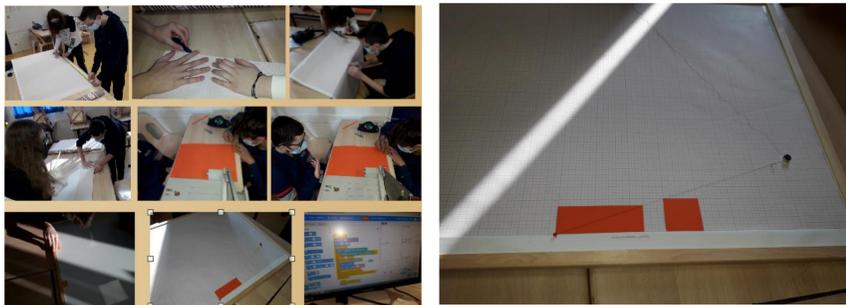
# STEM WITH ARTS

Mostefa M. Mesmoudi | J. Y. Cousteau secondary school | Bussy St Georges | France

## The Fractiometer

from a new mathematical tool to applications in Music, Acoustic, Astronomy and Biology

**Project description.** In this project we have invented and constructed a new mathematical tool to perform fractional calculus in a pure geometric novel way using rectangles. We have called it the **Fractiometer**.

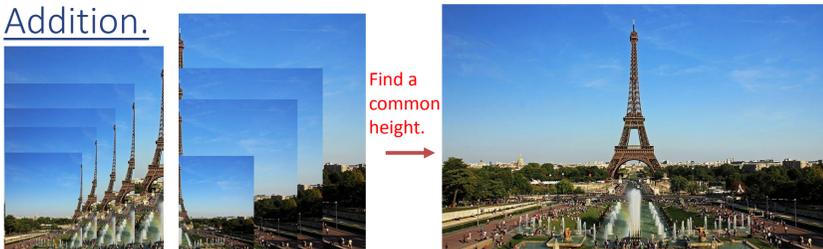


The starting point was the transition from Pythagoras theorem to fraction calculus. The 2<sup>nd</sup> idea came from screen TV format's representation by fractions:

4:3      16:9      21:9



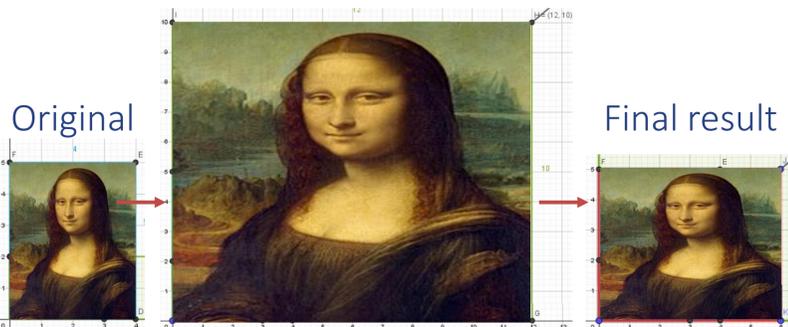
Addition.



[https://commons.wikimedia.org/wiki/File:Eiffel\\_tower\\_from\\_trocadero.jpg](https://commons.wikimedia.org/wiki/File:Eiffel_tower_from_trocadero.jpg)

Multiplication.

$$\frac{3}{2} \times \frac{4}{5} = \frac{3 \times 4}{2 \times 5} = \frac{12}{10} = \frac{6}{5}$$



**Conclusion:** This project shows how scientific disciplines and art are linked together. It allows to pupils to explore some exciting and funny ways to learn science.

Application cases in Science and Arts

In Music and sound's physics. Pythagoras linked fractions to string vibration and music.

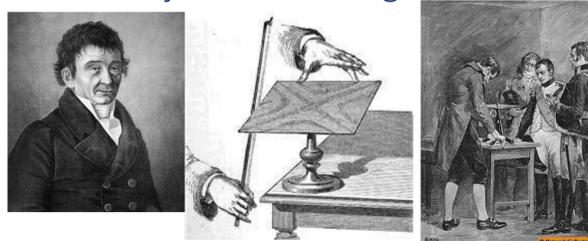


ARTE documentary images: Le grand mystère des mathématiques.



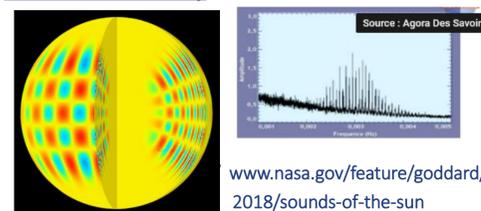
The Cajón is a rectangular drum

The surface of a violin also vibrates. Stationary waves are used by violin makers to tune boards.



E. Chladni presented his work on sound to Napoleon (1808)

In Astronomy. → Helioseismology



[www.nasa.gov/feature/goddard/2018/sounds-of-the-sun](http://www.nasa.gov/feature/goddard/2018/sounds-of-the-sun)

- Sounding the Sun and stars from their surface vibration → physical & chemical characteristics.  
- Vibrations at the origin of galaxies formation.

In Biology. Bioacoustics, Dopler effect, acoustic ecology.

Other questions related to Chladni figures in biology.



ARTE documentaries images: Le grand mystère des mathématiques & Images sonores de l'eau par Alexander Lauterwasser