



Lighthouse Keepers!

A bit o' Learnin'...

Magic and Mirages!

In *The Animal Lighthouse* story, the lighthouse's beams are special. They light up the sea to stop ships crashing on the rocks, and also do “**science magic**” to keep the island – where Jim and the animals live – hidden.

You will have heard of mirages, which happen in the desert when people think they see water far away that turns out to be **silvery shimmers** of rising heat. This is similar to how the lighthouse beams work. It makes sailors “see things”.

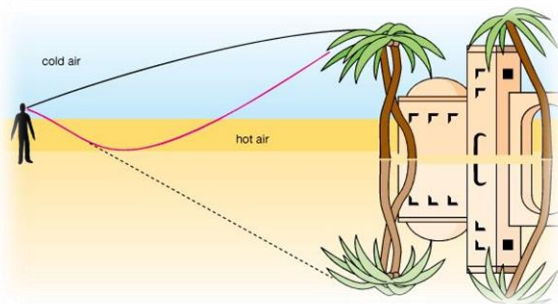


This happens in real-life and there are three different types of mirages, or optical illusions as they're called. They occur on land, on sea, in the air, or in space!



Superior Image – this is where a mirage image appears **above the real image** you're looking at. It happens when air below where you're looking is colder than the air above it. This makes light rays bend downwards so the miraged object appears above the real one.

Inferior Image – this is where a mirage image appears below the real image you're looking at, **often a mirror of the one** above it. The real object is usually the blue sky, and because you're looking at cold air above you and warm air below you, the light rays from the sun travel through this mixed air and get refracted, or bent. This makes an image look like it's below the real object (like the sky is on the ground and looks like water).



Fata Morgana – this sounds like something a witch might say to you when casting a spell (it is actually the Italian name of a fairy-witch in the **King Arthur's legend**, called Morgan le Fay, and she cast spells to make castles and ships look like they could fly). But a Fata Morgana is really where a miraged object rapidly changes, stretches and blurs.

The object – a ship, some land, an iceberg or a lighthouse – is usually far away on the horizon when you are looking at it, and this type of mirage makes it seem upside-down, back-to-front and stacked on top of each other. All at the same time!

This happens because the object you're looking at is inside several **clearly defined** bands of warm and cool air that do not mix and these **distort rays of light** as they pass through the different layers.



This layering of air is called a **Thermal Inversion**, and means objects behind or inside these bands of air turn into different kinds of mirages all at the same time when you look at them (so they become superior and inferior images as well as jumping around, changing shape and places in the sky or on water, and they can also look like a tower of similar images).



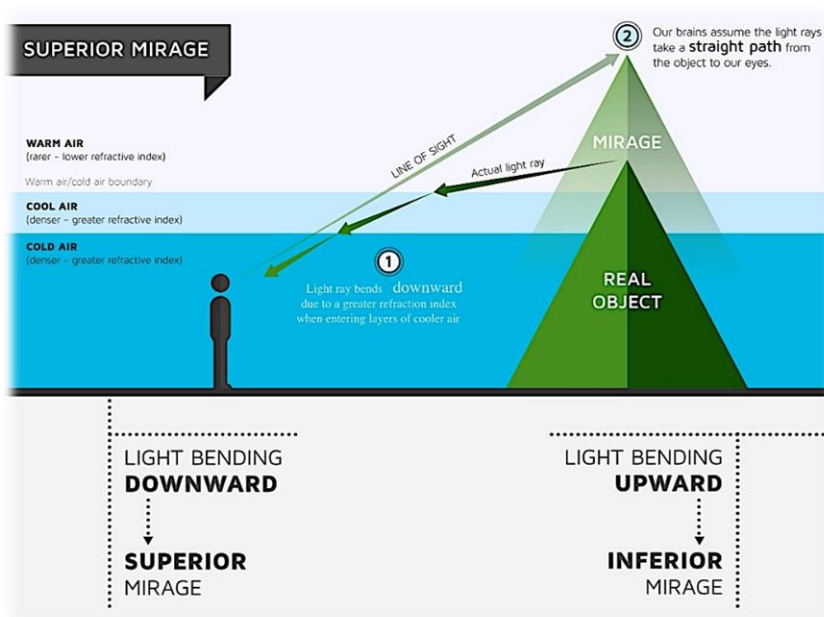
Try this!

In Icelandic a Fata Morgana is called a *hafgerðingar*. In English, that is pronounced HAL-KAL-LING-ASH. Try saying that out loud!

Eyesight – A Trick of the light!

These mirages have happened **ever since time began**. But it has only been since human eyes have evolved to become so complex and able to see lights, shapes, shadows and objects far away, that we have seen and understood them. But, of course, long before science explained how these light rays get bent up and down through hot and cold air, people used to think mirages were floating spirits of ships, magic and omens.

Science tells us that an illusion, or mirage, happens when our eyes tell our brain they are seeing something they are not. This is because we are used to seeing the world in a particular and “logical” way, where **boats don't usually fly** or lighthouses don't disappear underwater or behind a shield of heated-up water made by a special lighthouse beam!



Anything we see that looks a bit weird makes us think we are hallucinating or “seeing things”.

But all that has happened is the right air temperature conditions and your line-of-sight (where you're looking) have come together to distort something normal, that's still there, **into a wild and odd illusion** like the three superior, inferior and Fata Morgana mirages described above.



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A bit o' Doin'...

Fact or Fiction?

In *The Animal Lighthouse* the orangutan, Oskar, is skilled at engineering and inventing gadgets. He has changed the lighthouse bulbs and mirrors to make them create a Fata Morgana inferior image mirage. An illusion.

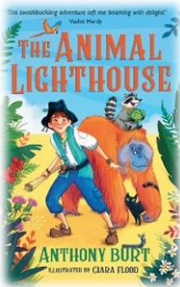
Oskar's done this to hide the island and to keep Jim safe from his real human father, **the pirate Blackbeard**.



And, as the story is set in 1716, before science could explain everything like it does today, most people back then still believed in magic, evil spirits, mermaids, ghosts, superstitions, and mysterious "goings on" at sea.

If they saw a mirage at sea, they might think it was bad luck and change course.

And, the clever orangutan, Oskar, has used this combination of magic and science. His handiwork means **the lighthouse beam three-and-a-half** heats up a shield of water around



the island. And, as warm air rises above cold air, this creates a light-bending lens around the island. Anyone looking at it from far away – like sailors or pirates – will see two things:

- 1) *absolutely nothing, even though the island is still there, because the rising warm air has made the island "disappear" below the ocean, and*
- 2) *the island seems to be moving up and down, side to side and is actually five or six islands on top of one another.*

So, the Fata Morgana illusion confuses the sailors and pirates at sea, making them think they're **hallucinating** or "**seeing things**" that aren't really there. This means they don't go near the island because they're afraid of it...or simply cannot pin-point where it actually is!



Try this!

Choose one type of mirage you have learnt about, and draw or paint a scene with a real object and its mirrored image.

Remember – because mirages don't last long and the image mixes in the air, make your mirage image look blurrier or distorted compared with your real object.

If you like, illustrate your painting with the hot or cold air bands that makes the light rays bend to make the mirage happen. And draw YOU or someone you know in the picture looking at the object.

