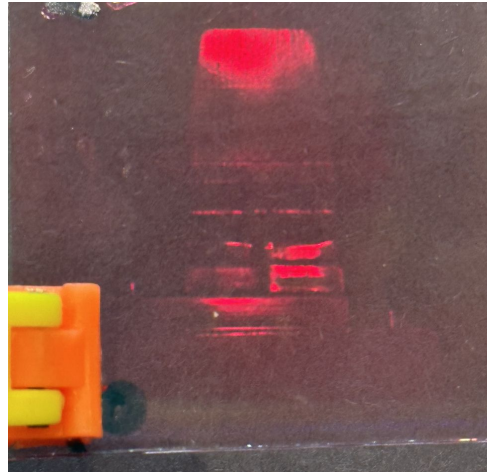


# Exploring Holograms

## Life In 3D

Grade Level  
Second Grade



## Testable Question:

1. How do I create a hologram and how do I make those holograms better?

## Prediction:

1. Based on my research, it takes a few components to create a hologram:
  - a. Lasers
  - b. Film (I am using self-developing)
  - c. Dark room (to prevent exposure of film)
  - d. Objects (LEGO mini-figs)
2. The holograms can be improved by
  - a. Longer Exposures (when the film is exposed to light for a longer period of time)

# Procedure:

The first step in my process was to research how to make a hologram. The research indicated that this process could be used

1. I set up an object to take a hologram of. I thought based on my research that a reflective object would work best. So I used shiny Lego mini-figs that could be placed in a way that they did not move.
2. I protected my eyes using laser protection glasses and made sure I did not look into the laser directly
3. I placed the laser in front of the objects to make sure that the laser light would cover the object
4. I blocked the laser light from reaching the object using a cardboard box
5. I turned off the lights in the room.
6. I removed the film from it's protective package and placed it in front of the object
7. I started a timer
8. I removed the cardboard box from in front of the laser and exposed the film for the length of the timer
9. When the timer went off, I shined a light bulb in front of the plate to finish it's exposure (based on the instructions from the film company)
10. Most importantly, I recorded the time and results in my logbook

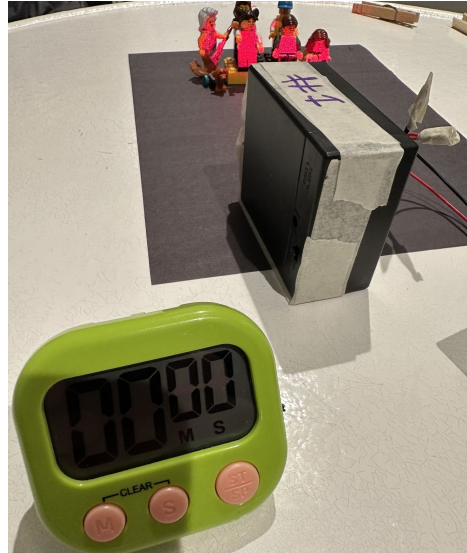
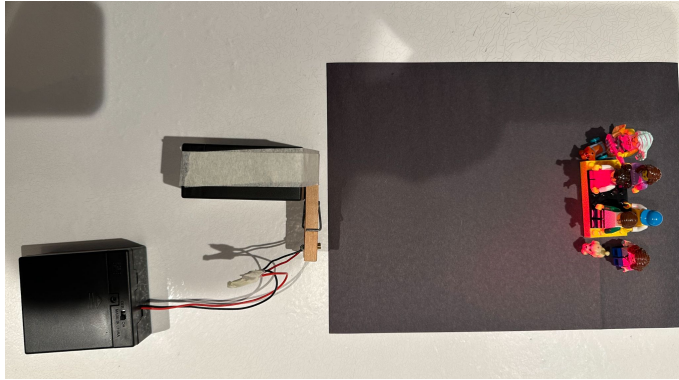
# Procedure:

I performed three main experiments

1. Experiment 1 - Baseline
  - a. Figure out what how long I had to expose my film to at least get a hologram
2. Experiment 2 - Compare Lasers
  - a. Using the two lasers I had for the experiment, see if one was a better laser
  - b. Did two lasers work better or worse for creating the holograms
3. Experiment 3 - Optimal Hologram
  - a. Using the best laser from experiment #1, expose the film in minute increments and see what the best time was

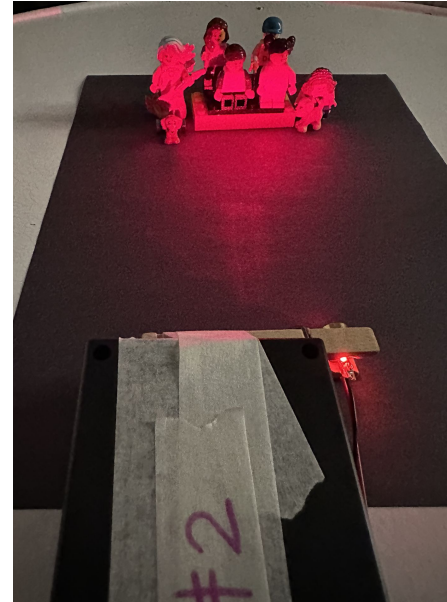
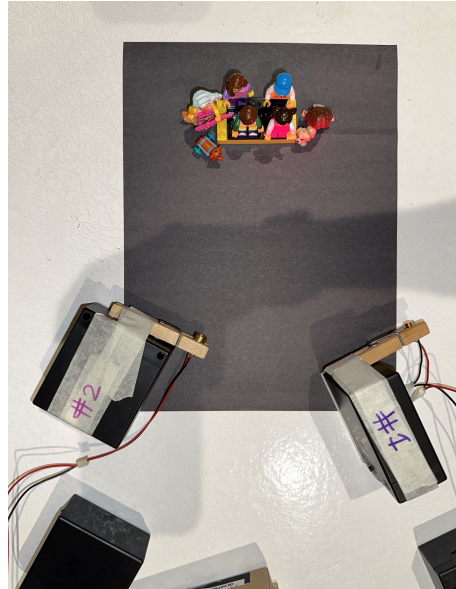
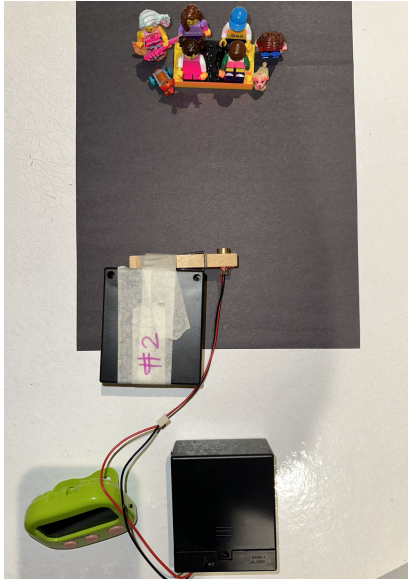
# Procedure:

## Basic Setup



# Procedure:

## Basic Setup



# Procedure:

## Basic Results



# Background:

I chose this project because I find holograms really interesting. It's interesting to me that are different than regular pictures in that the objects in the holograms look three dimensional. I wanted to understand if they were something that I could make at home and how I could make them well.

In researching the project, I discovered that a company called LitiHolo had film that needed no chemicals to develop (fix the image to the film). This let me create the holograms using just a laser and the film without having to use a complicated film development process. The laser could be an inexpensive and low powered (meaning safe) laser that allowed me to do this.

This project is important because it allowed me to learn about how to make holograms which can be used in lots of different ways in the world. According to my research, holograms can be used for super cool things like storing data, letting doctors see their patients' diseases and organs in 3D so they can help them better. It's also a fun way to create art including paintings and drawings as well as even creating holograms of musical artists that perform in front of people without actually being there.



# Constant Conditions:

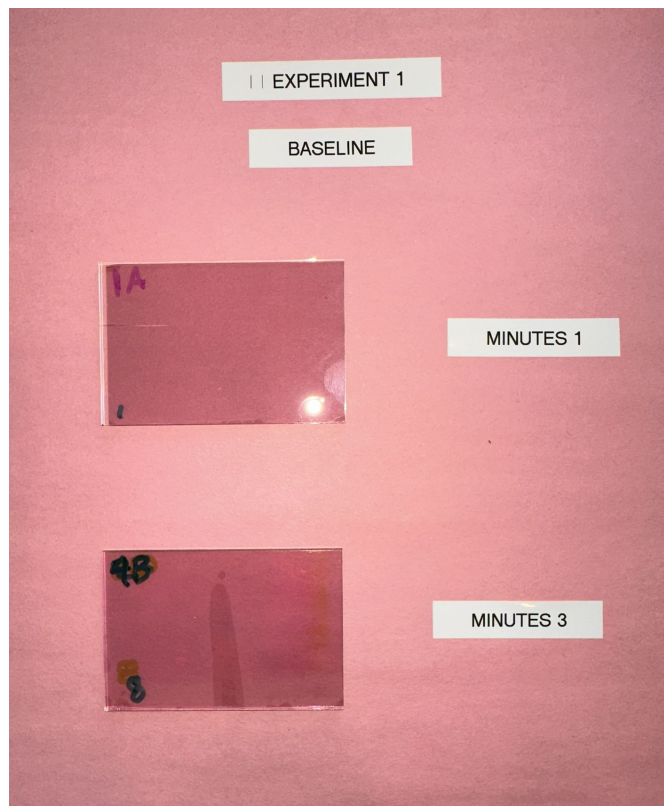
Independent Variable: During my experiment, the most important variable was the time of exposure. I also changed the laser to see if one of the lasers I used made better holograms than the other. Most importantly, for each different laser, I exposed the film for a different amount of time.

Dependent Variable: During my experiment, I wanted to see if the length of exposure improved the quality of the hologram. Also, using the two different lasers, I wanted to see which one made the best holograms.

Constant Conditions: For each experiment, I used the same laser (except for when I was trying one laser or the other) and same distance between the laser and the object. I also used the same film plates and same objects so that the only change was the time of exposure.

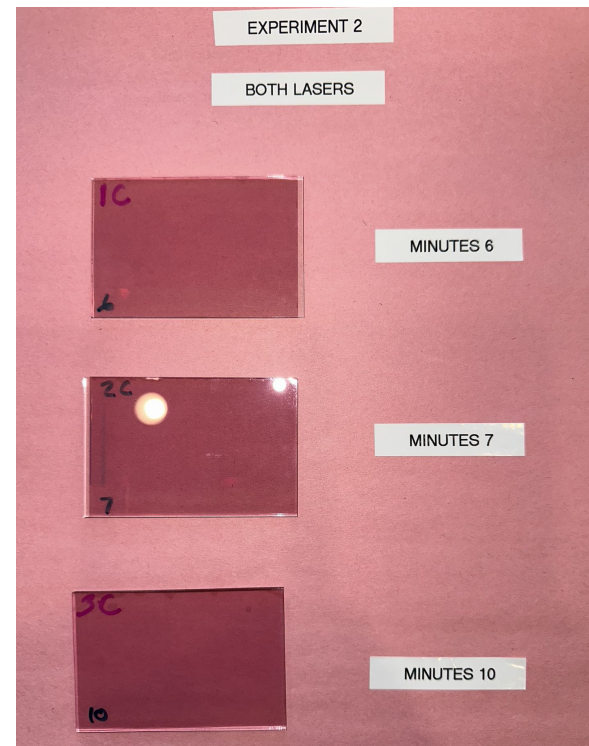
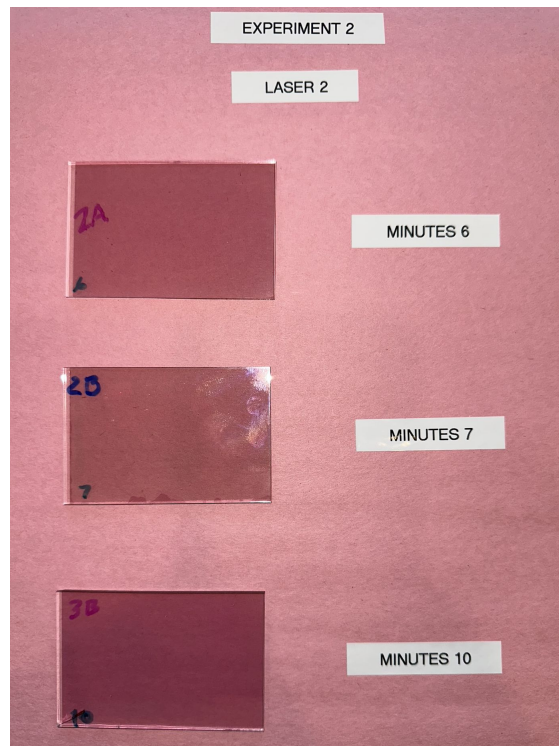
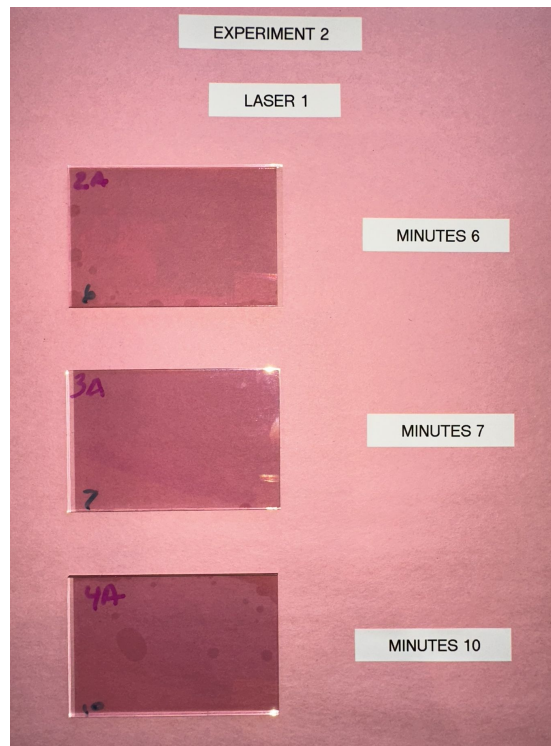
# Data and Trials:

## Experiment 1



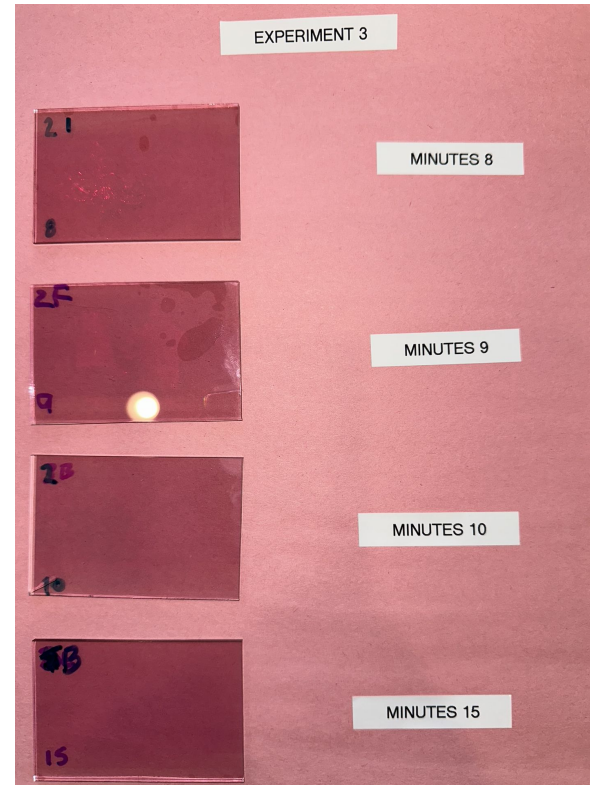
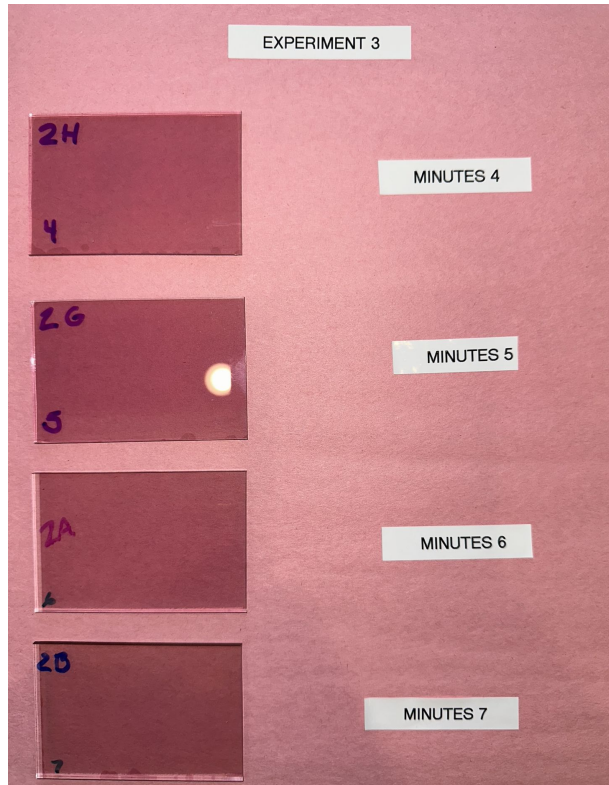
# Data and Trials:

## Experiment 2



# Data and Trials:

## Experiment 3



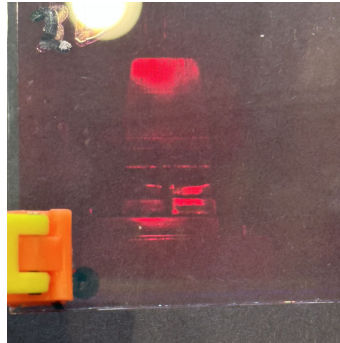
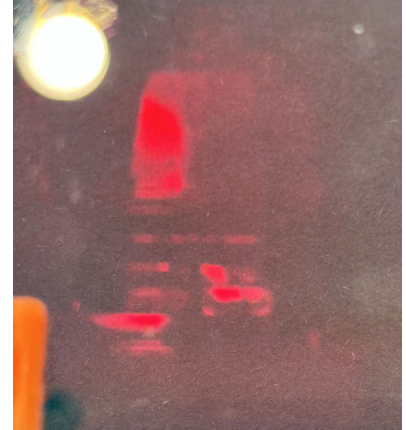
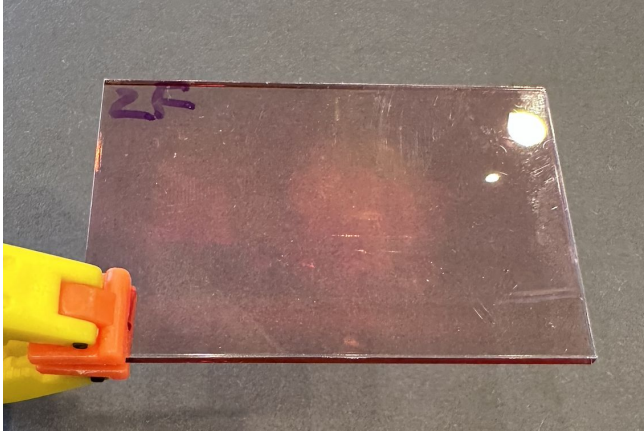
# Data and Trials:

[illegible]



# Data and Trials:

\*Holograms are really hard to take a picture of



# Conclusion and Reflection:

## Experiment #1

- Exposure time of 1 minute produced no hologram.
- I had to expose for 3 minutes to obtain a result

## Experiment #2

- The two lasers I was using even though they were the similar (both had the same power amounts and used 2 D batteries) produced different results. Of the two lasers, the laser #2 was better and produced better holograms. Using two lasers together created bad holograms. They had lots of interference lines.
- It was hard to take a picture of the holograms for my slides

## Experiment #3

- Reviewing the holograms, the best hologram (bright and visible) was at 9 minutes using laser 2

## Conclusion and Reflection:

I was surprised to learn that the really long exposure times produced worse holograms (15 minutes).

If I were to do this again, I would like to use different lasers that had either different colors or were slightly more powerful to have brighter holograms that were easy to see.

My holograms were hard to see because the laser was not that bright.