

# Europeana Learning Scenario

## Title

Four Dimensions in Physics and Arts

## Author(s)

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## Summary

*This is an interdisciplinary learning scenario combining the courses of Physics and Art History. The main objective of the learning scenario is to combine a variety of elements from the two above-mentioned courses in order to examine the dimensions of width, height, depth and time as presented and taught in Physics lessons, from a different perspective the Arts. Through Europeana's art collections students would have the chance to study how the four dimensions of physics have been attributed over the centuries. Finally, they will also investigate the new concepts learned by using an Augmented Reality (AR) app which will give them the chance to "control" time and space variables and make changes to the (virtual) painting of the painter. The teaching approach that will be applied is Inquiry Based Learning as it is the one applied to Physics lessons of Secondary School. This scenario was part of the Erasmus + European Program: Augmented and Virtual Reality in Education.*

### Table of summary

Subject	Physics Art History
Topic	Time and Space Art History
Age of students	13 years old
Preparation time	3 h
Teaching time	45 min
Online teaching material	Europeana: <a href="https://www.europeana.eu/portal/el">https://www.europeana.eu/portal/el</a> AR App: Van Gogh's Stargate Star (Starry Night) <a href="http://www.experenti.eu/advertising-en/visual-art-and-augmented-reality-curios-new-app-and-a-bit-of-van-gogh/">http://www.experenti.eu/advertising-en/visual-art-and-augmented-reality-curios-new-app-and-a-bit-of-van-gogh/</a>
Offline teaching material	iPads
Europeana resources used	<a href="https://www.europeana.eu/portal/en/exhibitions/from-dada-to-surrealism">https://www.europeana.eu/portal/en/exhibitions/from-dada-to-surrealism</a> <a href="https://www.europeana.eu/portal/el/record/2063619/CZR_280_006.html?q=cubism#dcId=1560999742520&amp;p=1">https://www.europeana.eu/portal/el/record/2063619/CZR_280_006.html?q=cubism#dcId=1560999742520&amp;p=1</a> <a href="https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro_4158-js">https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro_4158-js</a> <a href="https://www.europeana.eu/portal/el/record/2063624/UK_280_027.html?q=cubism#dcId=1560999742520&amp;p=1">https://www.europeana.eu/portal/el/record/2063624/UK_280_027.html?q=cubism#dcId=1560999742520&amp;p=1</a>

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## Integration into the curriculum

This lesson is part of Physics curriculum for the 7<sup>th</sup> grade (13 year old students)

## Aim of the lesson

The students explore, analyze, compare and recognize different approaches of shaping of the human body in Greek sculpture. They notice differences of proportions and explore different approaches to the body through the Greek canon.

## Trends

Collaborative Learning, Visual Search&Learning, Student Centred Learning, Open Source Learning

## 21<sup>st</sup> century skills

Creativity, Critical Thinking, Communication, Collaboration, ICT, Scientific Inquiry

## Activities

Describe here in detail all the activities during the lesson and the time they require. Remember, that your learning scenario needs to use Europeana resources.

Name of activity	Procedure	Time (min)
<b>Activity 1</b>	Trigger: <a href="https://youtu.be/pigFSxi25qc">https://youtu.be/pigFSxi25qc</a>	5
<b>Activity 2</b>	Hypothesis: Discuss with students which are the dimensions in Physics. (previous knowledge)	5
<b>Activity 3</b>	Students work in pairs to investigate the three dimensions in Physics. Materials: a ruler, different objects Students' task is to measure the width, height and depth of 5 unknown objects.	5
<b>Activity 4</b>	Big Idea: Four-dimensional world	15

*We live in a three-dimensional world and our brains are trained to see three dimensions — height, width, and depth. This was formalized thousands of years ago in the year 300 B.C. by the Alexandrian Greek philosopher, Euclid, who founded a school of mathematics, wrote a textbook called the "Euclidean Elements," and is known as the "father of geometry." However, several hundred years ago physicists and mathematicians postulated a fourth dimension. Mathematically, the fourth dimension refers to time as another dimension along with length, width, and depth. It also refers to space and the space-time continuum.*

*Many artists during the early 20th century, among them the Cubists, Futurists, and Surrealists, have attempted to convey the fourth dimension in their two-dimensional artwork, moving beyond the realistic representation of three-dimensions to a visual interpretation of the fourth dimension, and creating a world of infinite possibilities.*

*In Cubism artists illustrated their understanding of the fourth dimension, meaning that the artist would simultaneously show views of the same subject from different viewpoints — views that would not normally be able to be seen together at the same time in the real world. In this sense, the Fourth Dimension concerns the way in which two kinds of perception work together as we interact with objects or people in space. That is, to know things in real time, we must bring our memories from past time into the present. For example, when we sit down, we don't look at the chair as we lower ourselves on to it. We assume the chair will still be there when our bottoms hit the seat.*

#### **Cubism and Time**

*Cubists painted their subjects based not on how they saw them, but on what they knew of them, from multiple perspectives.*

[https://www.europeana.eu/portal/el/record/2063619/CZR\\_280\\_006.html?q=cubism#dcId=1560999742520&p=1](https://www.europeana.eu/portal/el/record/2063619/CZR_280_006.html?q=cubism#dcId=1560999742520&p=1)

[https://www.europeana.eu/portal/el/record/2063624/UK\\_280\\_027.html?q=cubism#dcId=1560999742520&p=1](https://www.europeana.eu/portal/el/record/2063624/UK_280_027.html?q=cubism#dcId=1560999742520&p=1)

#### **Futurism and Time**

*Futurism, which was an offshoot of Cubism, was a movement that originated in Italy and was interested in motion, speed, and the beauty of modern life. The futurists were influenced by a new technology called chrono-photography that showed the movement of the subject in still-photos through a sequence of frames, much like a child's flip-book. It was the precursor to film and animation. One of the first futurist paintings was *Dynamism of a Dog on a Leash* (1912), by Giacomo Balla, conveying the concept of movement and speed by blurring and repetition of the subject. *Nude Descending a Staircase No. 2* (1912), by Marcel Duchamp, combines the Cubist technique of multiple views with the futurist technique of the repetition of a single figure in a sequence of steps, showing the human form in motion.*

[https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro\\_4158-js](https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro_4158-js)

#### **Metaphysical and Spiritual**

	<p>Another definition for the fourth dimension is the act of perceiving (consciousness) or feeling (sensation). Artists and writers often think of the fourth dimension as the life of the mind and many early 20th century artists used ideas about the fourth dimension to explore metaphysical content. The fourth dimension is associated with infinity and unity; the reversal of reality and unreality; time and motion; non-Euclidean geometry and space; and spirituality. Artists such as Wassily Kandinsky, Kazimir Malevich, and Piet Mondrian, each explored those ideas in unique ways in their abstract paintings.</p> <p><a href="https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro_4158-js">https://www.europeana.eu/portal/en/exhibitions/towards-abstraction#ve-anchor-intro_4158-js</a></p> <p><b>Surrealism and Time</b></p> <p>The fourth dimension also inspired Surrealists such as the Spanish artist Salvador Dali, whose painting, "Crucifixion (Corpus Hypercubus)" (1954), united a classical portrayal of Christ with a tesseract, a four-dimensional cube. Dali used the idea of the fourth dimension to illustrate the spiritual world transcending our physical universe.</p> <p><a href="https://www.europeana.eu/portal/en/exhibitions/from-dada-to-surrealism">https://www.europeana.eu/portal/en/exhibitions/from-dada-to-surrealism</a></p> <p>The idea of time as a fourth dimension is usually attributed to the "Theory of Special Relativity" proposed in 1905 by the German physicist Albert Einstein (1879-1955). However, the idea that time is a dimension goes back to the 19th century, as seen in the novel "The Time Machine" (1895) by British author H.G. Wells (1866-1946), wherein a scientist invents a machine that lets him travel to different eras, including the future. Although we may not be able to travel through time in a machine, scientists have more recently discovered that time travel is, in fact, theoretically possible.</p> <p>Activity: Investigating the four dimensions in Arts. Students work in pairs investigating four dimensions in different paintings found in Europeana collections. e.g. Picasso's Protocubist painting, "Demoiselles D'Avignon," uses simultaneous fragments of the subjects as seen from different viewpoints - for example, both a profile and frontal view of the same face, depicting the four dimensions. Other examples of Cubist paintings showing simultaneity are Jean Metzinger's "Tea Time (Woman with a Teaspoon)" (1911), "Le Oiseau Bleu (The Blue Bird)" (1912-1913), and Robert Delaunay's paintings of the Eiffel Tower behind curtains.</p>	
<p><b>Activity 5</b></p>	<p>Students investigate the four dimensions in Arts by using Van Gogh's Stargate Star (Starry Night) app, which is an augmented reality app.</p> <p><a href="http://www.experenti.eu/advertising-en/visual-art-and-augmented-reality-curious-new-app-and-a-bit-of-van-gogh/">http://www.experenti.eu/advertising-en/visual-art-and-augmented-reality-curious-new-app-and-a-bit-of-van-gogh/</a></p> <p>In this app the user "controls" the space and time variables and therefore is able to make changes to the (virtual) painting of the painter.</p>	<p>5</p>
<p><b>Activity 6</b></p>	<p>Discussion and Conclusions</p>	<p>5</p>
<p><b>Activity 7</b></p>	<p>Exit ticket (Annex 1)</p>	<p>5</p>

## Assessment

The teacher evaluates what each student has adopted through an exit ticket.

## Student feedback

Annex 1: Exit ticket

## Teacher's remarks

*The used methodology, Inquiry based learning was an effective and engaging one, helping students to understand the four dimensions in Physics and Arts. The students were active listeners as well as co-workers sharing ideas and collaborating efficiently. According to students' feedback the learning scenario introduced was really interesting and fun. Along with the students, I found myself discovering new sources, designing prototype teaching material as well as exchanging ideas with colleagues via this project.*

## About the Europeana DSI-4 project

[Europeana](#) is Europe's digital platform for cultural heritage, providing free online access to over 53 million digitised items drawn from Europe's museums, archives, libraries and galleries. The Europeana DSI-4 project continues the work of the previous three Europeana Digital Service Infrastructures (DSIs). It is the fourth iteration with a proven record of accomplishment in creating access, interoperability, visibility and use of European cultural heritage in the five target markets outlined: European Citizens, Education, Research, Creative Industries and Cultural Heritage Institutions.

[European Schoolnet](#) (EUN) is the network of 34 European Ministries of Education, based in Brussels. As a not-for-profit organisation, EUN aims to bring innovation in teaching and learning to its key stakeholders: Ministries of Education, schools, teachers, researchers, and industry partners. European Schoolnet's task in the Europeana DSI-4 project is to continue and expand the Europeana Education Community.

### Annex 1. Exit ticket

#### 1. False (F) or True (T)?

- a. The dimension that was first given in the Art was the depth. \_\_\_\_
- b. In the Art of the ancient Greek pottery the dimensions that was first given was the width and height. \_\_\_\_
- c. Time was first depicted in Impressionism. \_\_\_\_

#### 2. What form of work did you like the best? Explain why.

- a) individual   b) in pairs   c) group work

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#### 3. How did you feel during today's lesson? Explain why.

- a) bad   b) interested   c) excited   e) bored   f) as usual

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#### 4. What would you do to improve this lesson?

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#### 5. Are you satisfied with today's lesson?

a) yes      b) no

**6. What would you change in this lesson?**

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**7. What did you like best about this lesson?**

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