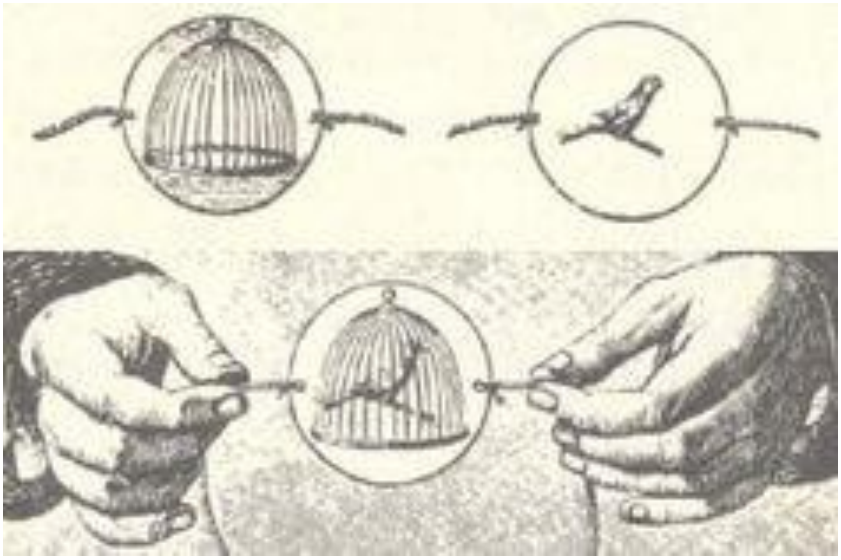
Thaumatropes—Handheld Animation Toys

For this workshop you will need to prepare for each student the following items:

2 index cards with a single hole punched on each side
2 pieces of string about 8 inches long each
A pencil
Colored pencils, crayons, markers (optional)

(see the image below for what the final product looks like, only imagine the paper is rectangular instead of circular)
You'll also need a flashlight.
Approximate time: 1 hour



We are surrounded by moving images. Whether we're seeing them on our computers, our phones, on television, at the movies—even at a bus stop or on the side of a building—all these different kinds of moving images are made the same way: a series of still images are shown one after the other quickly enough that our brains trick us into thinking we are seeing motion.

One explanation for this is something called "persistence of vision." The idea here is that when you see a series of still images one after the other at a high enough speed, you continue to see any one image long enough that it blends together with the next, creating the illusion of movement. You can show students why people thought this was possible through a simple experiment:

Dim the lights. Turn on a bright flashlight and ask the students to look at the light for a few seconds. Then ask them to close their eyes. Ask them if they see anything and, if so, to describe it.

Now it's time for a second experiment with the flashlight. Quickly draw a circle in the air with the flashlight and then ask the students to close their eyes again and describe what they see. They will likely tell you that they see a circle. This is because they are continuing to see the light from the flashlight as it traveled through the air long enough that it connects into a single shape of light.

Now for the fun part. The students can now make their own handheld toys that use what they just learned about vision. They're going to make something called a "Thaumatrope". This is a word that was made up in the 1800's to make a fun toy sound scientific and educational. It comes from Greek words that roughly translate to "wonder spinner". That's because it's a toy that spins, and does something that makes you wonder: how does that work? It's simple: you have a piece of paper with images on both sides. When you spin the paper fast enough, you see the two images combined into one; this is just like how the students saw a solid circle of light when you moved the flashlight in a circle earlier.

To make the Thaumatrope you will give each student two index cards, two pieces of yarn, and a pencil. Ask the students to name their favorite animals. On one of the cards, have them draw their favorite animal. Let them spend about five minutes on this. Not everyone needs to fully complete their drawing before moving on to the next step—in fact, it's best if they don't feel they have fully finished, as they will likely need to make some adjustments later.

Next, ask them where they'd like to see their favorite animal. The classic example of a Thaumatrope has a bird on one side, and a cage on the other, so you see the bird *in* the cage. Get them to think of other places animals might live: maybe their animal lives out in a field or a forest, maybe they live in the ocean or they sleep in beds like people. Have them draw this place on the other card you've given them. Allow them to draw for five or so minutes. Again—let them know that it's OK if they don't think they're finished with their drawing. What you want to do now is to take a look and see how their Thaumatrope is coming along.

This part is a little tricky. You want to take the two index cards and place them back to back, so that the drawing on each card is visible. Now, you want to have them take one of the cards—it doesn't matter which one—and turn it *upside down.* They can now take one of the pieces of yarn and pull it through the holes punched on one side of the cards,

allowing equal lengths of yarn to hang on either side. Then do the same on the other side of the cards. If this seems confusing, refer to the image at the top of this document. The idea is that they are able to hold both ends of the string on the right side of the cards with their right hand, and both ends of string on the left side of the cards with their left hand. Then, they roll the string between their fingers to make the card turn.

Ask them how their drawing looks. Can they see their animal in the place they drew? Maybe something seems wrong—perhaps they have a tree running through the middle of their dog, or a chair on top of their cat instead of the other way around. Have them make adjustments to each of their drawings to make the Thaumatrope better. They can erase parts of the background that overlap with the animal, for instance, or they can add more details to make their drawing more convincing. Once they are happy with how things are looking, they can make the lines darker (this will make the effect work even better). They can even add color.

Your students have now made their own handheld animation toys. These toys were very popular in the 19th century, and they continue to have interest today. The best thing about Thaumatropes is how simple they are to make, once you get the hang of it. Your students don't need computers or cameras to make animations—now they have the tools to make their own animated toys out of pencil, paper, and a little bit of string.

Below are a couple more examples of some historic Thaumatropes for inspiration.