

Stealth Object Design

Vocabulary

Mimesis - A camouflage technique where an animal tries to look like something uninteresting to the observer.

Direct Instruction

Introduction

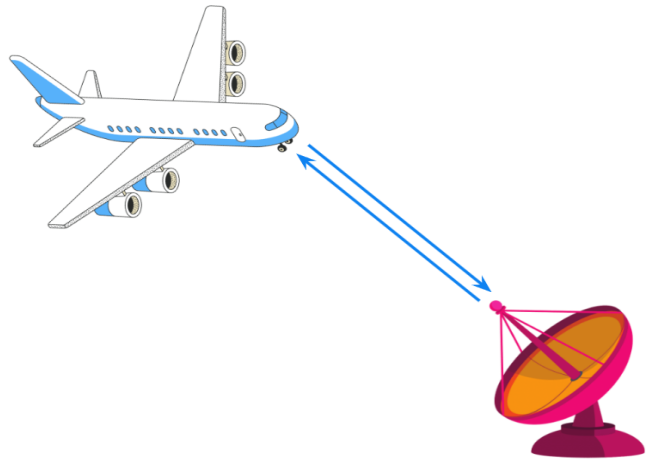
1. Show a few examples of camouflage to the class, like the images below. Ask students to identify features common to animals that can camouflage well.



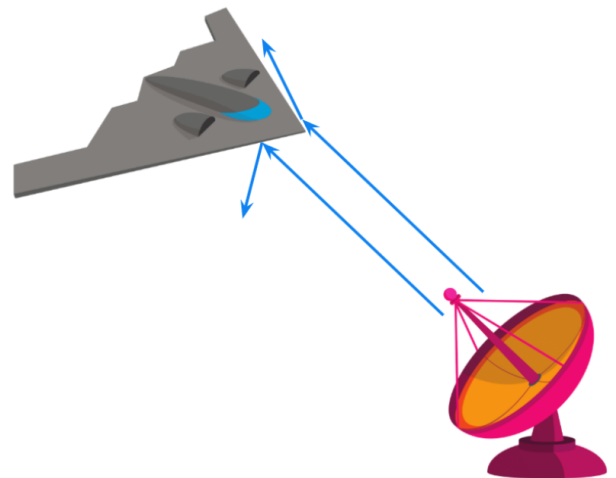
2. Animals use many techniques to blend with their environment, like mimesis, blending in with similar patterns, and color matching. The goal of all things that stealth is the same - try to go unnoticed.

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3. One way that aircraft can be detected is through radar - **radio detection and ranging**. A radar pulses radio waves, which are reflected back to an antenna if they hit an object. The antenna picks up the reflected waves and is able to detect the aircraft.



4. The shape of an aircraft plays a huge role in how easy it is to detect with radar. For example, aircraft that have more rounded features are easier to detect than aircraft with sharp, straight edges because of how radio waves reflect off their surfaces.



5. The material aircraft is made out of also plays a factor. Light and radio waves are both part of the electromagnetic spectrum, and a material's surface interacts differently with electromagnetic radiation depending on its wavelength. Some materials are more reflective, while others are better able to absorb electromagnetic radiation, which affects how easy they are to detect.



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6. Ari's distance sensor uses Time-of-flight sensor technology to measure distances. It sends a beam of light, which bounces back to Ari once it hits a surface.



Ari calculates the distance based on how long it takes the light to travel to the object and back to Ari. The longer it takes, the further the object is.

Activity 1 - Gathering Materials to Test

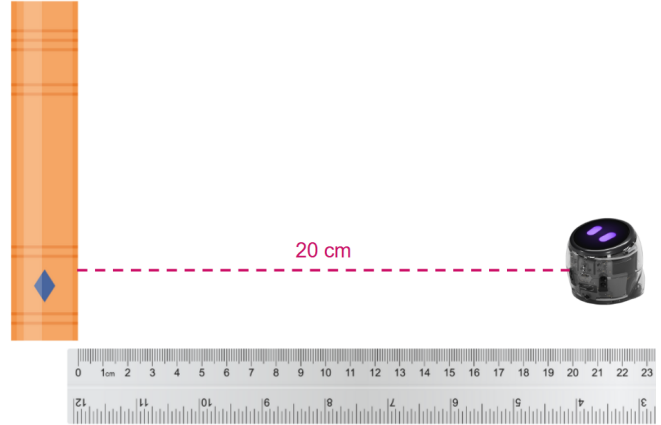
1. For this activity, students are tasked with finding a variety of materials in order to see how well Ari's Time-of-flight sensor works on the given surface.
2. Place students into groups and provide each group with an Ari.
3. Students should find a variety of objects that vary in color, shininess, shape, and material. Ideally, they want materials that have opposite properties - light vs dark, matte vs glossy, round vs flat, etc.
4. Once students have found their objects, have them note the materials and their properties in their Student Activity Sheet.



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Activity 2 - Material Testing and Data Analysis

1. For the second activity, students will test how well each of their materials works with Ari's Time-of-flight sensor.
2. Place a ruler on a flat surface and place Ari 20 cm away from 0, as shown in the image. Turn on Ari's distance app to verify the distance is 20 cm.
3. Test an object by placing it at the 0 cm mark and recording Ari's distance reading and how "stable" the reading is.
4. Repeat step 3 for the remaining objects.
5. After testing all the objects, analyze the data. What properties do reflective objects seem to have in common?



Evaluate: Exit Ticket

Students will fill out and submit their Exit Tickets (The last page of the Student Activity Sheet).