

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 6

Capturing light: the plasticine figures project



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 'plasticine figures' with them being the main holographic objects. The students will be encouraged to experiment with plasticine of different colours and types and to their very own plasticine figure. Then they will be invited to use the HoloKit in order to successfully record the figure.

Est. Duration	2-5 hours (dependant on the implementation of the extended activity scenarios)
Equipment/materials needed	The portable HoloKit, batteries, holographic film, plasticine of different colours
Links to external files	Useful material can be found in Dropbox O3>Projects>PlasticineFigures Additional OERs that might be useful for introductory purposes: https://holomakers.eu/oers/ External resources: https://holomakers.eu/wp-content/uploads/2019/01/ExternalResources-PlasticineFigures.pdf
Learning objectives	We expect students to: <ul style="list-style-type: none">• 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 the colour of the object to be recorded• practice their collaborative skills towards producing a more complex and meaningful – from an artistic perspective – hologram
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 colours of plasticine. <i>The experience gained during C2 training activity might be useful.</i>

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.

Some good tips before you start:

- 1) Carefully select the material for making the object. Plasticine-like clay (modelling clay) is likely to give you better results. Use black colour markers to decorate your object;

this will allow you to more easily identify the recorded hologram on the holographic film.

- 2) Spend some time to experiment with different materials and materials of different colours.
- 3) Trial and error: Try to use a shiny object (before placing the one that you have designed) in order to find the position that gives the better reflection.

Phase 1: Introduction into the scenario of the activity

At the beginning the students will be encouraged to do a short research on plasticine in order to find out about the different uses of this material in various categories such as art and cinema (Figure 1). This step is not crucial for the holographic process, but it can function as an inspiring/triggering and preparation stage for the present activity as well as for further activities that will later be described.

Scenario: Artur is a Polish teacher that implements the “plasticine figures” project with his students. He thinks that it is important to immerse the students into the scenario of the activity. He forms students in teams and moves them to find information about the use of plasticine figures in animation and cinematography. He then demonstrates pictures and videos of plasticine figures (see Figure 1) and encourages the students to reflect upon the colour of the figures and whether they could be holographed successfully. He then invites the teams to work on their own figures inspired by an animation that they like. He realizes that some teams come up with many different and crazy designs building upon existing plasticine characters/figures. This practice was embraced and supported by Artur as it offers students many opportunities to express their creativity and use their imagination.



Figure 1 Figures made of plasticine or clay

Experimenting with plasticine

For better recording results, the students are informed that they should avoid using plasticines of green and black colour. However, they should be encouraged to test different colors so as to realize the importance of this parameter in physical holography. A good idea is to create a figure composed of different colours so as to see the difference. They can also use black pen to decorate their figure (e.g. draw the eyes or the nose of a dog). They also should keep in mind that their figure 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 the parameter of colour in the process of physical holography.

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

- Does the colour of the plasticine play a role in the holographic recording?
- Why does the white colour work better?

White objects can reflect every colour 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 in order 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 agree that the reflection on the holographic/plexiglass plates of the plasticine figure is the finest (that can be done), then the set-up will be ready for the recording phase.

Some general rules/tips that usually give 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 changing the height of the laser diode

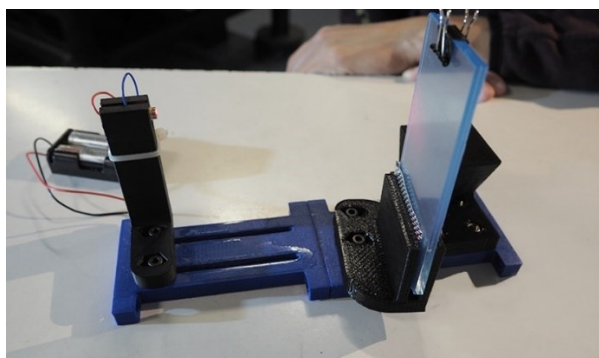


Figure 2 The portable HoloKit

Outcome: At this point, the student should have become familiar with the HoloKit and the underpinning physical holography procedures. 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 the holographic/plexiglass plates are clean). After that, they will wait for approximately 3-5 minutes.

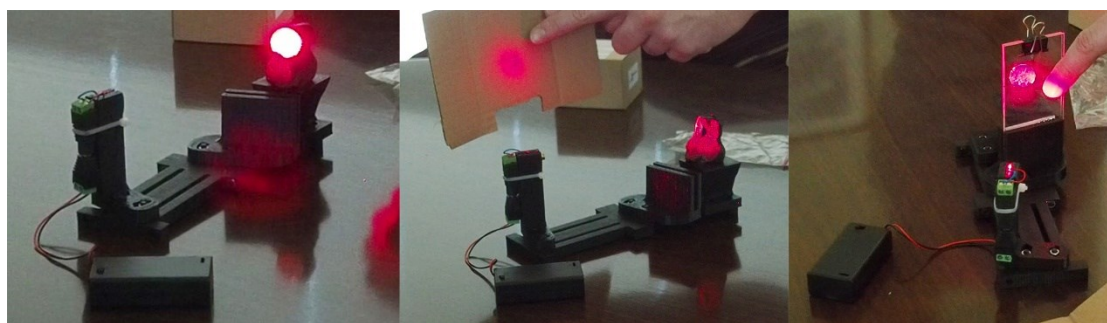


Figure 3 Checking object's reflection on a neutral surface to get familiar with the process and then on holographic/plexiglass plate.

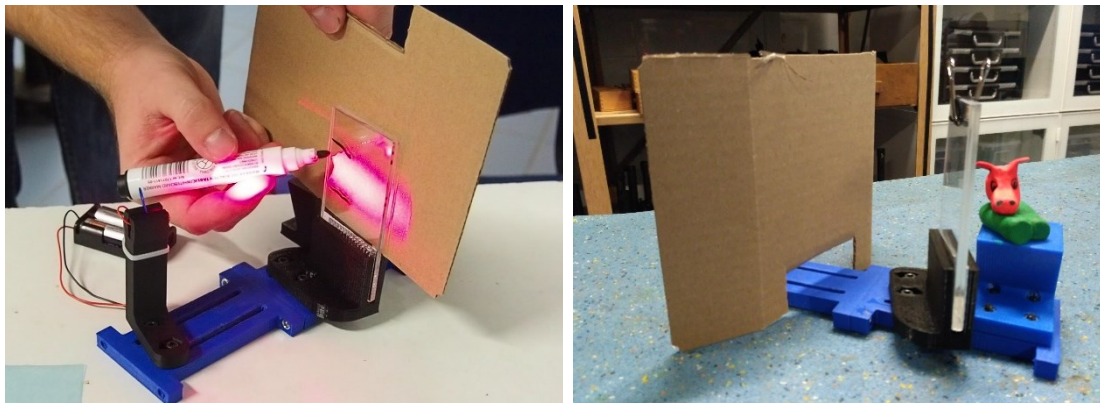


Figure 4 Marking the holographic/plexiglass plate (left), Placing the shutter (right)

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 one 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 foil to be removed and for the second holographic/plexiglass plate to be placed. Then, the two holographic/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=4lwSLHOQpWM>

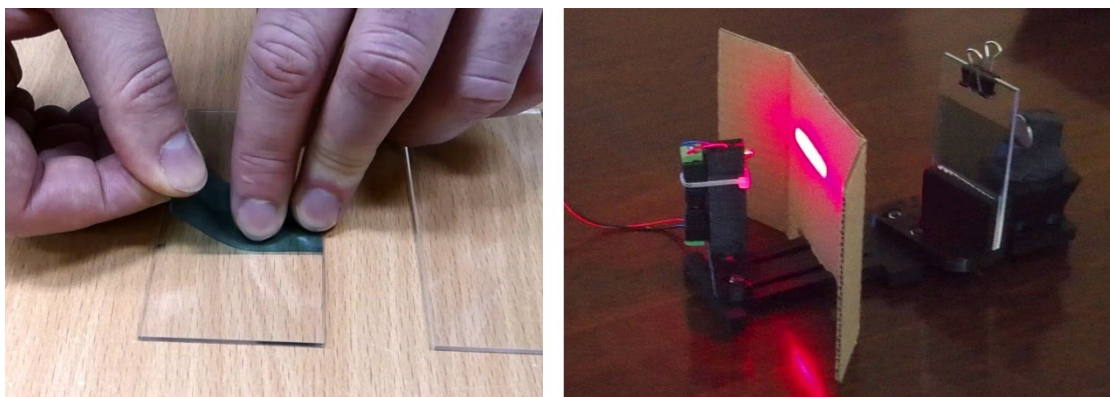


Figure 5 Sticking the film on the holographic/plexiglass plate (Left), Placing the holographic/plexiglass plates with the embedded film on the kit (Right)

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 the 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 holographic/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 has been holographed, then the set-up was correct. If the object is not holographed, then the set up should be modified. In general, it is recommended to test at least 2 or 3 different setups 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.

Additional activities

As previously mentioned, students can be triggered to do further research on the topic of modelling with plasticine in order to draw inspiration from different fields. For example, they can search for instructions on how to make figures from clay or plasticine (see Figure 6) and try to recreate them or/and even to remodel them in order to produce their own figure. They can also be inspired by movies that have been exclusively made of plasticine or clay. They can discover the art of animation and stop motion (see Figure 7) and thus try to produce holograms that can possibly function as a sequence of movements. They may also use materials that were used in previous activities, such as coins, metal nuts or any shiny object they desire.



Figure 6 Instructions to model an ant with plasticine, image retrieved from: <http://diy-is-fun.com/arts-crafts-for-kids/simple-crafts/arts-and-crafts-of-plasticine-for-children-do-it-yourself/>



Figure 7 Image from stop-motion process, retrieved from: <http://beccaasmedia98.blogspot.com/2014/10/stop-motion-animation-claymation.html>

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 physical and computer-generated holograms.

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

- Can you describe the process in your own words?
- What is the most challenging part in this process?
- Can you think of similar activities?
- Why some colours are more suitable for the present process of holography?
- In which case or set-up green plasticine could be holographed?



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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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