

Topics: Vision, Color,
Light

Materials List

- ✓ CD
- ✓ Benham's Disc pattern (see page 2)
- ✓ Marble or other object to create a spinning platform
- ✓ Cap or other object to make a handle
- ✓ Hot glue or white school glue

This Activity can be used to teach:

- Light and Vision (CA Science Standards: Grade 7, 6.e and 6.b)
- Light and Color (CA Science Standards: Grade 3, 2.c, 2.d)
- Characteristic Properties of Waves (CA Science Standards: Grade 9-12, 4.c, 4.e)

Black and White Makes Color !?!

The Mystery of Benham's disc



Students can easily turn a Compact Disc into an excellent spinning platform. By adding the pattern for a Benham's disc to this set-up, you and your students can explore the interesting effect that happens – the spinning black and white pattern creates an illusion of seeing colors in the spinning disc and reveals an interesting aspect of how our eyes and brain perceive color.

Assembly

1. Attach the black and white Benham's Disc pattern to the CD; it doesn't matter which side of the disc you choose.
2. Secure the marble (or equivalent) to the bottom of the CD halfway into the hole to create a spinning platform.
3. Secure the cap to the center of the CD over the Benham's Disc pattern.

To Do and Notice

1. Spin the top and watch the pattern carefully as it spins. Look for narrow arcs of color at different distances from the center of the circle. Different people may see different colors, and a very few people will not be able to detect the effect.

The Science Behind the Activity

The color sensing nerves in the eye are called cones; they are located in the back of the eye on the retina. Cones come in 3 types: red-sensitive, green-sensitive, and blue-sensitive. White light is a mix of all the colors in the visible spectrum; white triggers all three cones to fire, and our brain tells us we are seeing white. Black is the absence of color, no cones fire and our brain tells us we are seeing black. After each cone fires, it takes a brief period of time to reset before it can fire again. Each of the different types of cone has a slightly different "reset" time.

Notice the pattern consists of one half-circle entirely black, with arcs of black of different lengths at different distances on the other half-circle. Recall from the previous paragraph that white causes all three cones to fire, black causes them to turn off. As you watch the pattern spin, each transition from black to white should trigger all three cones to fire together. However, as the different cones turn on and off rapidly, their different reset times cause them to get out of sync. Instead of all three cones firing together when your eye sees a transition from black to white, only 1 or 2 of them fire. As a result, your brain interprets the information as seeing color!

Interestingly, scientists still cannot explain why this specific pattern is required to generate the effect. Random black and white patterns when spun do not tend to produce the effect of color. Somehow, the precise length of the arcs of black and their locations around the disc are important – but the exact details continue to elude explanation.

Web Resources - Visit www.raft.net/more for how-to videos and more ideas!

