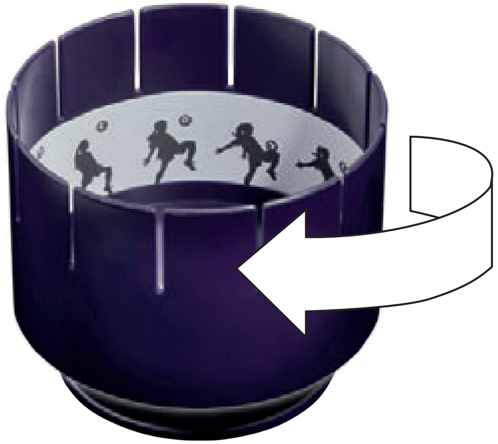
Zoetrope



The History of your Zoetrope

The Zoetrope is the best known of several animation toys which were invented in the 19th century, a time when people first discovered ways to make still pictures move.

Other nineteenth-century animation devices included the Flipbook, Thaumatrope, Praxinoscope, and the Mutoscope.

The Zoetrope first appeared in England in 1834, France in 1860 and the United States in 1867.

The Zoetrope was named by its French inventor, Pierre Desvignes. The root word, “zoo” is from a Greek word meaning animal or life. “Trope” is also from Greek and means a thing that turns. It is also known as “the wheel of life”.

The Science behind your Zoetrope

When you place a strip of still images inside the Zoetrope’s drum, spin it and look through the slots, you will see the images come to life. Of course, this is only an illusion of motion.

Persistence of vision

Persistence of vision was noted in 1820 by Peter Mark Roget. It was a theory that first attempted to explain how our eyes see individual images as one continuous image, as in a movie or animation. This theory suggested that an image persists on the retina (the “screen” at the back of our eyes which is sensitive to light) for just long enough so that we do not see the spaces between the images. However, this theory has since been replaced with the idea of the Phi Phenomena.

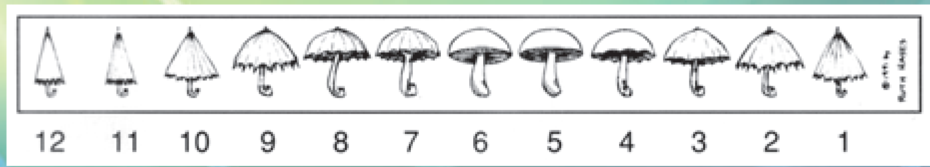
The Phi phenomenon

The Phi phenomenon theory was proposed by Max Wertheimer in 1912. Wertheimer was a Gestalt psychologist and Gestalt theory emphasised that humans perceive entire patterns and not individual parts - “the whole is greater than the sum of the parts”.

Therefore, when we see two different images close to each other, our brain automatically creates a relationship between them. We interpret the arrows below as one jumping arrow instead of two separate ones.

If these arrows were separated by a short amount of time (as in the Zoetrope) instead of a small space, you would be even more inclined to see them as one moving arrow. Your instinct to connect these two images gives them movement and meaning. When you look at a zoetrope strip, you perceive one single event, when you are actually seeing a succession of images that follow one another rapidly.

An umbrella becomes a mushroom without interruption, even though this is not something you would ever see in the real world.



How this works in the Movies

Movies are composed of different scenes. The scenes contain shots of characters taken from different angles, at a variety of distances. All of these scenes are edited together, and you probably do not notice the edits. A skilled editor can use the Phi phenomenon to their advantage.

The film can be edited to maximise an illusion of continuity, but you, the viewer, are the most responsible for this continuity. You see the shots together, and your mind creates a world from them that has its own space and time.

The Zoetrope and other nineteenth-century animation devices were early steps in the development of film and video. On the surface, our modern media technologies look different from the optical toys of the 1800s, but they share many common properties.

Your Zoetrope has slots that create a stroboscopic effect. Movie projectors have a shutter that interrupts the light from the projector bulb, as the film advances through the gate. The strobe of the projector shutter keeps the film from blurring.


Stroboscopic effect

Video images are scanned onto your TV or computer monitor by a beam that zig-zags across the screen from top to bottom, twice for each frame.

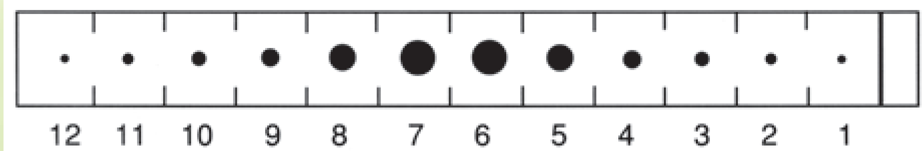
You can vary the speed of your Zoetrope. The faster it turns, the smoother the motion in the strips appears. When the Zoetrope slows down so that each image is seen for a tenth of a second or more, the illusion of movement begins to break down. You can see the strobe more easily. Film projectors usually run at a rate of 24 frames, or pictures, per second.

Old silent movie projectors ran at 18 frames per second. This is why silent movies may seem to flicker. They are slow enough that we can detect the strobe.

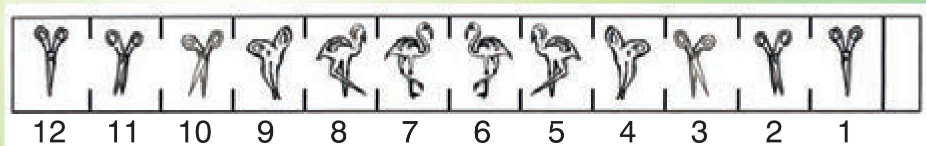
Video records and plays at a rate of 30 frames per second. Both film and television are designed to take advantage of the Phi phenomenon.

Draw-your-own strips - advanced

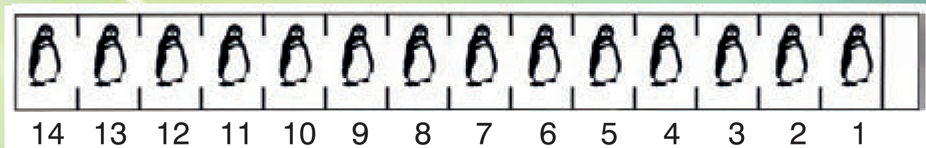
The Zoetrope instruction leaflet explains how to create simple animations, like the dot below. You might want to try more complicated ones.



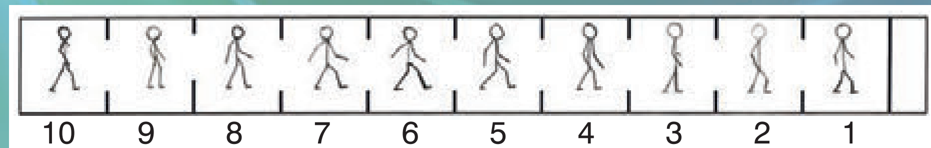
To animate a metamorphosis, or one thing transforming into something else, draw your first image in frame one and the image you will transform it into in frames six and seven. Use the frames in between to draw the gradual changes. You can copy these in reverse order in frames eight to twelve to complete the cycle.



Instead of twelve frames, make a strip with ten, eleven, or fourteen frames of equal size. Draw the same simple shape in each frame. Notice that, in the Zoetrope, the shape seems to move in one direction or the other even though you have not animated it.

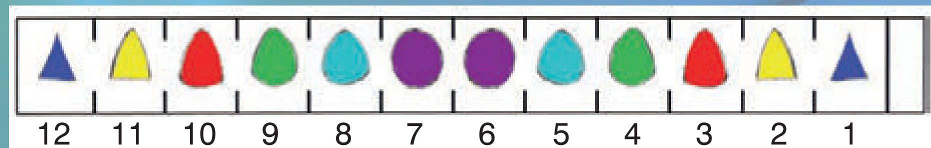


Animate a ten-frame cycle of someone walking. They will appear to walk from right to left if you spin clockwise and left to right if you spin anti-clockwise.



You may want to make your drawings more detailed. You can draw them larger, then reduce them to the right size on a photocopier. Make sure that your lines are bold and black, or they won't reduce well.

You can colour your strips. Pale colours don't show up very well so use bright, bold ones. Experiment with alternative blocks of colour from frame to frame.



Have fun!