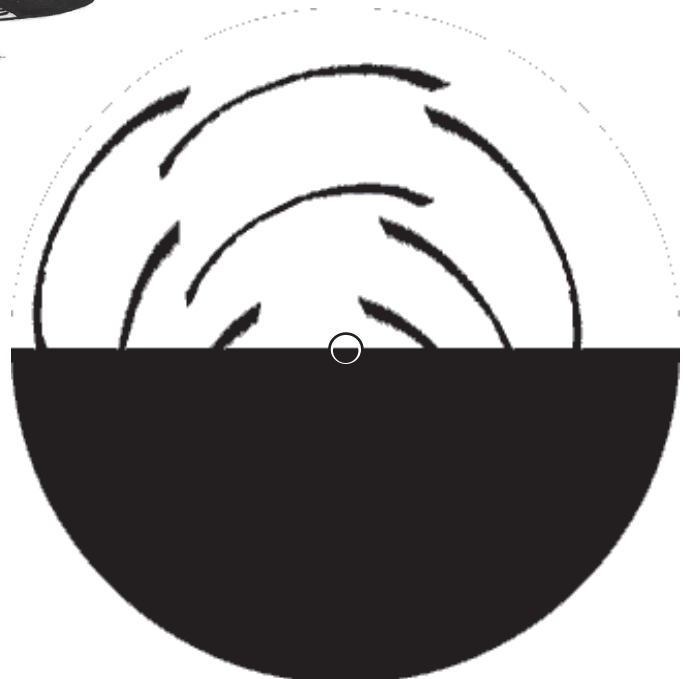
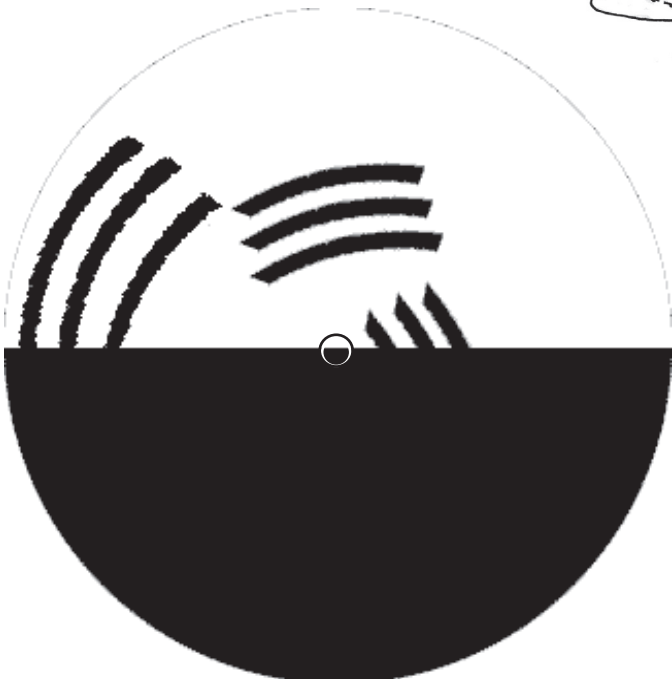
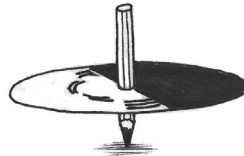
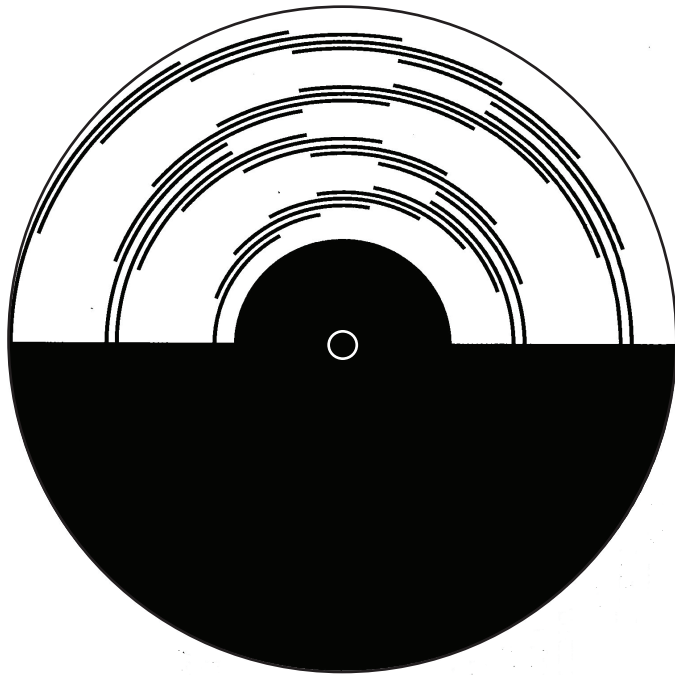


BENHAM DISCS, also known as “Artificial Spectrum Tops”

In the late 1800s, an amateur inventor (a journalist by trade) named Charles Benham (*pronounced BEN-um*) accidentally discovered that tops printed with black and white patterns trick the eyes into seeing rings of pale colors. He began selling these tops as novelty toys, calling them “Artificial Spectrum Tops.” The colors are artificial because, as you can see, the discs contain no color at all, only black and white. Why, then, do they look like they have colored rings when you spin them? Even to this day, scientists are not completely sure what causes this effect. Their best guess is that the color-sensing cells (“cones”) in the back of your eye differ in their response times.

You have three types of color-sensing cells: one type sees red, one sees blue, and one sees green. The combination of these three can produce all the other colors. (If you don’t believe these three colors can produce any color, look at a TV screen with a magnifying lens. You will see only red, green and blue dots!) If all three types of cells are stimulated, you see white. So the white part of the disc is stimulating all of your color-sensing cells. The black areas don’t stimulate any of them. As the disc spins, the cells are switching on and off as they look at the quickly alternating areas of black and white. However, the cells don’t all respond at the same rate. Blue-sensing cells take the longest time to turn on and off. So they are always lagging behind a bit. If the red and green sensing cells have already switched off but the blue ones are still responding, this might cause your eyes to see a hint of blue for a split second. Eye cells are so sensitive that even a small difference in the patterns of the stripes will cause different color effects. Even reversing the direction of the top will produce changes, often a reversal of the order of the color rings.

HOW TO ASSEMBLE: Glue this page to a piece of cereal box cardboard or heavyweight poster board. Cut out a disc, then cut an X at its center (or pierce a large hole using a compass point or a ball point pen). Push a short pencil through the center. Keep the disc low, almost at the pencil point.



OPTICAL SPINNING DISCS (Color-it-yourself version)

These discs are a do-it-yourself version of a classic physics toy. The spinning tops let you experiment with the physics of blending colors. If you spin a red and blue top will it look purple? Will a black and white top look gray? Spin and find out!

COLORING TIPS: Try red/yellow/blue, or red/blue/green. Do either of these make white? (You could do both of these- one per ring- on the top right design.) Also try colors that are on opposite sides of the color wheel, such as purple/yellow or blue/orange. Try your own ideas, too. Also, try to make the areas of color very solid (no white patches peaking through). Markers might work best.

HOW TO ASSEMBLE: Glue this page to a piece of cereal box cardboard or heavyweight poster board. Cut out a disc, then cut an X at its center (or pierce a large hole using a compass point or a ball point pen). Push a short pencil through the center. Keep the disc low, almost at the pencil point.

