What is Sonification ?

Sonification concept for educational purposes

Music Group

Click below to find more on how it was done

https://www.schoolofthefuture.eu/en/community/music-music-team-accompanying-performance-ghost-particles-creations-summer-school-2016-0

*The **symbolic** way of sonification in an educational setting we can say that fully rely on the creativity of teachers who encourage students to approach imaginative ways to convert ideas into sounds. Using basic concepts of the musical phenomenon as pitch (or even noise),notes (tone frequencies), note durations, Time signature (or other rhythmic or measure attributes), teachers guide the students to create sound designs, or musical pieces, expressing the required concepts.*

*The **mathematical** approach is associated with the direct sonification of data. Here the teacher explains the correlations between arithmetic or mathematical figures and the behavior of data flow (the parameters) of a scientific concept. Usually this method employs mathematical applications that can be associated with live coding, giving data conversions to audio directly via a computer application.*

*The **adaptive** approach is the combination of the two above methods. In the adaptive approach the teacher has the opportunity to choose how sonification can assist him/her depending both on the teaching needs and the learning environment. In this way purely mathematical approaches can be combined with creative solutions coming directly from a performance arts setting.*

Sonification concept for educational purposes

Music Group

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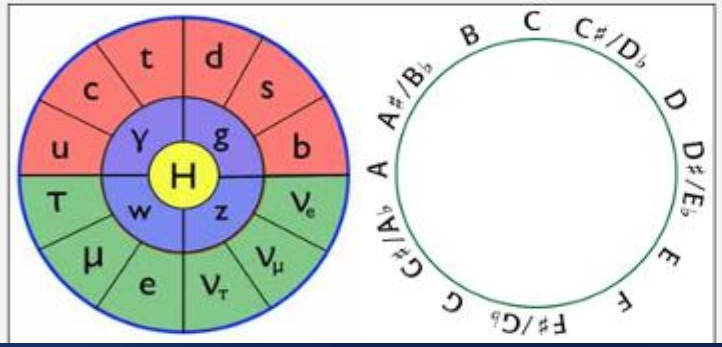
In mathematical terms, we define two sets, the set of the particles and the set of the musical notes. We call P the set whose elements are the particles:

P = {u, d, c, s, t, b, e, μ, τ, ν_e, ν_μ, ν_τ}

We call N the set whose elements are the musical notes of the chromatic scale:

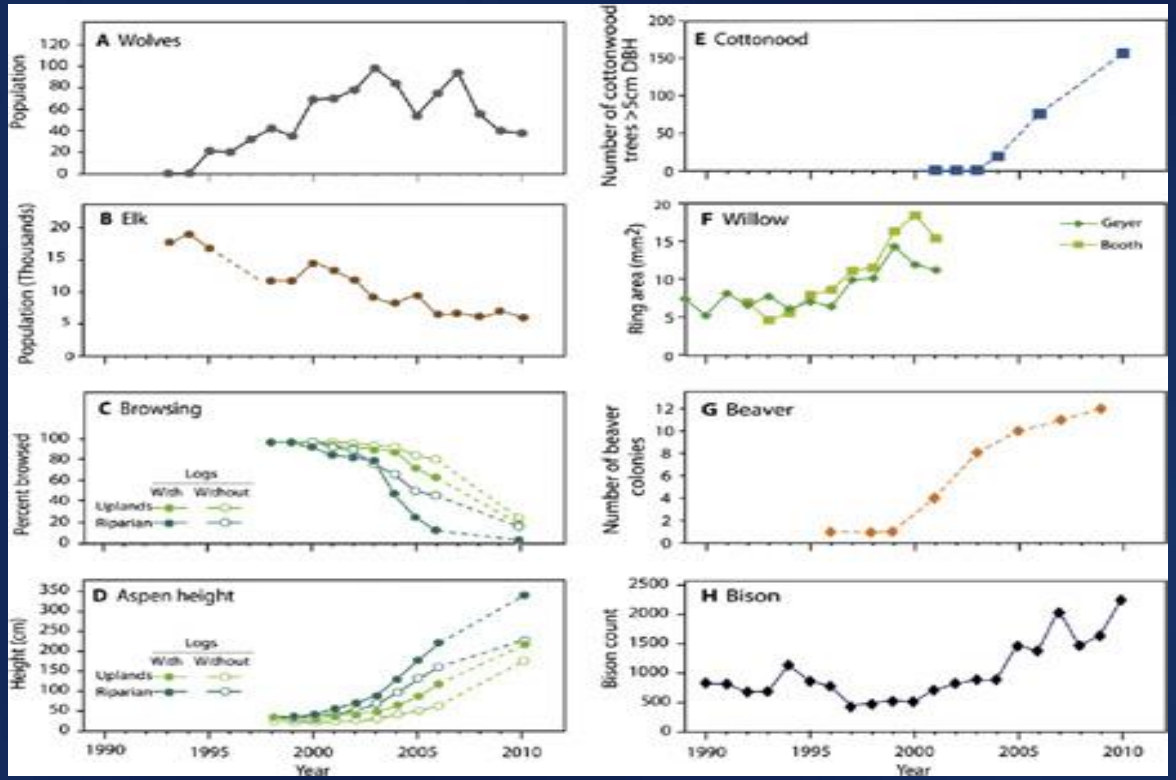
N = {C, C#, D, D#, E, F, F#, G, G#, A, A#, B}

So, we have two sets of the same cardinality (twelve elements each) (Image 3) and we are looking for an order.



Sonification of data

Transfer points of origin of a cartesian diagram into a sequencer



Sonification of data

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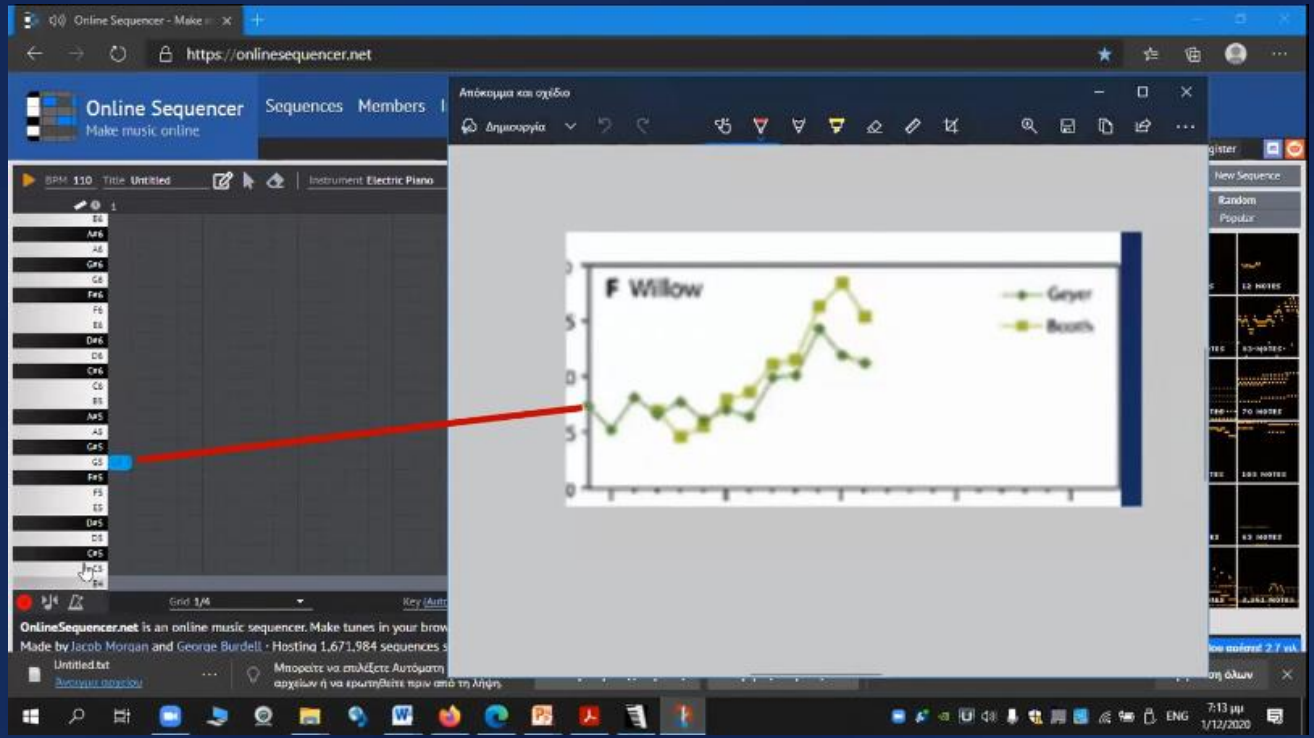


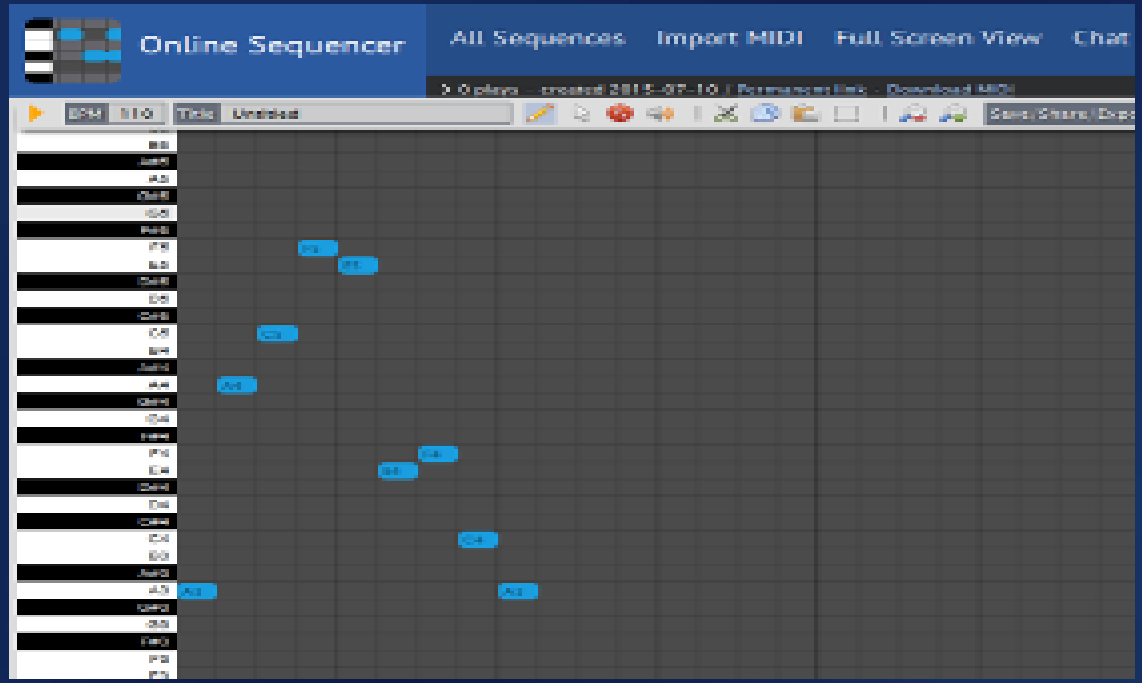
Erasmus+

Sonification of data

Use your mouse to select the points of origin in an online MIDI sequencer and play the result

Publish your creation using a unique URL

Export the result into a MIDI file for further editing



https://onlinesequencer.net/

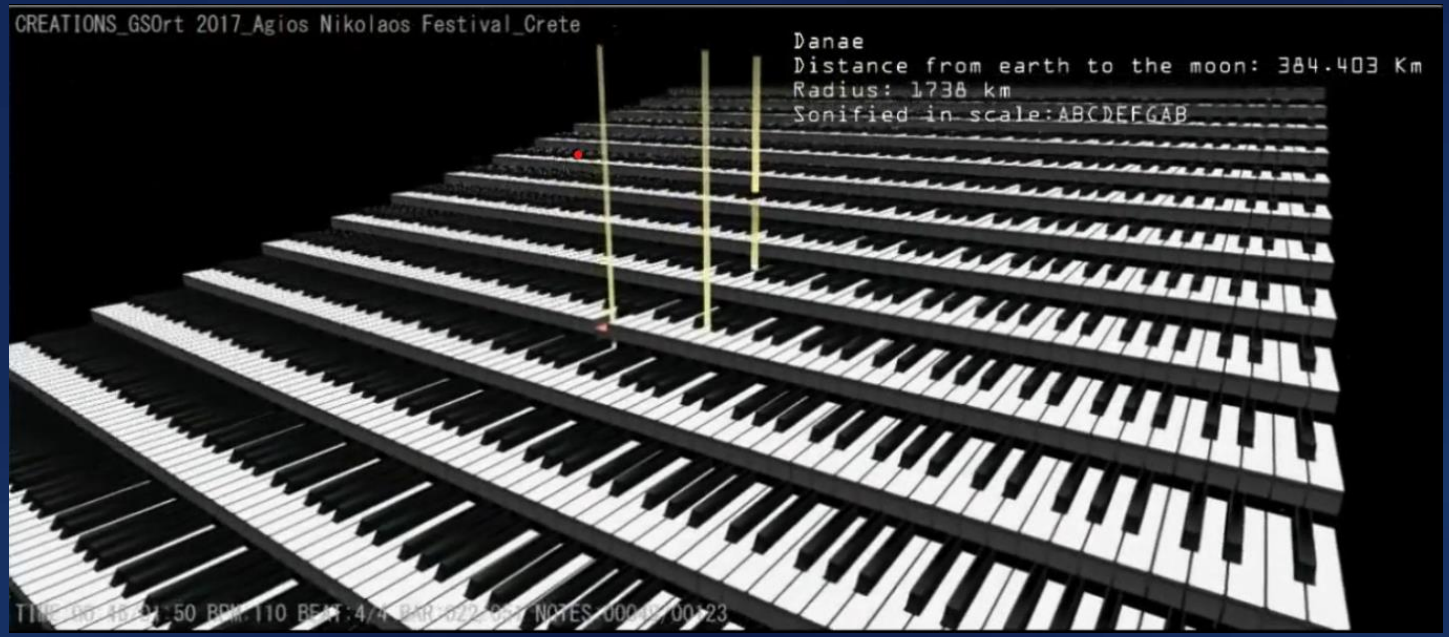
Sonification of data

Play your MIDI file using 3D Music Animation Software

MIDItrail software
https://osdn.net/projects/miditrail/

Video example
http://dma.ea.gr/sites/default/files/Particle2-1.mp4

With another 3d Music Animation option



Video example
http://dma.ea.gr/sites/default/files/GSO-Sonifications_Educational-Festival-Agios_Nikolaos.mp4

Music Animation Software

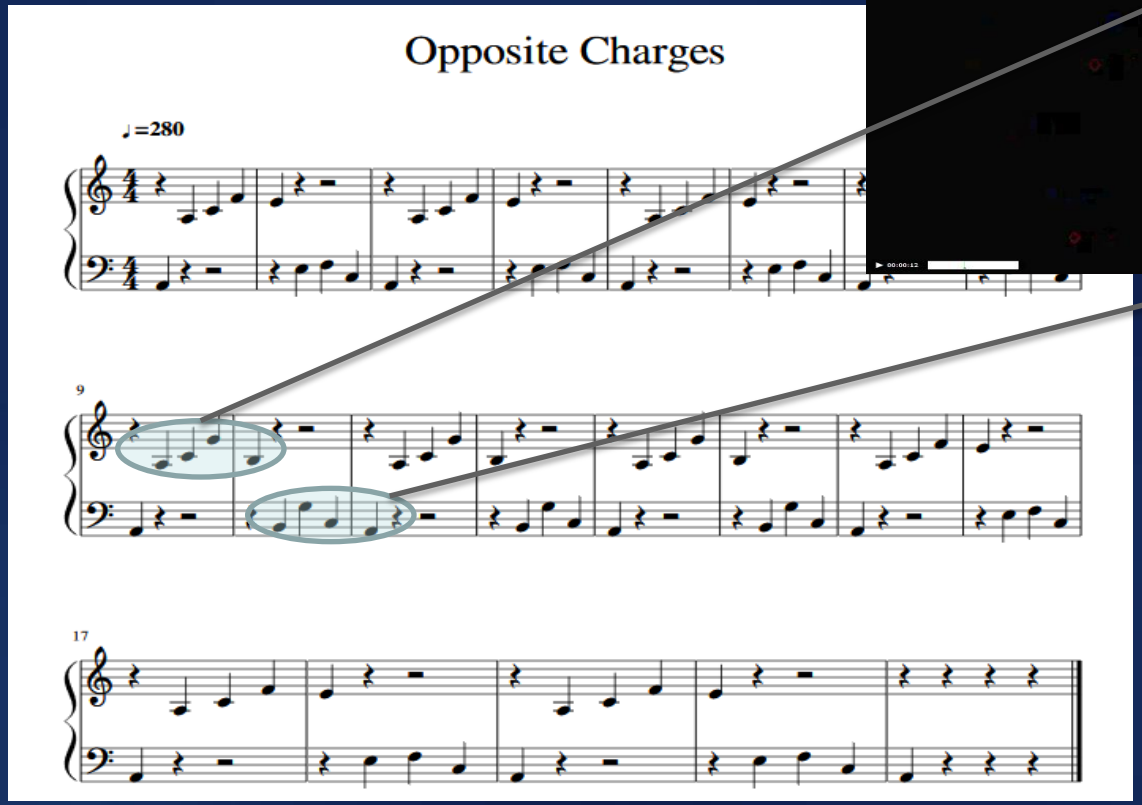
and

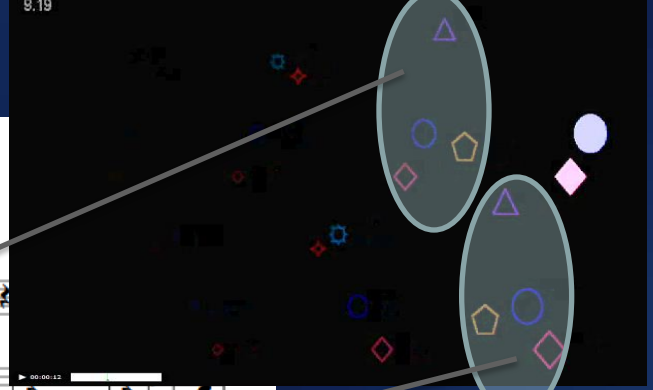
Music Notation software

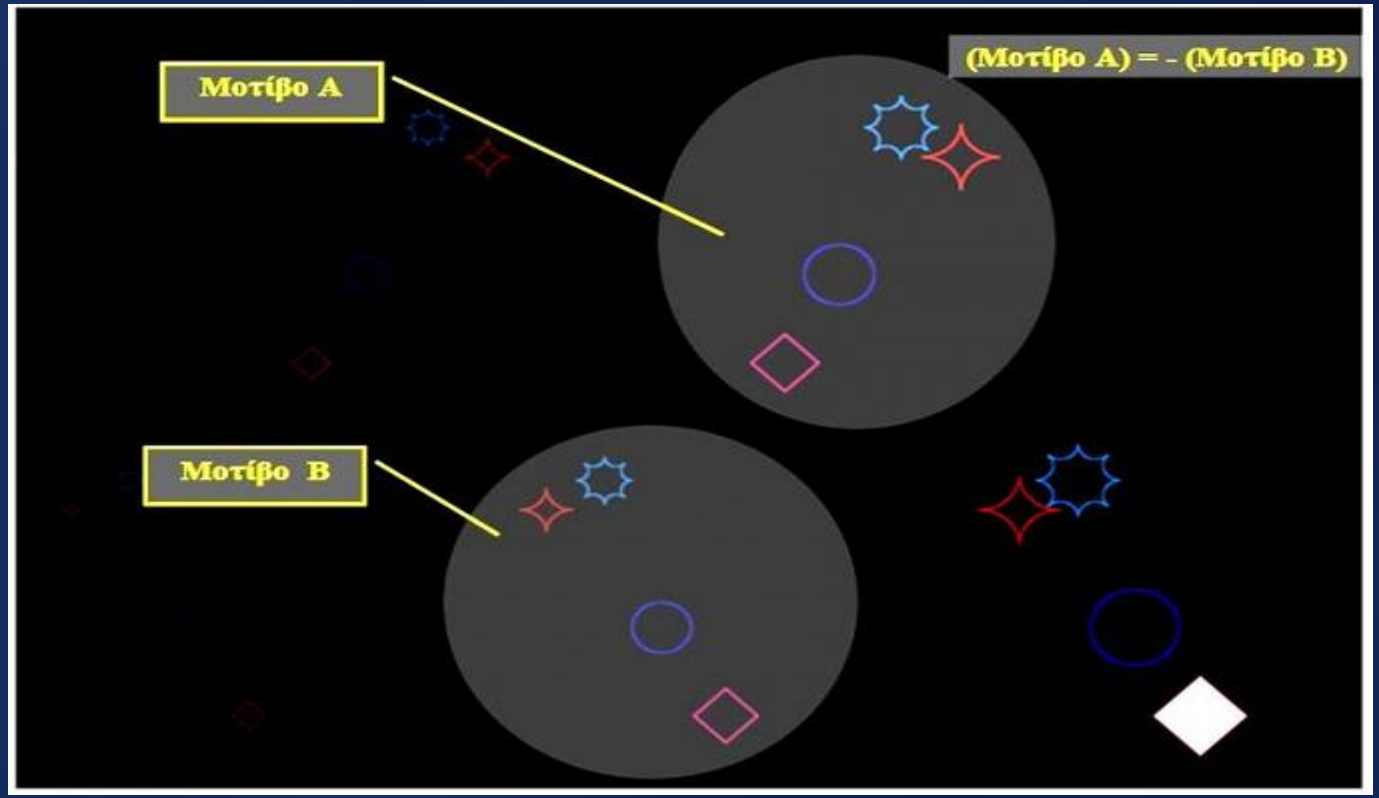
(Musescore)

Open Source Music Notation Software

https://musescore.org/en







Using Stephen Malinowski's

"Music Animation Software"
http://www.musanim.com/all/

Opposite Charges (Screenshot)

Video examples

Click links to watch videos

Why using sonification techniques to create music in GSO?

Because it helps students :

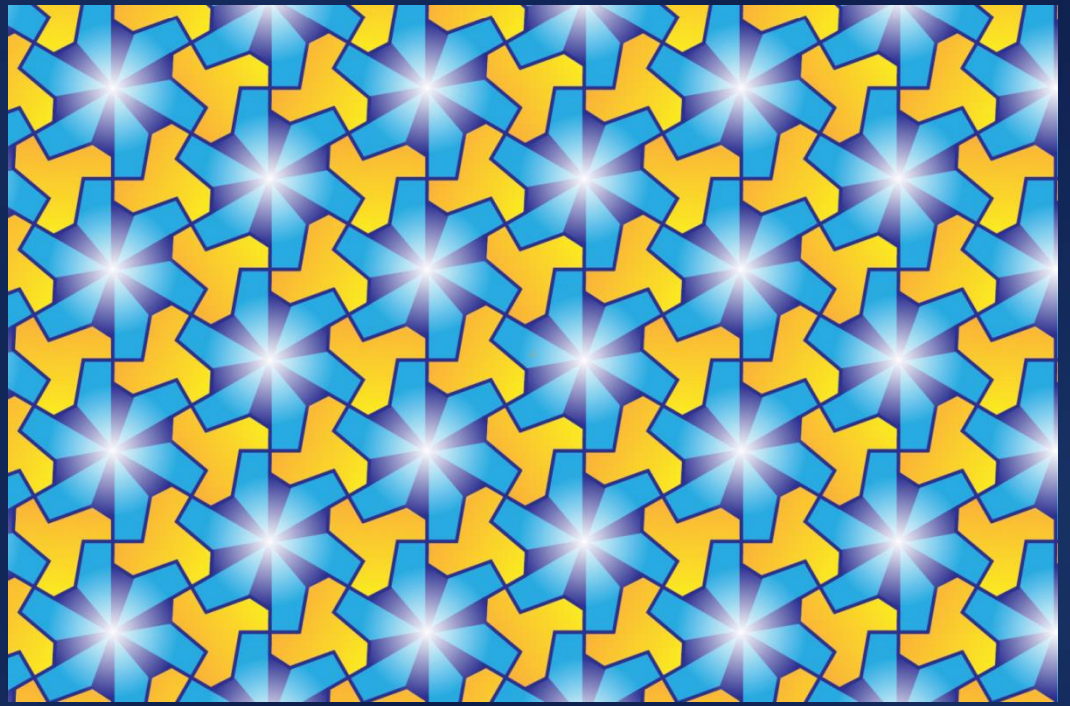
- to connect mathematical figures presented in a scene with sound or music

- to understand that a mathematical graph can also be expressed through sound or music that uses its own “cartesian coordinate system”
(the simplest e.g. x axis: time, y: pitch)

- to identify their creative role as designers of their own ‘protocol’ of expression as a personal outcome directly related to the scientific notion they learn.

What is leitmotiv?

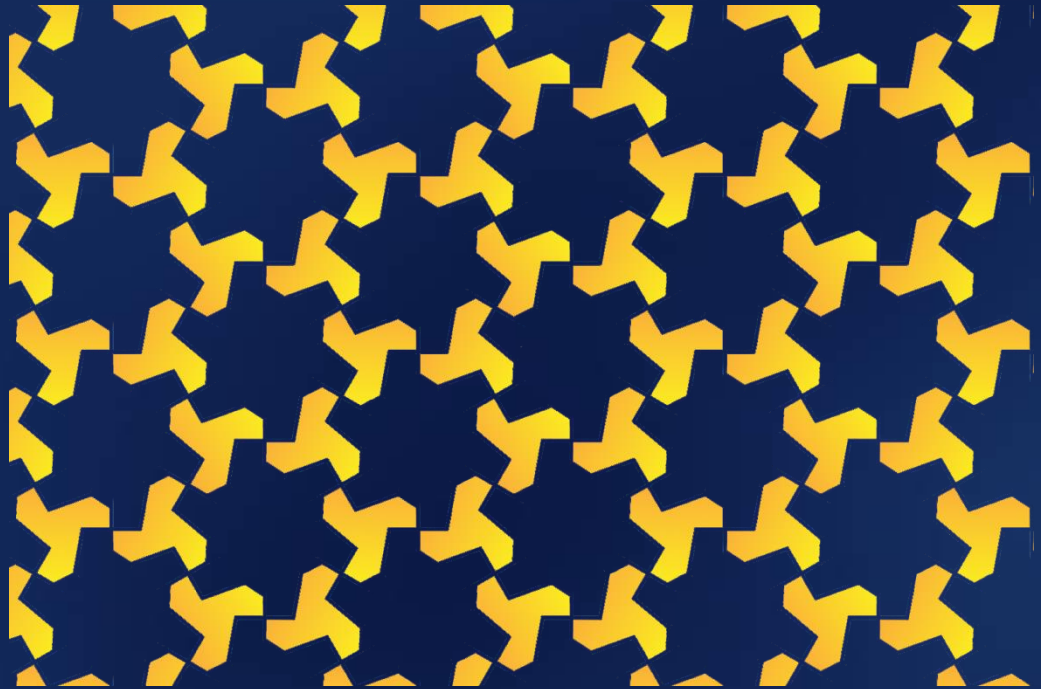
What is leitmotiv?



Let's suppose that this is a picture of a character

What is leitmotiv?

We can identify some of its characteristics



What is leitmotiv?

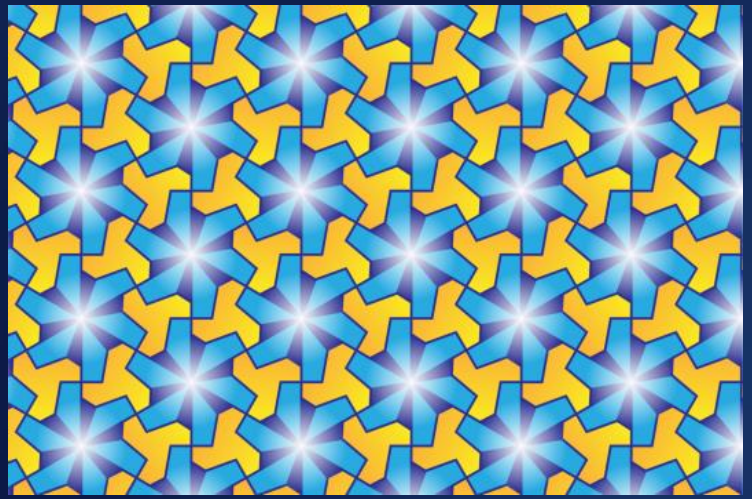
And then we can focus on a small pattern

What is leitmotiv?

... like this one

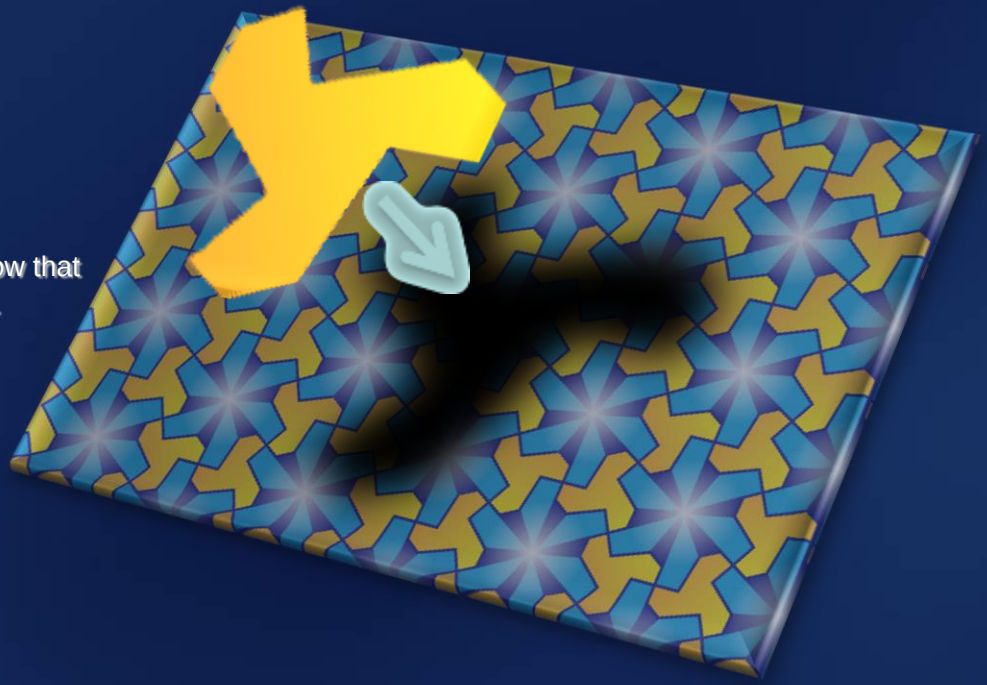
What is leitmotiv?

Now, if I present this pattern once next to its “root” picture, then the viewer can easily identify that both shapes are connected.



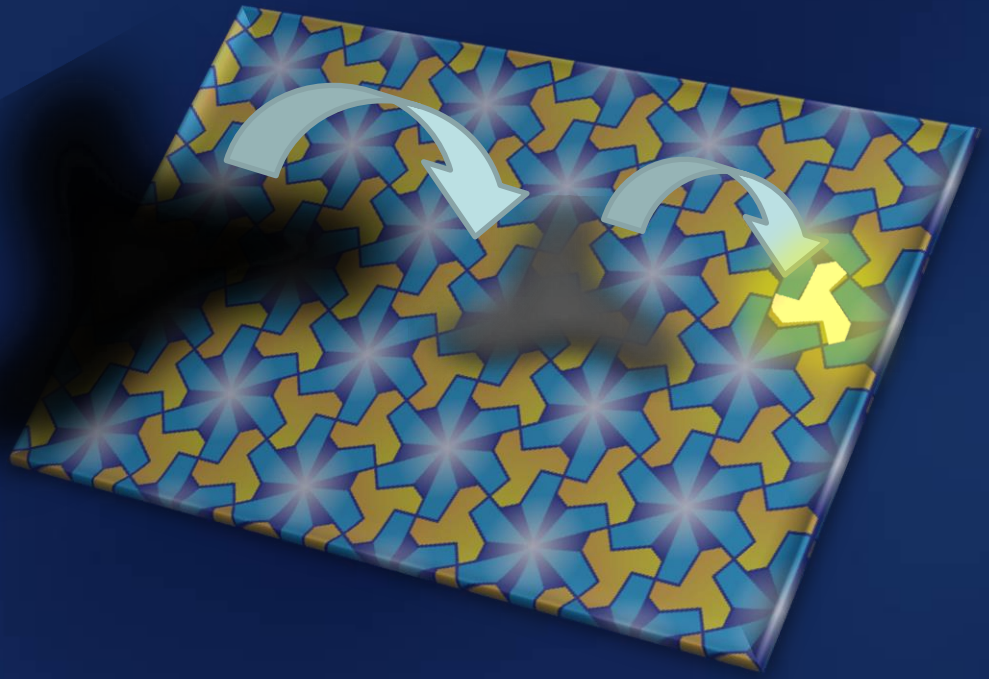
What is leitmotiv?

In this way we trigger a “recall” mechanism like a shadow that creates a connection between this small pattern...



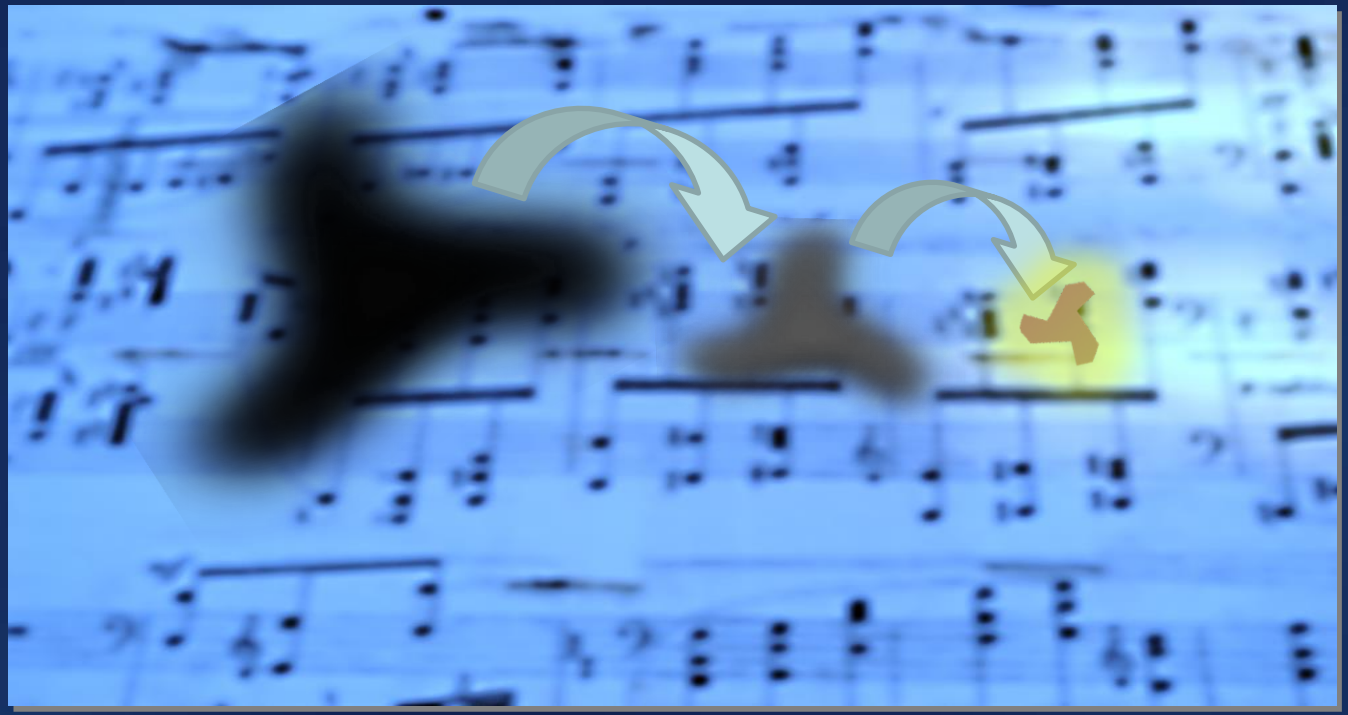
What is leitmotiv?

...and its original counterpart .



What is leitmotiv?

In Music this “recall” mechanism is triggered using notes

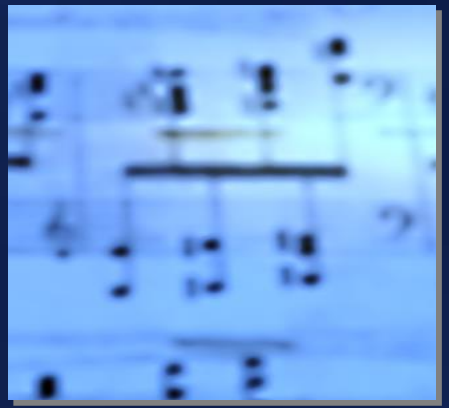


What is leitmotiv?

So the notes used
to trigger this reaction, create a
brief musical pattern called

Motiv

(or “motive”)

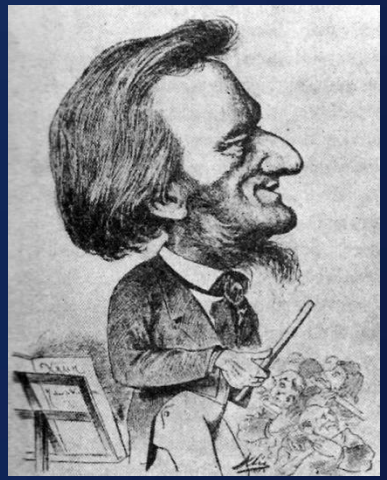


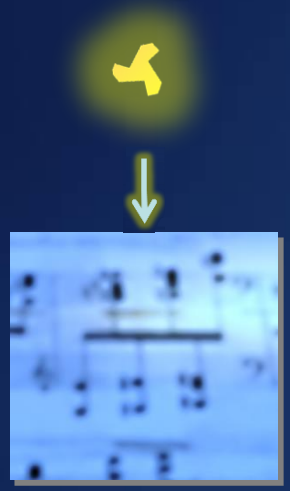
What is leitmotiv?

Richard Wagner extensively cultivated this technique.
In his Operas, motives defined his leading characters. The motive was the leading feature of his heroes and therefore analysts of his time added the word “Leit” in front, which means “leading”.

So his brief musical pattern took the name:

Leitmotiv



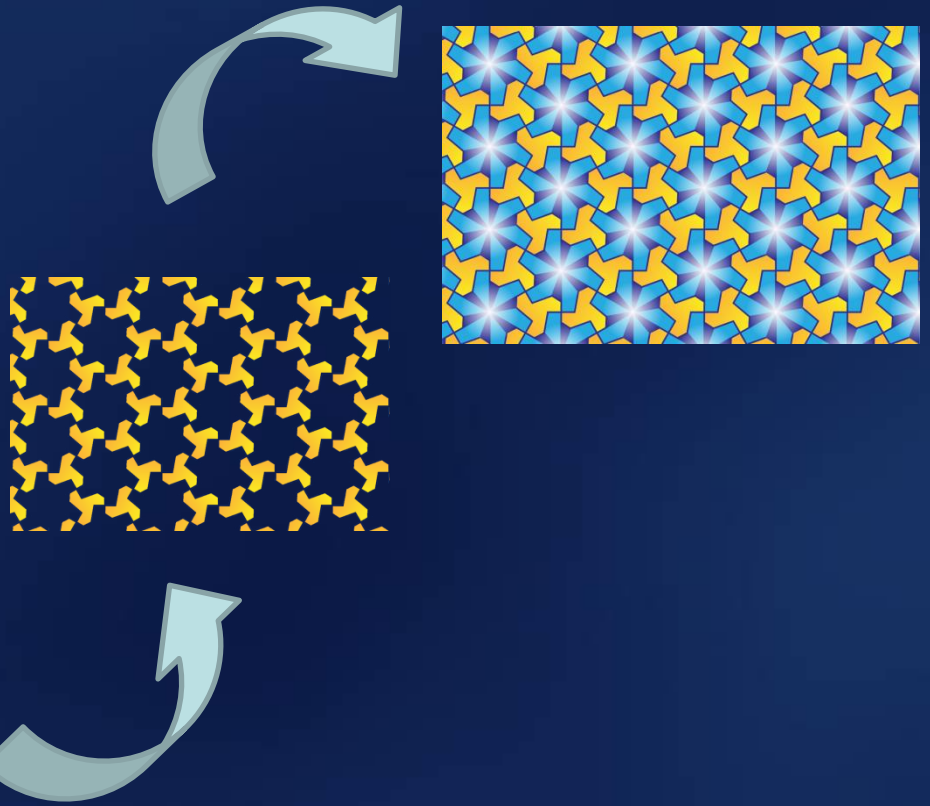


What is leitmotiv?

So “leitmotivs” can repeat themselves whenever there is need

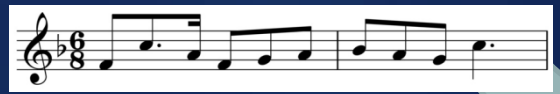
What is leitmotiv?

The way “shapes” are structured within a creation, helps us identify their “root” easier



What is leitmotiv?

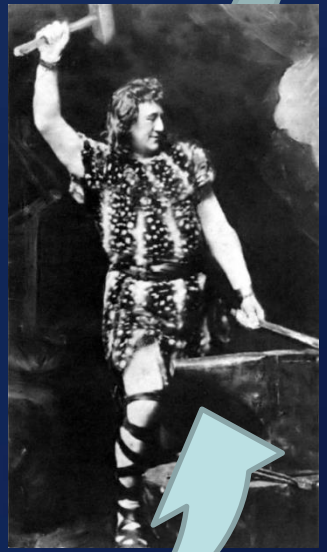
So are leitmotivs in an Opera



Siegfried's leitmotiv

Heinrich Wilhelm Gudehus
(1842-1909)

as Siegfried



Scene from the Opera "Siegfried"
Painting by Otto von Richter, (1892)

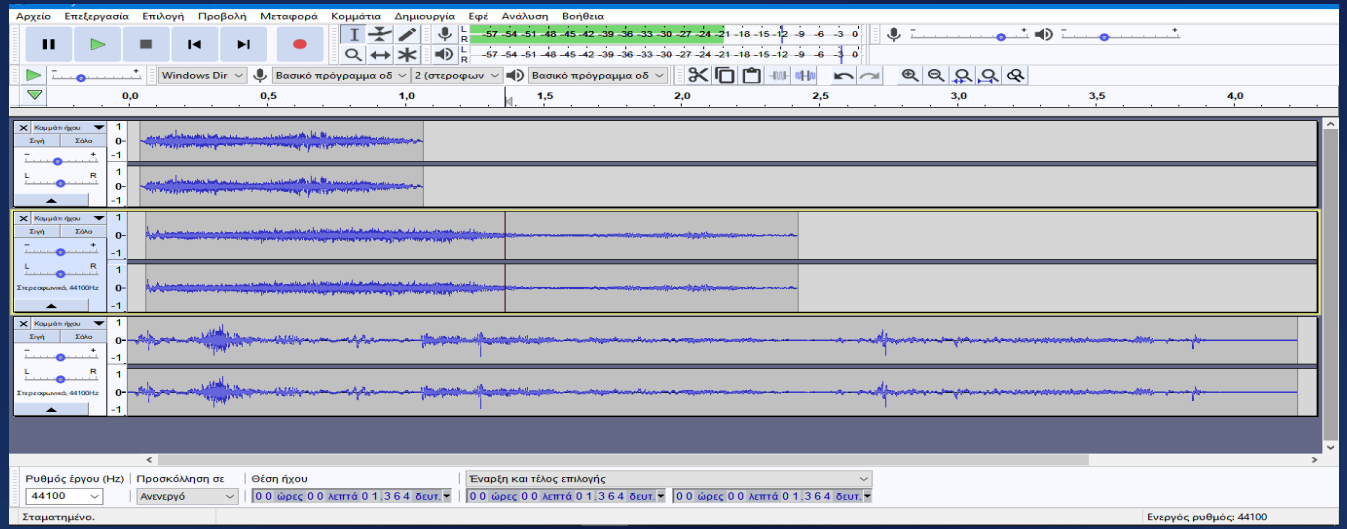
Soundscapes

Soundscapes

with smartphone recordings

Soundscapes

Using Digital Audio Workstations



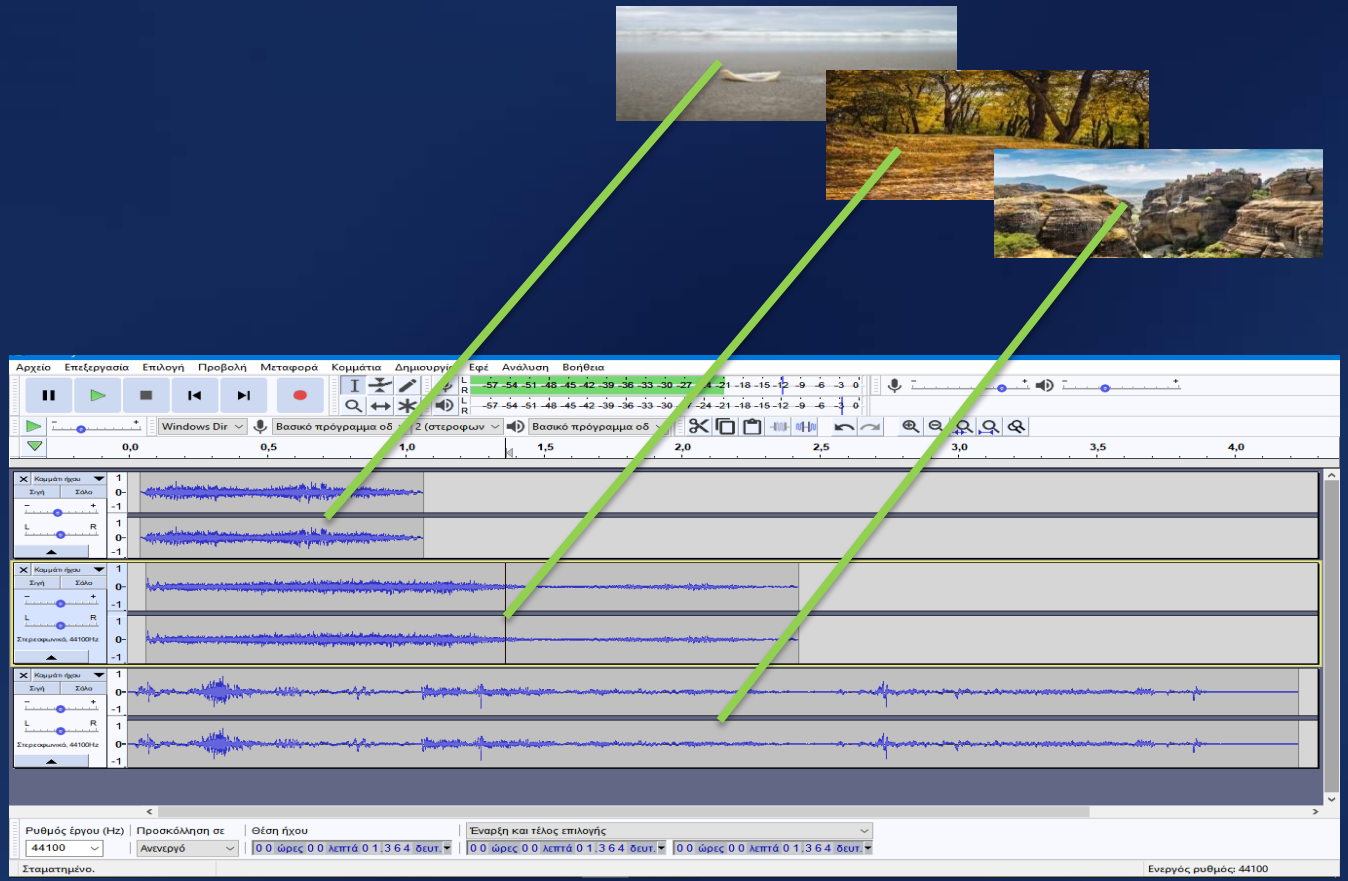
Audacity Software

https://www.audacityteam.org/download/

Soundscapes

with smartphone recordings

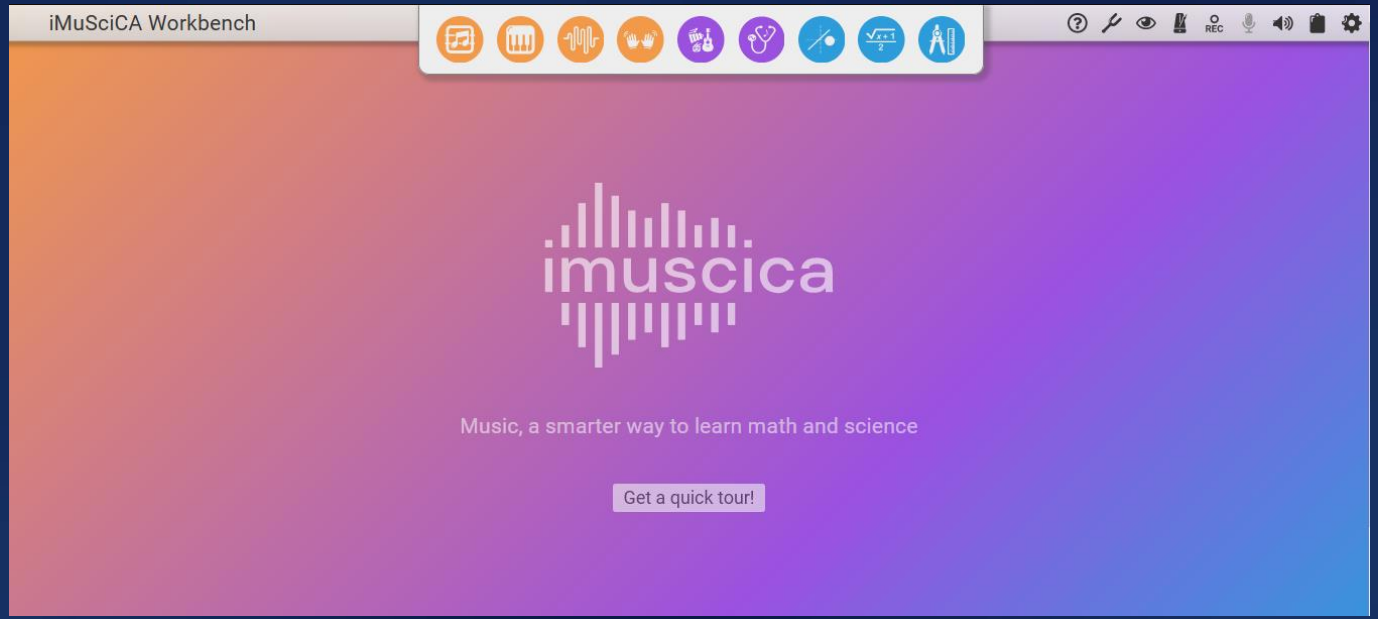
Audacity Software
https://www.audacityteam.org/download/



Other ideas

iMuSciCA Workbench

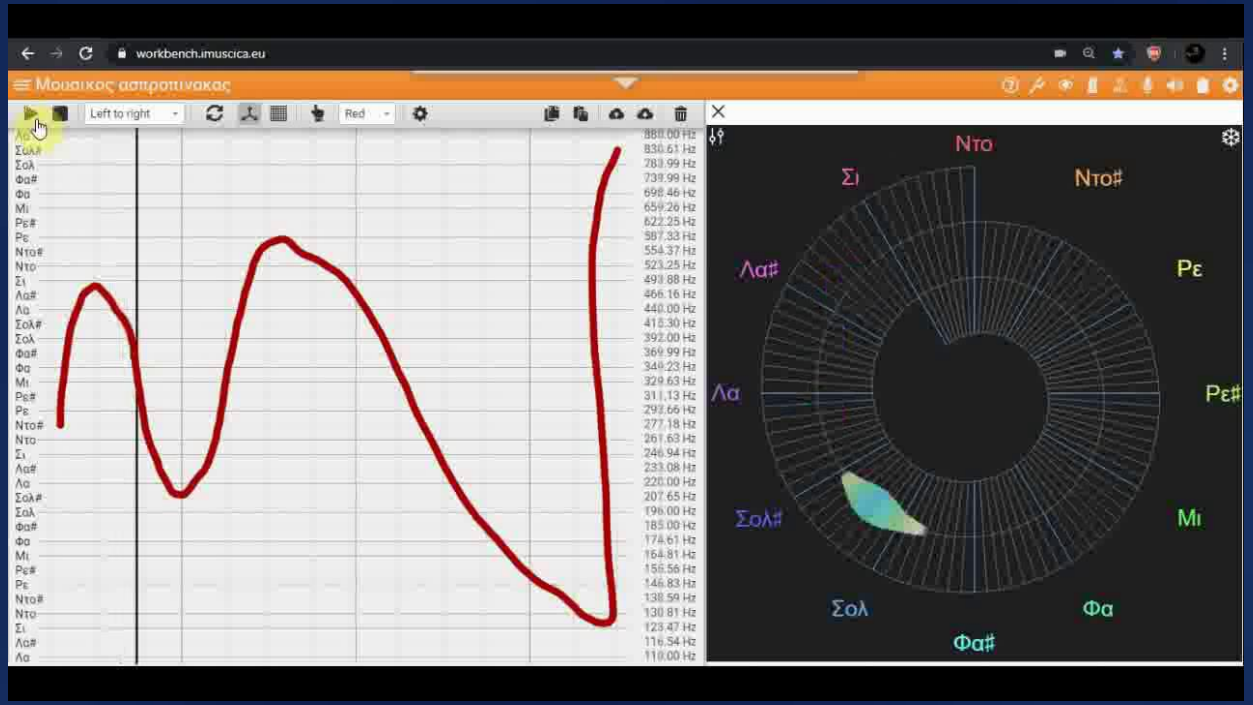
A quest for deeper learning



https://workbench.imuscica.eu/

iMuSciCA Workbench

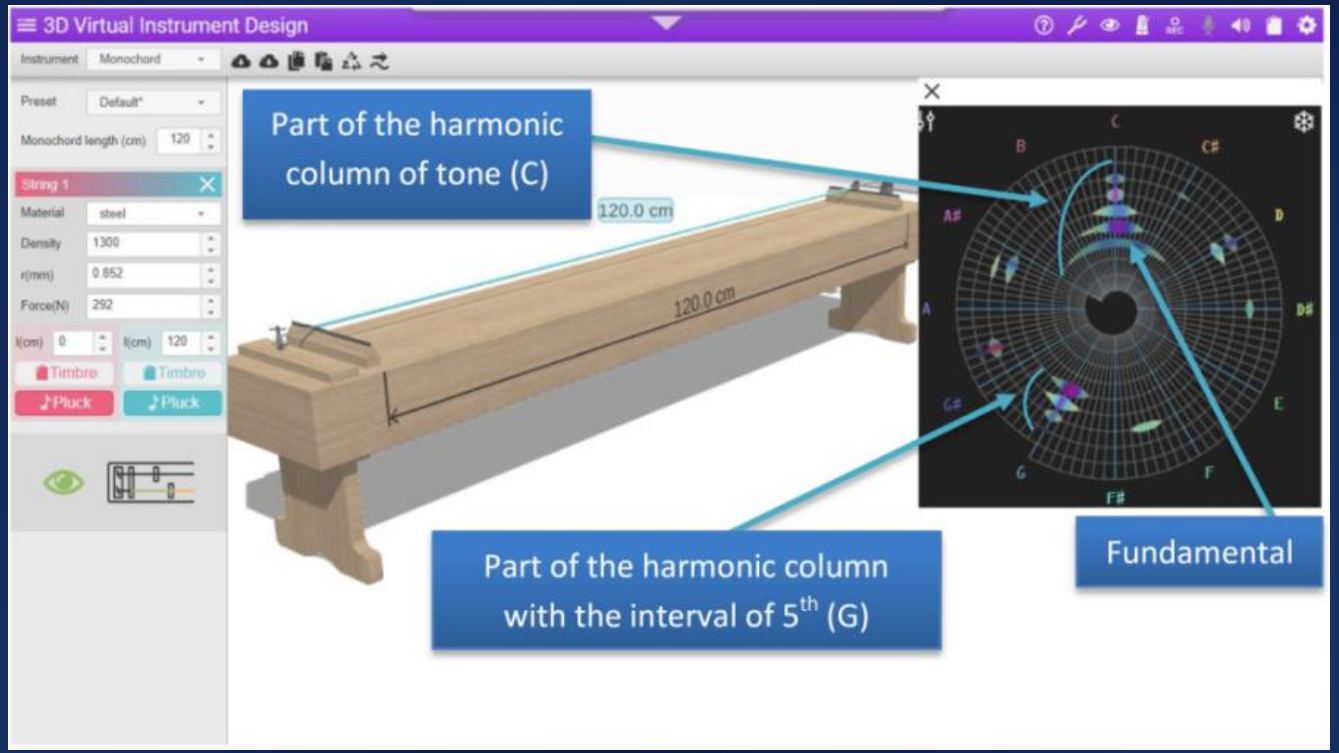
A quest for deeper learning



"Creating conditions for Deeper learning in Science" Conference proceedings

iMuSciCA Workbench

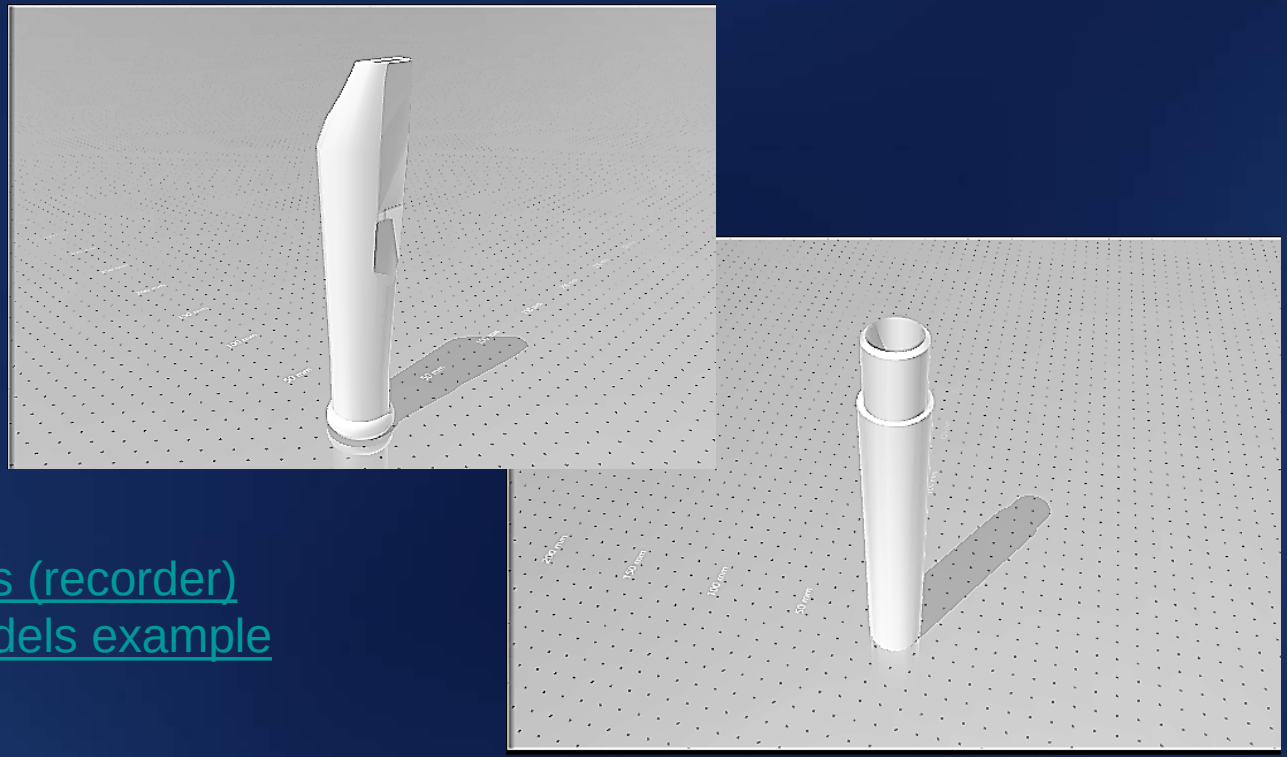
A quest for deeper learning



Video example

iMuSciCA Workbench

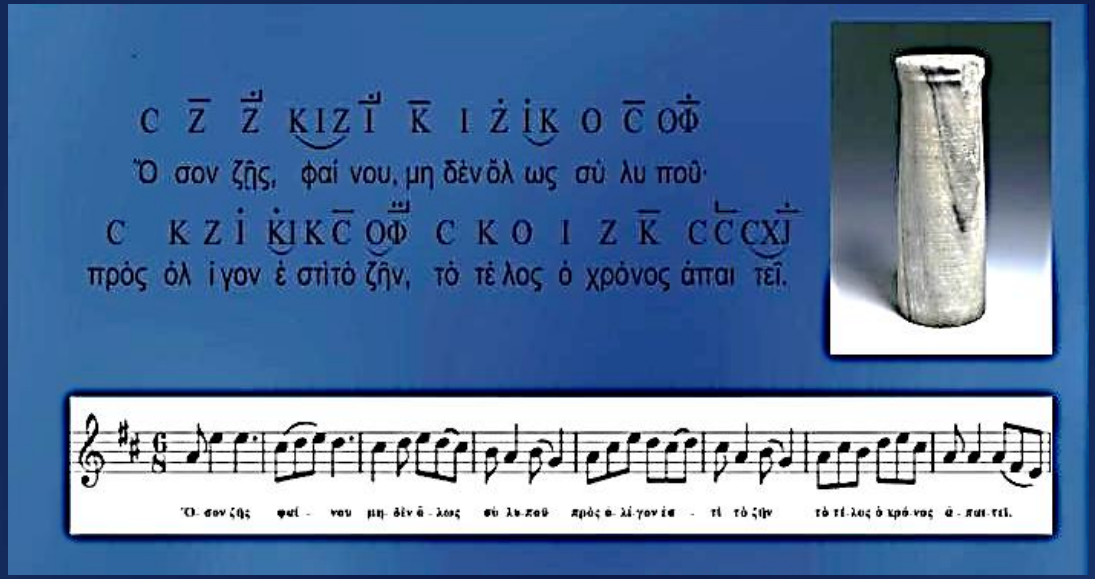
A quest for deeper learning



[Aulos (recorder) 3D models example]

iMuSciCA Workbench

A quest for deeper learning



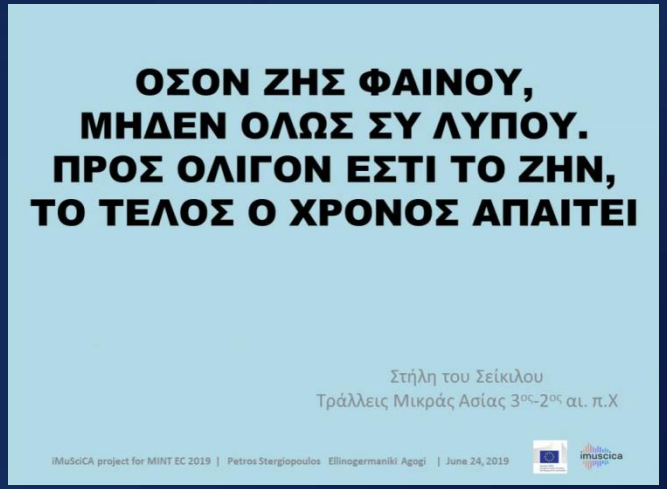
"While you live, shine, have no grief at all, life exists only for a short while and time demands its toll"

Find more about Seikilos here

Seikilos epitaph circa 200 BC

iMuSciCA Workbench

A quest for deeper learning



Click images to redirect to the Seikilos' Karaoke Video tutorial

"While you live, shine, have no grief at all, life exists only for a short while and time demands its toll"

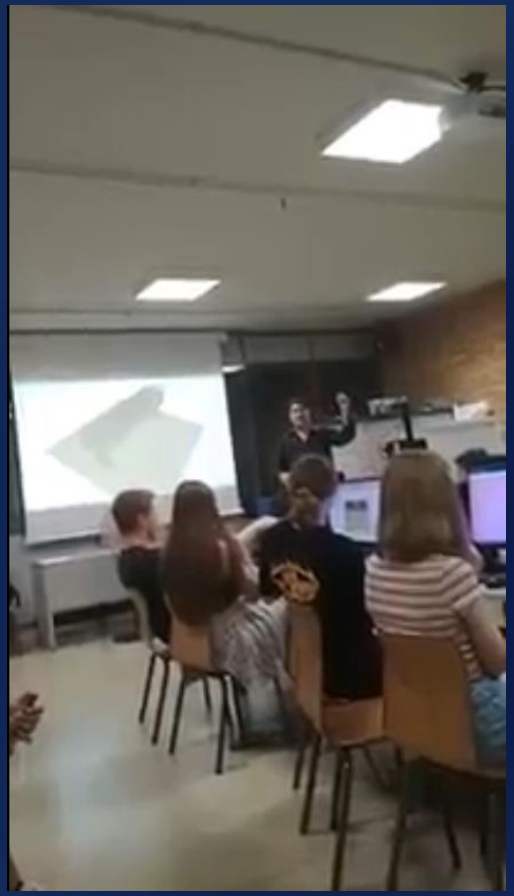
Seikilos epitaph circa 200 BC

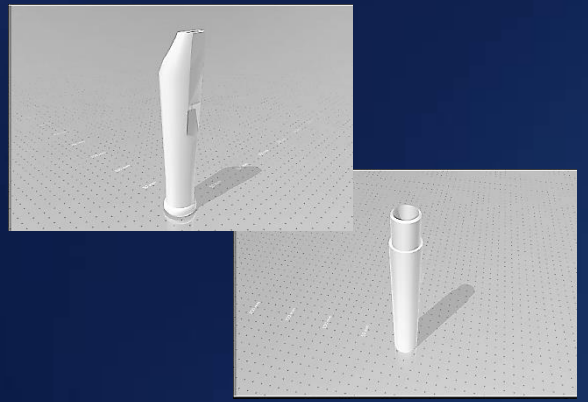
Erasmus+

iMuSciCA Workbench

A quest for deeper learning

Students combined recorders of different lengths to accompany the melody of Seikilos





Video example

Thank you

Petros Stergiopoulos
plagiavlitis@ea.gr