3D Educational Resources

BUILD YOUR OWN ZOETROPE

The zoetrope is an early animation device that delighted children and adults during the late 19th century. It uses an optical trick to make a series of still images seem as though they are moving.

ONTARIO CURRICULUM LINKS

Through this activity, your students will learn about optical illusions, and how the zoetrope tricks the brain into thinking a sequence of still images is in motion. This activity can be connected to multiple aspects of the Ontario school curriculum, our suggested link is:

- Grade 5: Science (Human Organ Systems)

Grades
1 – 6

Age Range
6 – 12 years

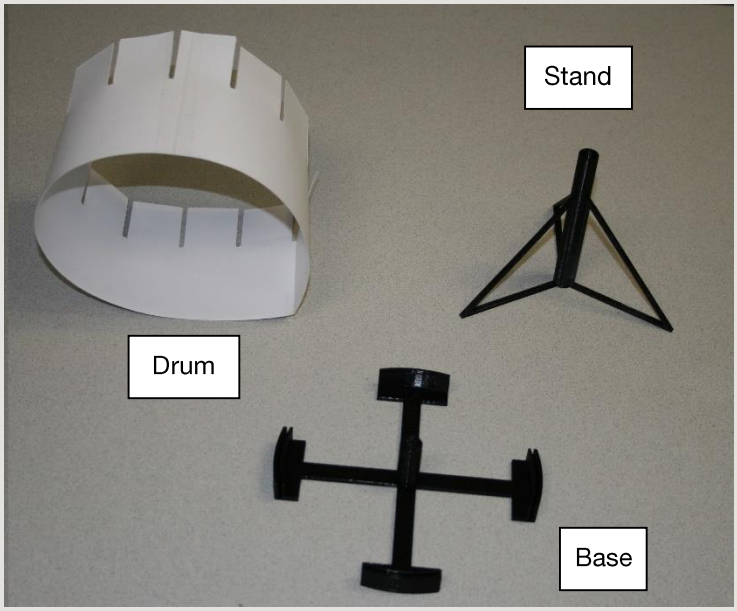
MATERIALS

1 – Set of 3D zoetrope parts
1 – Printout zoetrope drum template*
1 – Pen (BIC ® pens work particularly well)
1 – Printout of the zoetrope strips you wish to use*
1 – Tape
1 – Scissors

* Note: Print the drum template onto a tabloid-sized piece of cardstock (279 mm x 432 mm or 11” x 17”). Print the zoetrope strips onto a tabloid-sized piece of paper. When printing do not “print to fit”; make sure it prints at 100%. If possible, have your printer print “edge to edge”.

INSTRUCTIONS

For this activity, the following naming conventions will be used:



Constructing the Drum

1. Cut out one of the drums from the **zoetrope drum template** along the dotted lines. If your printer cannot print edge to edge, extend the top and bottom of the zoetrope drum so that the edges of the paper serve as the drum's edge (similar to what it looks like when viewed as a PDF).
2. Form a cylinder by attaching one side of the drum to the other. For best results, slightly overlap the edges by about 2 mm.

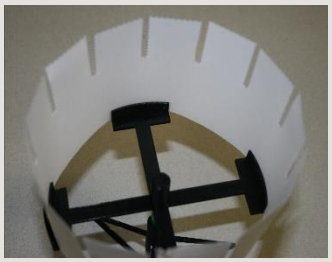
Making the Zoetrope Strips

1. Cut out the zoetrope strips along the dotted lines.
2. Form each zoetrope strip into a cylinder by attaching one end to the other. The greyed-out section at the end of the strip can overlap with the other end. If your printer cannot print edge to edge use the paper's margin to serve as this tab.

Building the Zoetrope

1. Place the pen in the stand. Make sure that it is pointing upward and that the top of the pen extends at least 4 cm beyond the top of the stand.

2. Insert the bottom edge of the drum into the slots at the ends of the arms of the base.



3. Place one of the cylindrical zoetrope strips into the zoetrope drum. For best results, ensure that each image is directly across from a slit in the drum.

4. Insert the base with the drum and strips onto the pen in the stand.
5. Your zoetrope is now ready!

SCIENTIFIC EXPLANATION

The animation produced by the zoetrope is based on something called persistence of vision. Persistence of vision is when, after seeing an object, our brains retain an image of the object for about 1/30 of a second after we stop looking at it. In a zoetrope, as you look through one of the slits, you see an image. Our brain then retains the image until the next image appears making it seem as though one image is "moving" to the next one. The slits in the zoetrope are important because they limit observation of each image to a brief moment. Without the slits, the spinning images in a zoetrope would become a blur. Some artists have created 3D zoetropes using strobe lights instead of slits. The periods of darkness created by the strobe light breaks up the image sequence, similar to the slits.

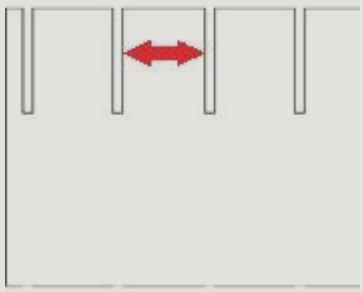
Try this! You and your students can see what an original zoetrope looked like by viewing a 3D scan of a zoetrope in the collection of Ingenium – Canada's Museums of Science and Innovation. See it here: ingeniumcanada.org/ingenium/museums/education/3D-zoetrope.php.

Try this! To further explore the concept of zoetrope animation, have your students alter a single aspect of the zoetrope while also predicting what will happen (and why). Then have them make the alteration, and observe the results. An easy alteration would be changing the speed at which the zoetrope spins. In general, the faster a zoetrope spins, the smoother the animation. If it is spun too fast, however, our brains cannot register the images properly and everything becomes a blur.

A more complex alteration would be to alter the slit width in the zoetrope drum. For this alteration, a new drum would need to be constructed. To do this:

1. Cut out one of the rectangles on the **zoetrope rectangle template** along the dotted lines.
2. Decide on the width of slit that you want; the original slit width is 0.3 cm.

3. Draw the slits onto your rectangle. The height of the slits should be the same as the height used in the main activity (3.9 cm). The width is the width that you determined in step 2. Use the zoetrope drum template to determine where to draw the slits; the slits on your altered version should be in roughly the same position as the original. To help with this task, the distance between the slits (see red arrow in image below) can be calculated as:
    a. Length taken up by slits (in cm) = 13 × width of slits (in cm)
    b. Length taken up by tabs (in cm) = 43 - (Length taken up by slits)
    c. Distance between slits (in cm) = Length taken up by tabs ÷ 13



4. Follow the rest of the steps in the original activity to build your new zoetrope and see the results of the change you have made. An ideal slit width would be one just wide enough to allow a clear view of the image directly opposite of the slit, but not wide enough to reveal much of the other images. Slits larger or smaller than this ideal width will likely affect the quality of the animation.

Ingenium has more than 110 000 artifacts in its collection, including many about zoetropes and zoetrope strips. You can explore other objects in the collection at: ingeniumcanada.org/ingenium/collection-research/collection.php.