

Benham's Disk

A color-changing toy! Explore the connection between the science of light and human eyes as you create a Benham's Disk optical illusion.

TEKS:

SCI 3-5.6 A: The student is expected to differentiate among forms of energy, including mechanical, sound, electrical, light, and thermal.

SCI 5.6 C: The student is expected to demonstrate that light travels in a straight line until it strikes an object and is reflected or travels through one medium to another and is refracted.

Materials:

- Benham's Disk template, printed on copy paper or cardstock (attached)
- Cardboard
- Clear tape
- Glue stick
- Pencil
- Push pin
- Scissors

How To:

1. Cut out the Benham's Disk template.
2. Place the circular Benham's Disk on top of the piece of cardboard. Use a pencil to trace a circle around the outside of the template.
3. Use scissors to cut out the cardboard circle.
4. Use a glue stick to glue the Benham's Disk circle to the circular piece of cardboard.
5. Carefully poke a push pin through the center of the cardboard circle (push towards the floor or table to not poke your finger). **Safety: an adult should assist when using the push pin.**
6. Place clear tape over the top of the push pin so that the pin is secure. This is your spinning top!

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7. Place the spinning top pin side down on a flat surface that won't get scratched.
8. Grab the push pin, spin the cardboard circle, and observe the Benham's Disk illusion!

STEM Explanation:

Discovered in 1894, Benham's Disk is the optical illusion where a specific pattern of black and white marks produce color when spinning. No one knows exactly why this optical illusion occurs, but many think it has something to do with how our eyes process light! The retina is the part of the human eye that responds to light, and it is composed of two kinds of receptors: cones and rods. Rods help us see in low light conditions. There are three types of cones, each sensitive to a specific wavelength of light, and they help us to see in color and bright light conditions.

The appearance of color on Benham's Disk might occur because of the different types of cones in our retinas. Each of the three types of cones is sensitive to different wavelengths of light. This means they respond to specific wavelengths of light (which we see as different colors) and stay activated for different amounts of time. When spinning Benham's Disk, the white color activates all three cones and the black color deactivates them all. When your eyes try to process the fast-spinning black and white disk, an imbalance might occur since each type of cone has its own response and activation time. This imbalance may cause the illusion of color!

Career Connection:

Optical engineers design components of optical instruments such as lenses, microscopes, and telescopes. They know all about the properties of light, so they are able to control and direct light to behave in a certain way.

Resources:

<https://faculty.washington.edu/chudler/benham.html>

https://docs.google.com/document/d/1ZMs7xM3C9AJk7tLXr4L_SQ6NS2ZyBcsgsf9sLeqTKw/edit#

<https://www.youtube.com/watch?v=hf3KTsRRPLs&t=230s>

<https://faculty.washington.edu/chudler/retina.html>

<https://www.scienceworld.ca/resource/benhams-disk/>

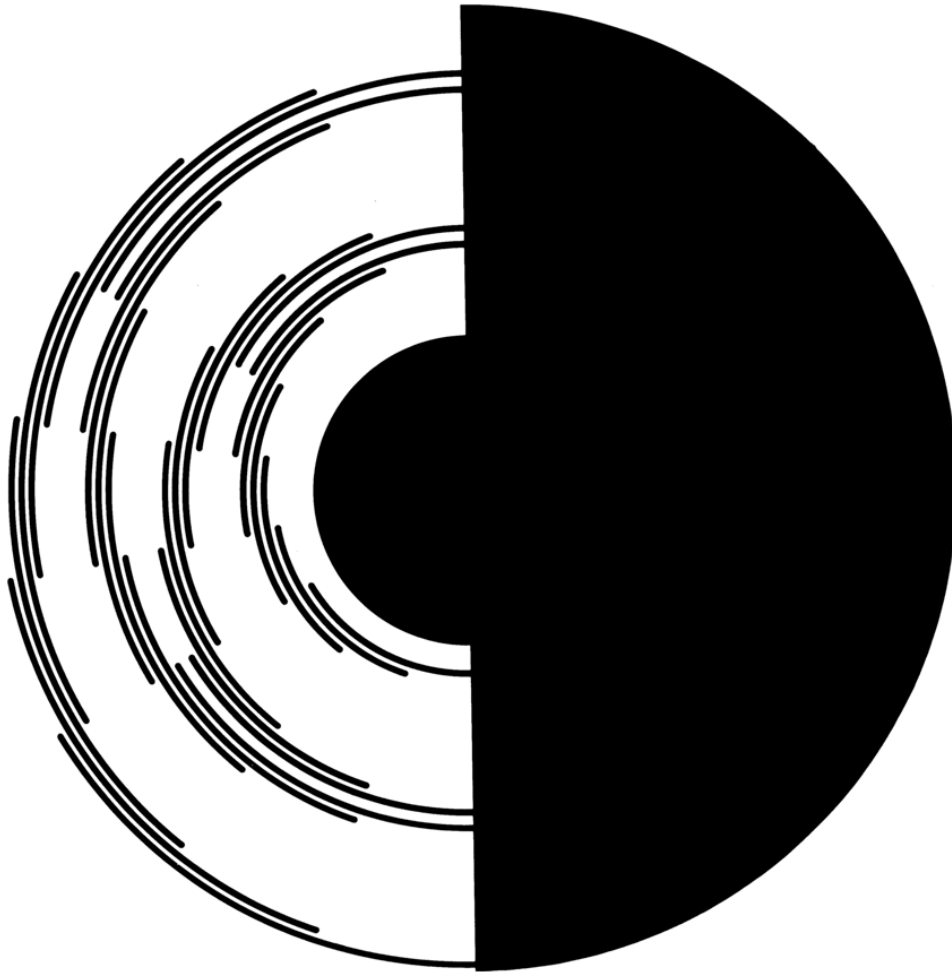
<https://www.exploratorium.edu/snacks/benhams-disk>

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Benham's Disk Template



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