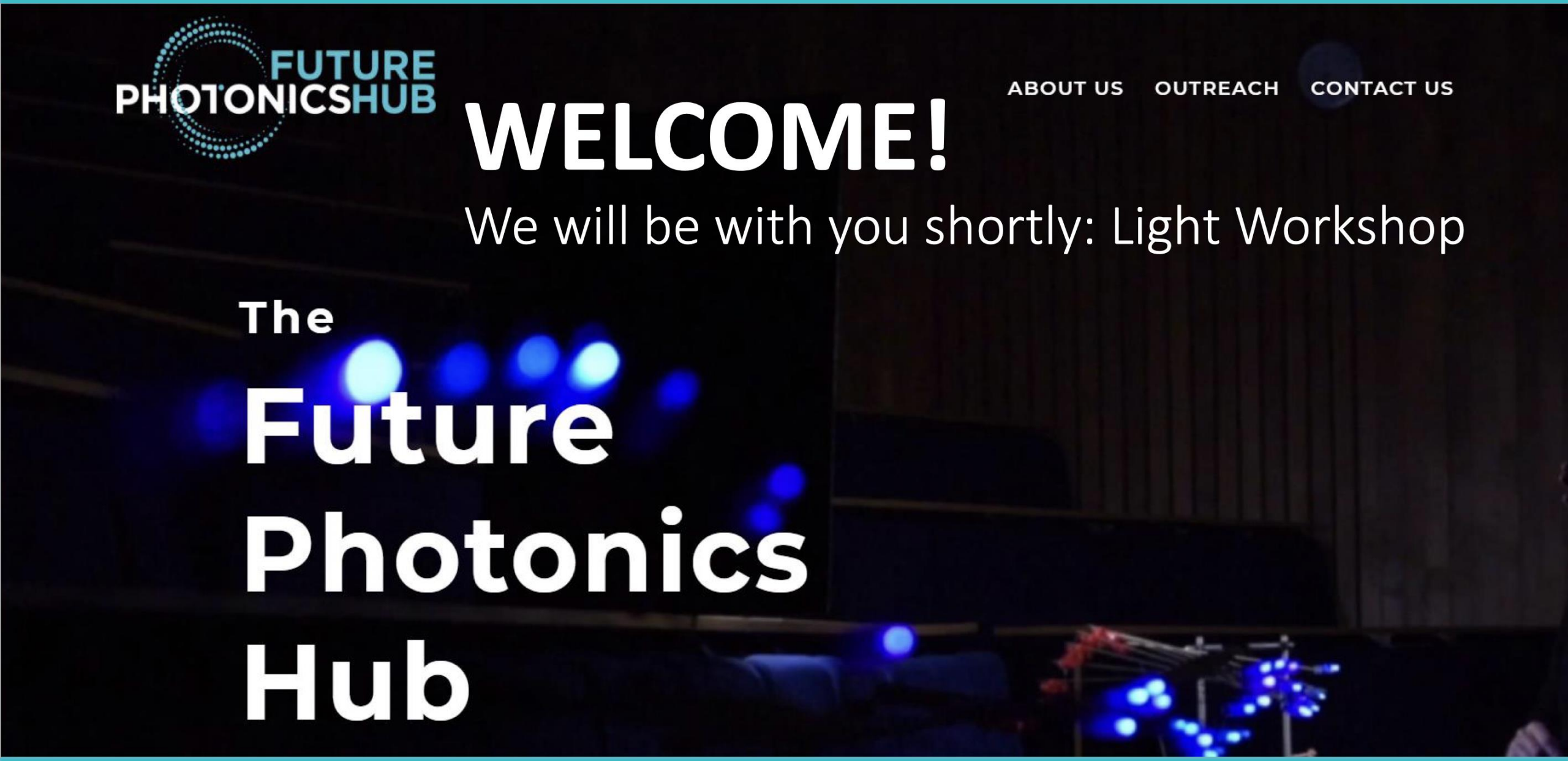
University of Southampton

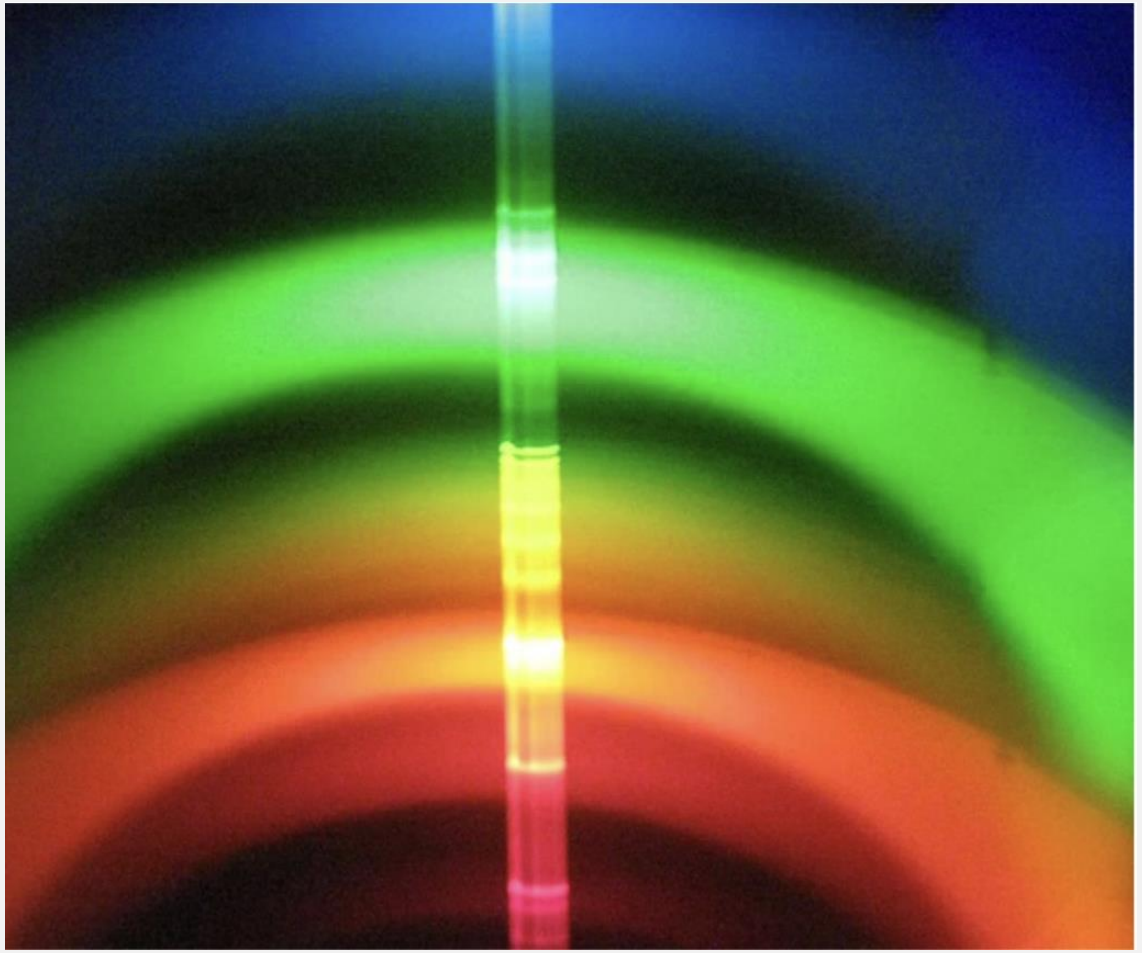


Today's workshop!

Aim: To enjoy learning about light.

Objectives:

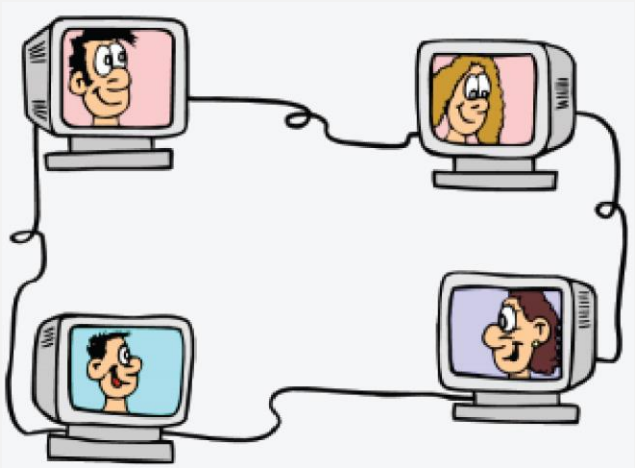
- To meet the scientists!
- To make a successful projection pyramids.
- To use your projection pyramid to observe see a Pepper's ghost.
- To learn more about reflection, refraction, transmission and transparent and translucent materials.
- To learn how we see in 3D.



Reflection

Reflection is very important; it is all around us!
Sometimes in hidden ways…

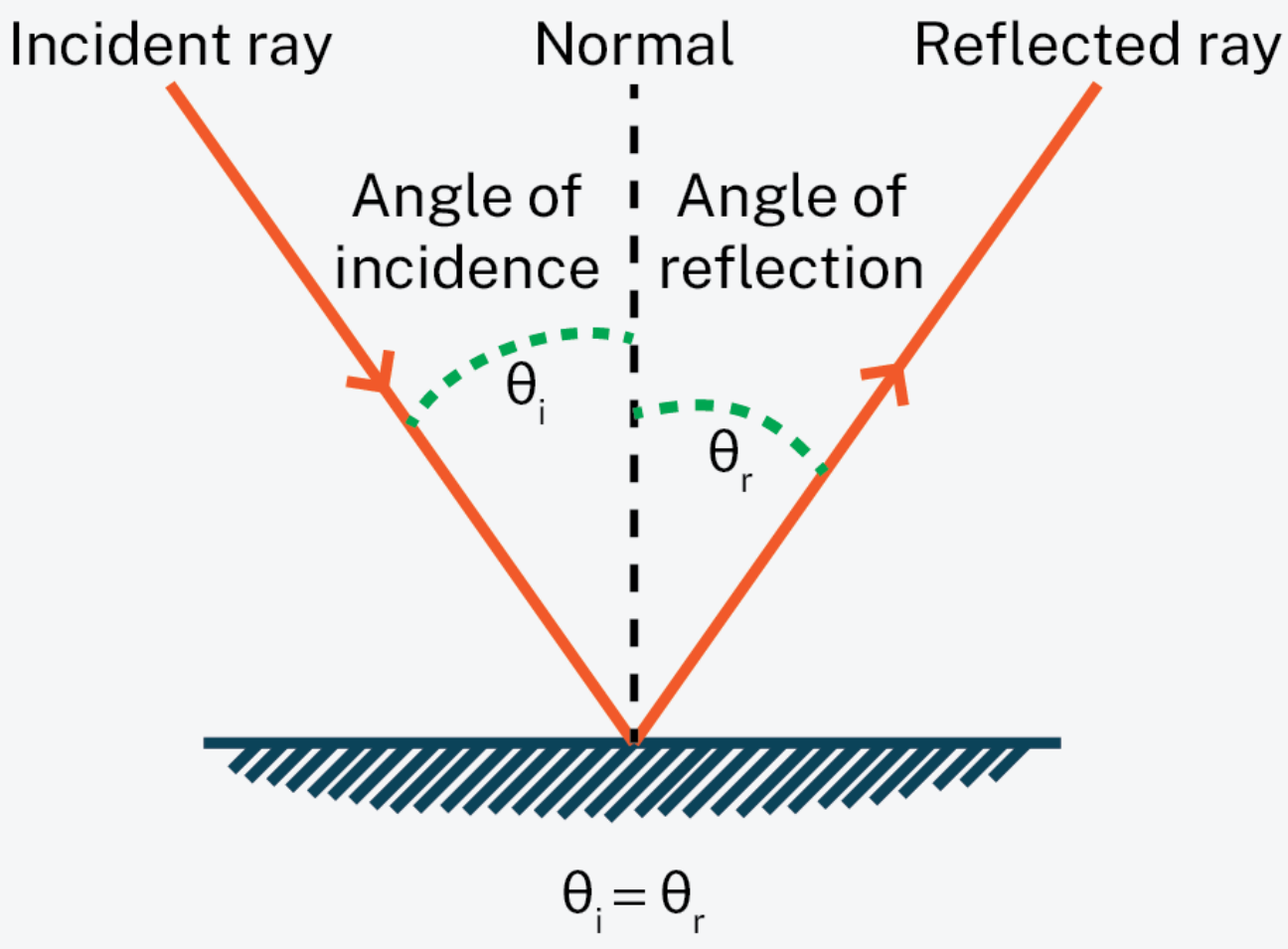
Here are some examples: when we look at ourselves in a mirror, or when we see a scenery in a lake, or even to carry information between to distant places!



Do you have other examples of reflection?

Lake reflection image source: https://en.wikipedia.org/wiki/Reflection_(physics)

What is reflection?



There is one main rule when it comes to reflection:

The incident light ray angle is always equal to the reflected light ray angle.

$$\Theta_i = \Theta_r$$

Since we know this rule quite well, we can use reflection to have some fun!

Making our projection pyramid!

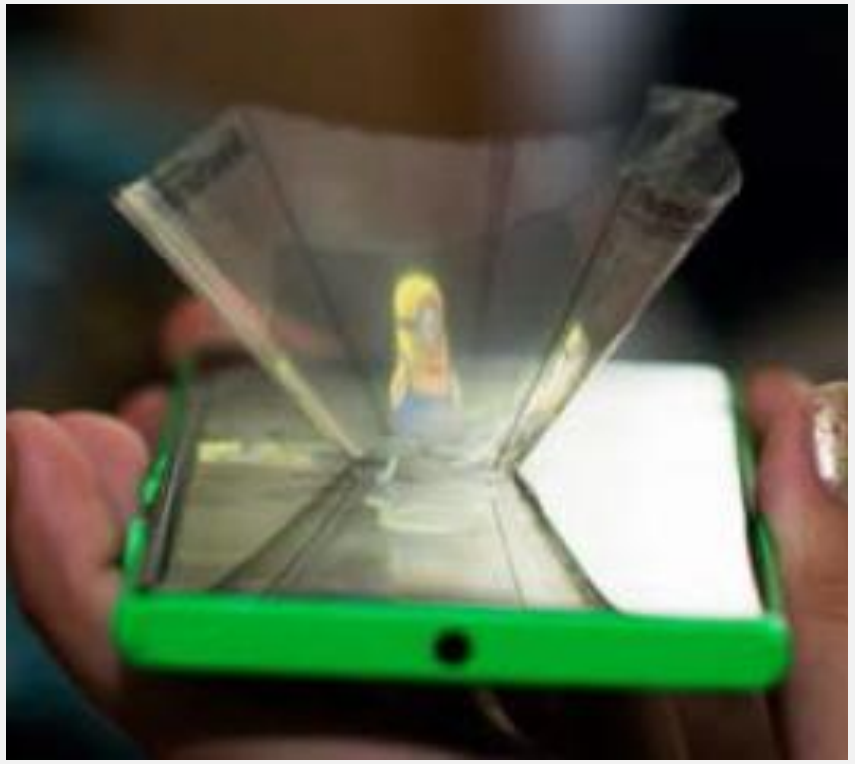
You will need:

- a sheet of transparent material such as acetate
- a black marker
- a pair of scissors
- a roll of tape
- A mobile phone with internet access

Using the projection pyramid

Once you finished building your projection pyramid, find an appropriate Pepper's ghost video, play it and place your projection pyramid on your phone. What do you see?

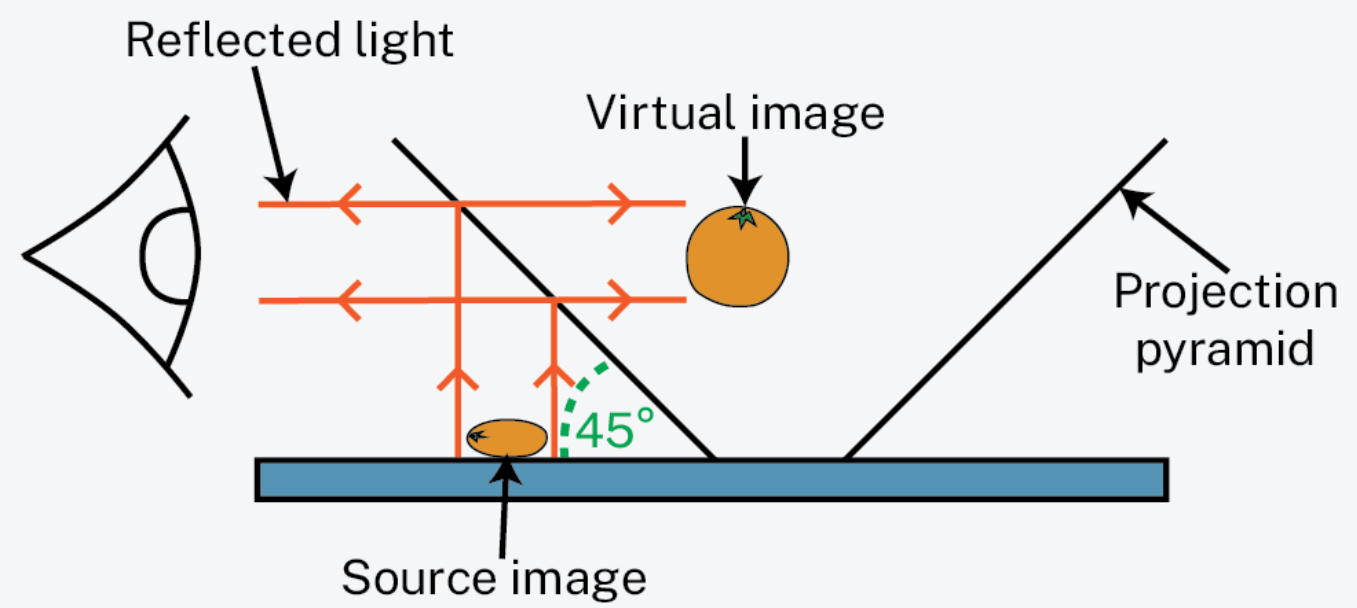
To find a Pepper's ghost video, search for "Hologram videos" on YouTube, or download a Pepper's ghost app for example "Hologram Pyramid Videos".



How does Pepper's ghost appear?

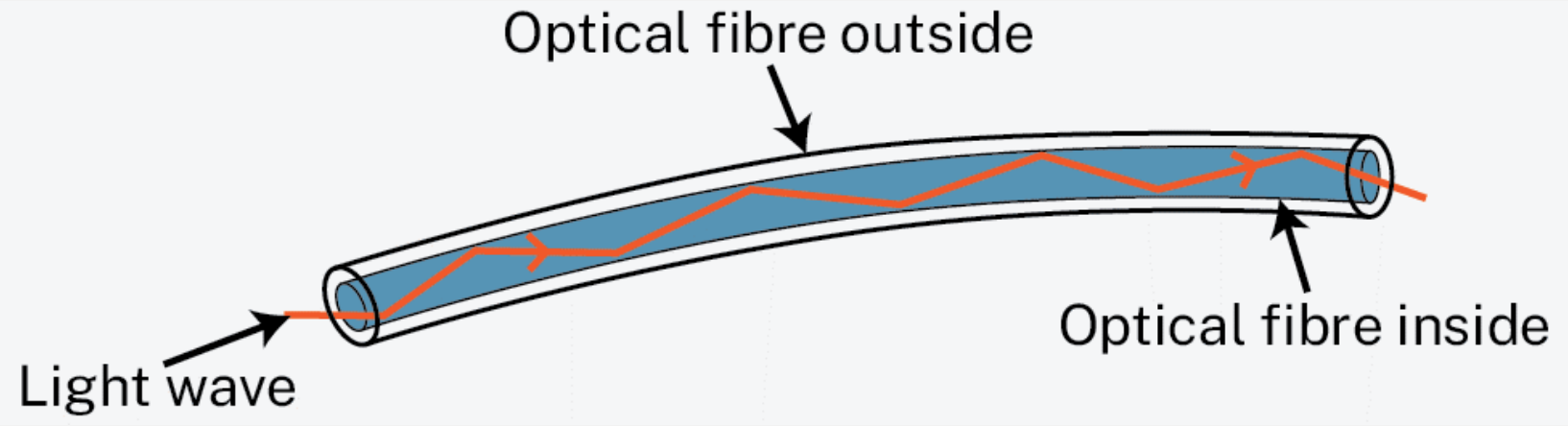
A 3D illusion is formed when rays of light are **reflected** off one surface onto another reflective surface then into our eyes.

As the second reflective surface is transparent, some of the light is reflected and the rest is refracted or transmitted at an angle. The image then appears to be translucent and floating in the centre of the projection pyramid.



Other examples of reflection

Reflection can be used in **optical fibres** to transport digital information carried by light for example over the internet.



The light is reflected inside the optical fibre and moves along it to reach its destination.

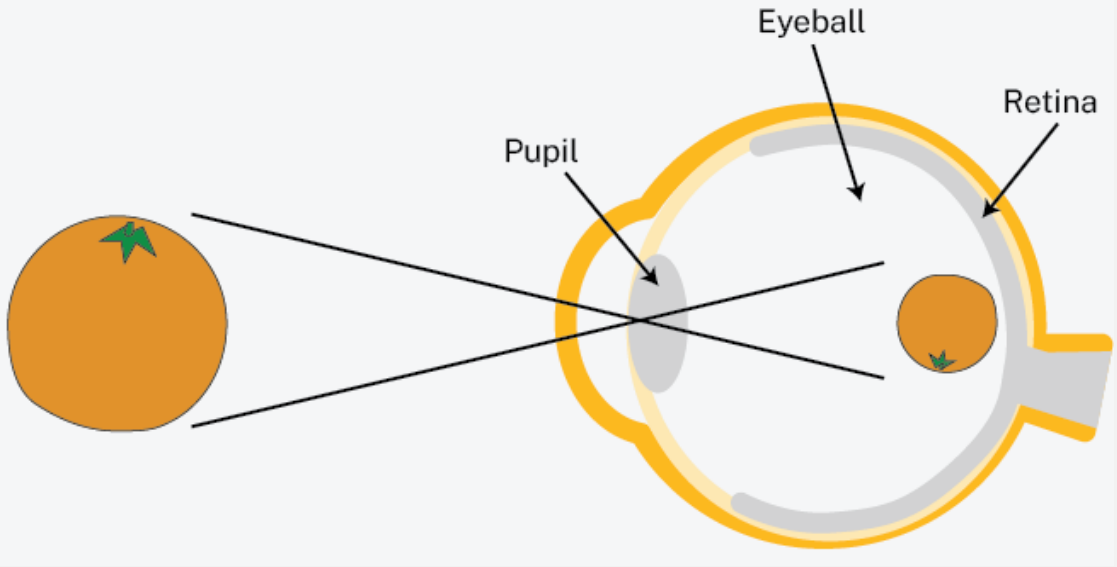
Other examples of reflection

Reflection in our **eyes** allow us to see!

Light is reflected off the surface of the objects around us into our eye.

Our pupil acts as a lens and focuses the light onto our retina.

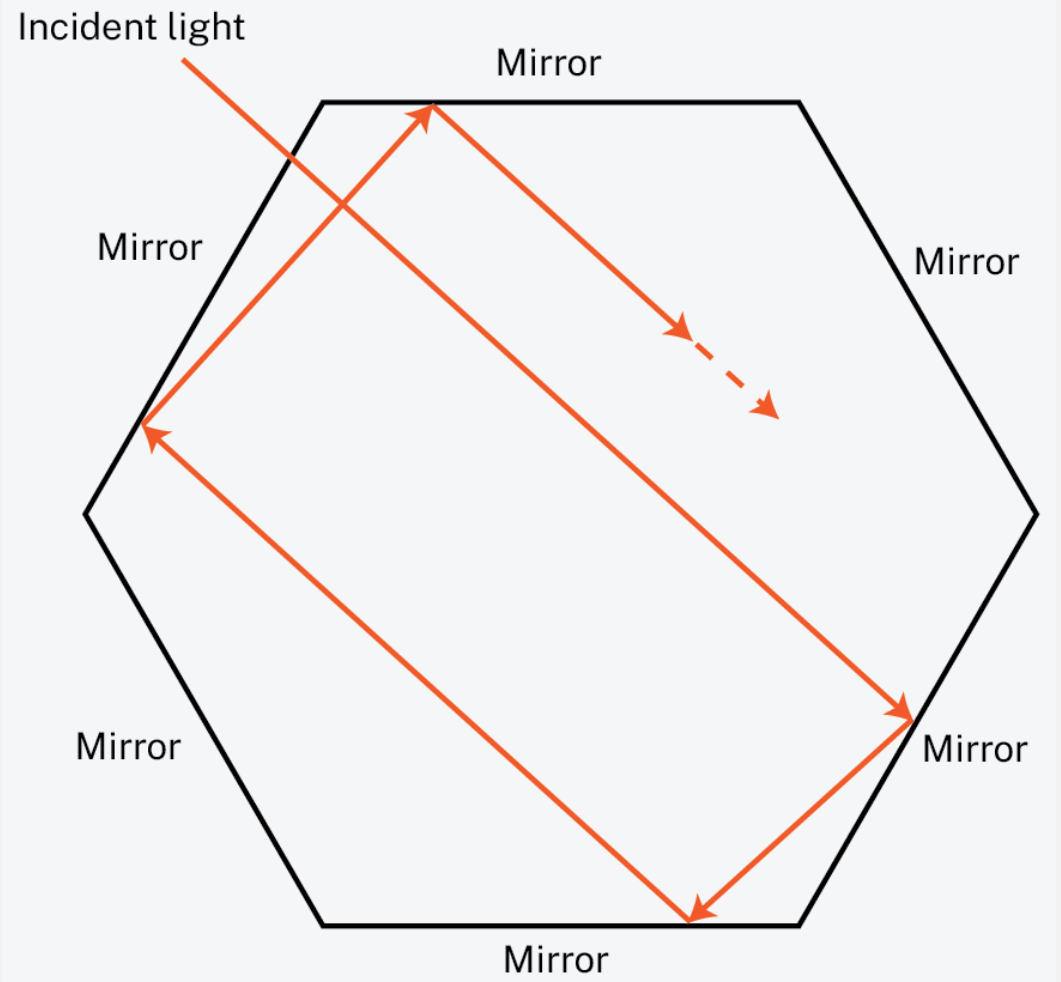
In that process, the image is inverted, so our brain needs to turn the image around again so we can see the world around us the right way up!



Other examples of reflection

Infinity mirrors!

Since the mirrors are placed in a hexagonal shape, light will always be reflected in a way to hit another mirror and be reflected again for an infinity number of times.



Questions???