HOLOMAKERS PROJECT

Motivating secondary school students towards STEM careers through hologram making and innovative virtual image processing practices with direct links to current research and laboratory practices

Erasmus+ KA2 2017-1-PL01-KA201-038420

Activity 5

Capturing light: the seashell project

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Project description for teachers

Overview

This activity is one of the interdisciplinary projects in STEAM for physical holograms that will be developed within the 2nd pilot phase of the Holomakers project.

In this project, we expect from the students to become familiar with the basic principles of optics through the use of physical holography and specifically through the use of the portable HoloKit, which represents a basic holographic set up. This activity revolves around the '**seashells**' topic, with seashells being the main holographic objects. Students will be encouraged to do a short research on this topic, choose or find (if it is possible) their own seashell and use the HoloKit in order to successfully record the object.

Est. Duration	**3-6 hours** (more time is required for the extended activity scenarios)
Equipment needed	The portable HoloKit, batteries, holographic film, seashells
Links to external files	Useful material can be found in Dropbox O3>Projects> Sea Shells Additional OERs that might be useful for introductory purposes: https://holomakers.eu/oers/ https://holomakers.eu/wp-content/uploads/2019/01/ExternalResources-Seashells.pdf
Learning objectives	**We expect students to:** • get familiar with the procedures of making a physical hologram using the HoloKit • understand how basic setups for hologram recording function • problematize upon the materiality and texture of the object to be holographed • practice their collaborative skills towards producing a more complex and meaningful – from an artistic perspective – hologram • go deeper in the context of the project and to explore 'seashells' from many different perspectives (i.e. Arts, Environmental Education)
Preparation needed	The teachers need to become familiar with the process by testing different angles and positions of the object to be holographed as well as different seashells with different geometries and various textures. *The experience gained during C2 training activity might be useful.*

Preparatory phase

In Dropbox (see folder O1, O2 and O3) there are several resources for physical holography that you may need in order to familiarize your students with the concept of holography. You can also trigger students' curiosity by asking them to do a short/small research on specific topics related to holography and holographic process.

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Phase 1: Discovering the history and utility of seashells

At the beginning of the first phase, students will be encouraged to do a short research on seashells in order to find out about the different categories, shapes and geometries of the seashells (Figure 1), as well as to be informed for the utility of seashells in different cultures and different historical periods. This step can function as an inspiring/ triggering and preparation stage for further tasks that will later be described.

Scenario: Maria is a teacher in an Italian school that implements the seashell project in her class. She pinpoints useful resources and invites her students to explore the topic of the activity in groups. She then demonstrates the following pictures of seashells and encourages the students to highlight the basic characteristics and differences among these seashells. *What shape they have? How shiny and glossy are they?*

Figure 1 Seashells of different shapes and geometries, retrieved from: http://www.stickpng.com/es/img/comida/conchas-marinas/concha-marina, https://www.freeiconspng.com/img/24620, http://png.clipart-library.com/tag/seashell-2.html

Choosing/Selecting the suitable seashell

For better recording results, the students are informed that the selected seashell should be white, shiny and glossy. However, they should be encouraged to test different textures in order to realize the importance of materiality in analog/physical holography. In addition, they should keep in mind that the selected seashell should not exceed the height of 2-4cm in order to fit the size of the holographic film.

Outcome: At this point, the students should be problematized on the significance of materiality in the process of analog/physical holography.

The teacher can raise the following questions to activate the dialogue in the class:

- Does the texture of the seashell play a role in the holographic recording?

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- Why does the white colour work better?

White objects can reflect every color that belongs to the visible light spectrum.

- What other colours would work well in our setup?

Every color that can reflect the red light. White, red as well as yellow and orange.

Phase 2: Preparing the set up

In this phase, the students are invited to use the portable HoloKit (Figure 2) and prepare the set up so as to record the selected object. You can find the instructions here (Output 2: https://holomakers.eu/intellectual-outputs/), in case the HoloKit is not already assembled from previous activities.

Students are encouraged to test different angles and positions among the laser beam, the holographic/plexiglass plates as well as the base of the object in order to better understand the mechanisms of holography. They are also encouraged to place the object in various heights and positions by using the provided plasticine. When the students believe that the reflection on the plexiglass plates of the object (namely the seashell) is the finest that can be done, then the set-up is ready for the recording phase.

Some general rules/tips that usually gives good results:

- Place the kit on a stable table
- Turn on the laser diode at least 5 minutes before making holograms
- Place the object as close to the holographic film as possible
- Place the object at a height that is illuminated by the laser beam
- Check that the reflection of the object is visible on the holographic/plexiglass plate (Figure 3)
- Avoid to change the height of the laser diode

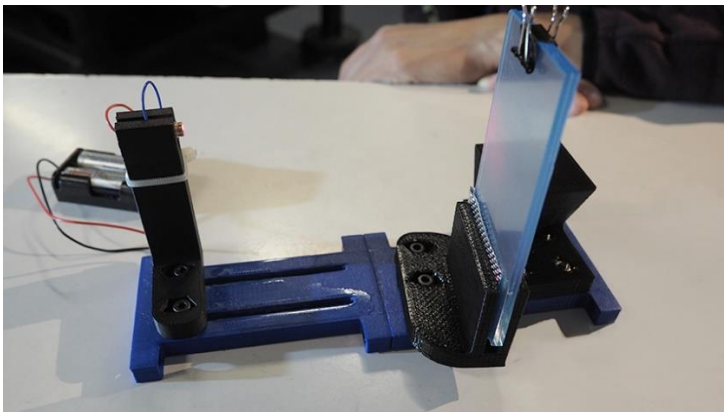

Figure 2 The portable HoloKit

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Outcome: At this point, the student should have become familiar with some processes of physical holography. The focus is on realizing the importance of choosing the best angle and positions among the basic parts of the set-up.

Capturing the artefact

Once the set-up is ready, the students should mark on the holographic/plexiglass plates the area where the holographic film will be placed (Figure 4, left). They should also place the shutter between the laser beam and the holographic/plexiglass plates (Figure 4, right). Then – with the help of their teachers – and in a semi-dark room, they will place the holographic film between the two holographic/plexiglass plates (before placing the holographic film it is important to check whether or not the holographic/plexiglass plates are clean). After that, they will wait for approximately 3-5 minutes.

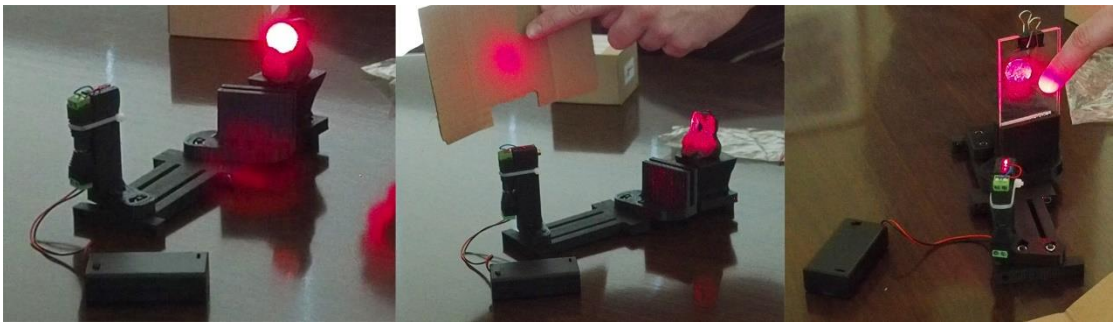

Figure 3 Checking object's reflection on a neutral surface to get familiar with the process and then on holographic/plexiglass plate.

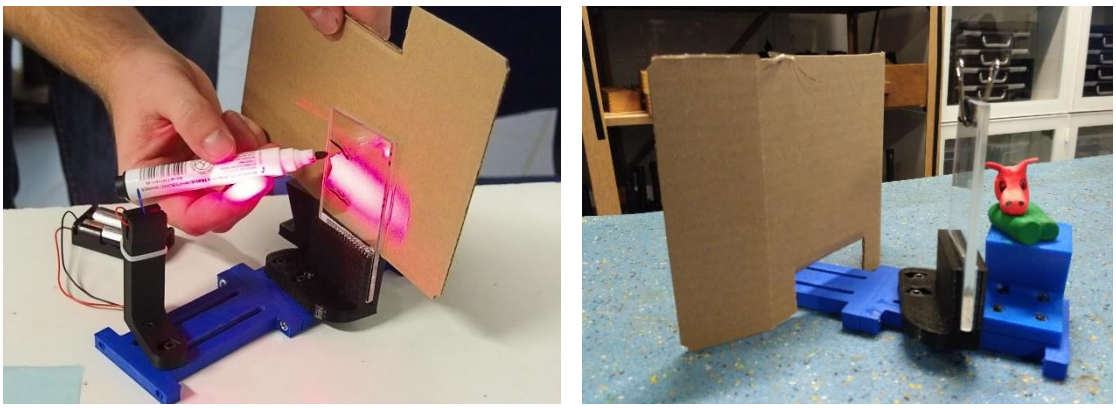

Figure 4 Marking the holographic/plexiglass plate (left), Placing the shutter (right)

Placing the holographic film: Before placing the holographic film, it is important to check the colour of the film and specifically if it is blue or red. Blue colour indicates that the film hasn't been previously exposed to light, while red indicates previous exposure. The holographic film is covered by two thin transparent foils, a colourless and a green one. The student in charge should firstly remove the colourless foil, and carefully stick the film on the marked area (Figure 5, Left). It is crucial to firmly and slowly stick the film on the surface in order to avoid getting/having bubbles. In case of mistake, do not try to unstick the film, but put some pressure on film's surface in order to pop the trapped air out. After sticking the film, it is time for the green

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foil to be removed and for the second holographic/plexiglass plate to be placed. Then, the two plexiglass plates with the embedded film should be placed on the kit (Figure 5, right). You can find more instructions here: https://www.youtube.com/watch?v=4IwSLHOQpWM

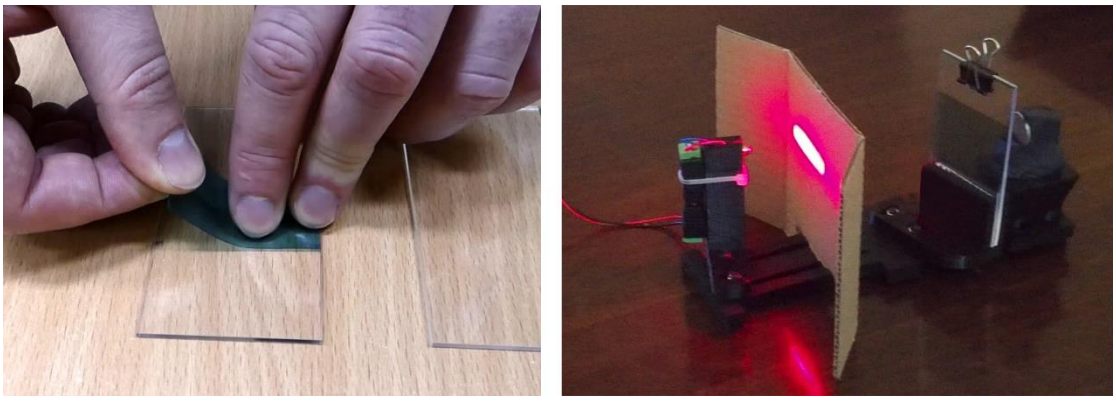

Figure 5 Sticking the film on the holographic/plexiglass plate (Left), Placing the holographic/plexiglass plates with the embedded film on the kit (Right)

Important notes: During recording the parameters of stability and silence are of crucial importance. Thus, apart from placing the HoloKit on a stable surface (e.g. the floor) it is recommended to have in charge one student for each HoloKit who, after removing the shutter, will stand still and silent for the entire recording time. The shutter should not be abruptly removed, but rather slowly in order to avoid any disturbance or/and failure that can be created by the air flow.

Checking the produced holograms

After 3-5 minutes the students can check if their object was holographed. Therefore, with the laser beam still connected to the feed supply, they should look at the holographic film (which will still be between the plexiglass plates) from different angles in order to find out if their object (the entire object or part of it) was successfully recorded on the film. If the object is holographed then the set-up was correct. If the object isn't holographed then there should be modifications. In general, it is recommended to test at least 2 or 3 different set-ups in order to engage the students to the entire procedure.

Important notes: To avoid any disappointment or even frustration, the students should be informed that the process of holography is not always straightforward, and it takes a lot of tests and practice in order to have the best possible results. You should also have in mind to check the level of the provided power to the laser beam because low power levels can lead to failure during the recording process.

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Further activities

Holography meets Arts

As previously mentioned, students can be triggered to do further research on the topic of seashells in order to draw inspiration from different fields. For example, they could search for paintings that contain seashells (e.g Figure 6) and try to recreate them or/and even other parts of the entire painting and thus to produce several complementary holograms that could possibly function as an artistic re-interpretation of an artwork. In this way they can also use materials that have been implemented in previous activities (e.g coins, plasticine etc.).

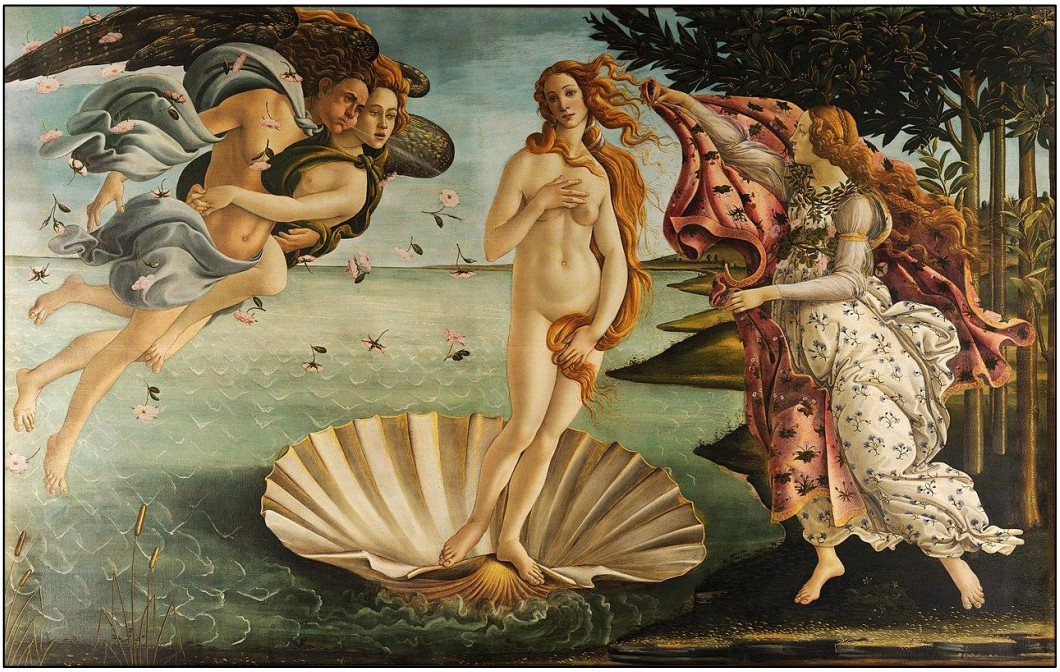

Figure 6: The birth of Venus, retrieved from: https://www.uffizi.it/en/artworks/birth-of-venus

*Teachers present to the class the famous painting "**The birth of Venus**" and ask students to highlight the basic components that constitute this work of art (figure of Venus, other figures, seashell, wings, flowers etc). Then they ask them to imagine a way that they could re-create this painting through holography by encouraging them to choose one of the components (or parts of it) and remodel it by using different materials (e.g plasticine for figures, a seashell, shinny objects like paper clips for the trees etc.). Finally, they are encouraged to use the HoloKits in order to record their objects. In that way they can create a re-interpretation of the painting.*

The students can be also encouraged to look for "sea shells" in Arts and analyze additional pieces of art (as described above).

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Holography meets Environmental campaigns

The seashells project can be further extended entering the area of environmental education. The teachers can provide students with specific articles (published in Lonely Planet) on how tourism and the pocketing of pebbles and seashells affects negatively the natural beauty of sea shores.

> *[…] the unique pebbles can only be found in that area of Skiathos but pebble-picking has the past ten years. In an effort to protect the beach, the island's Cultural Association with the support of the Port Authority and some local residents, has launched a campaign to ban people from pocketing the pebbles. Signs have been posted across Lalaria Beach telling visitors: "take pictures, not pebbles. Save Lalaria Beach" and posters have been distributed to boat companies and fishermen so that the message is spread across Greece […]*
>
> *Article in Lonely Planet: https://www.lonelyplanet.com/news/2018/08/27/illegal-take-pebbles-idyllic-greek-beach/*

The teacher can encourage the students to form teams and to explore whether holography can provide a solution to the aforementioned problem. Can the students identify possible challenges? Do they have any suggestions that could possibly contribute to the efforts already made? Can they come up with their own awareness raising campaign?

Discussing students' experiences in class

After accomplishing the project, the students should be encouraged to discuss and share their experience with their teachers as well as with their classmates. It is important to provide the link between this experience and the previous activities and thus make a comparison between analog/physical and computer-generated holograms.

Here are some questions that can be addressed to the students:

- Can you describe the process of recording a hologram in your own words?
- What is the most challenging part in the process?
- Can you think of similar activities and techniques?
- Can you think possible applications of this practice?

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Declaration

This report has been prepared in the context of the HOLOMAKERS project. Where other published and unpublished source materials have been used, these have been acknowledged.

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