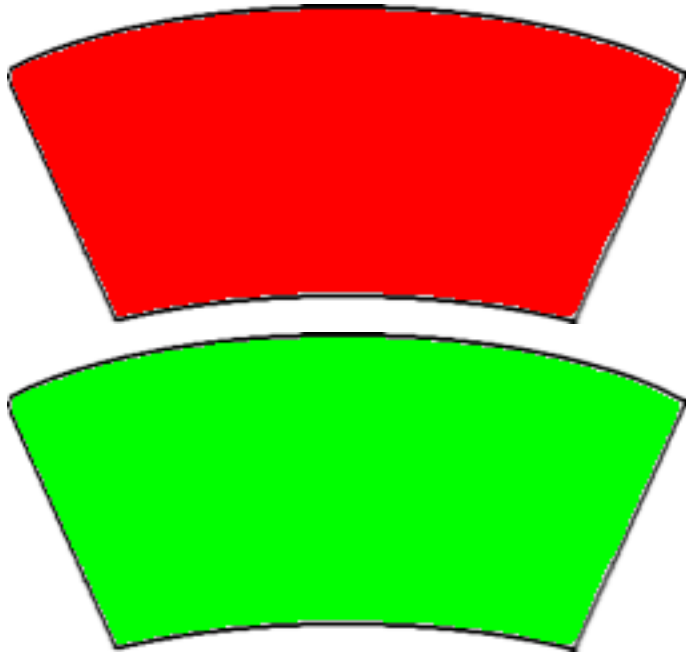
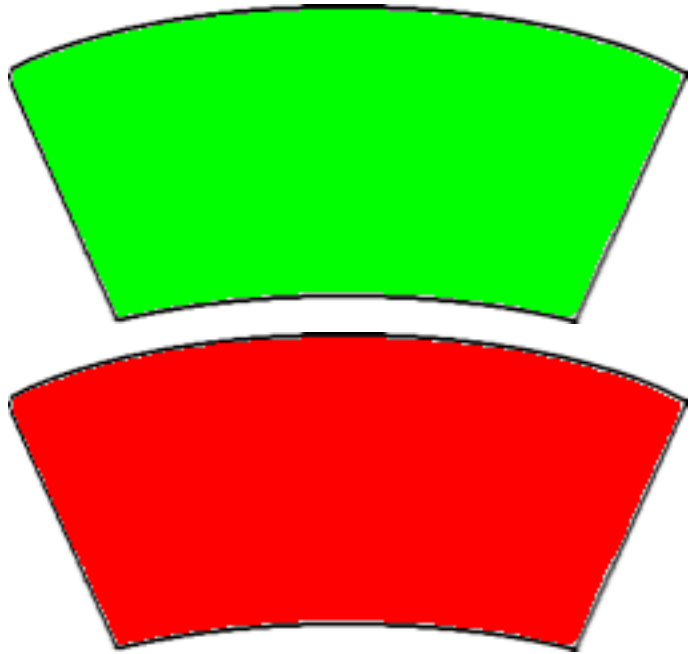


## Baffling Boomerangs Jastrow Objects

The red boomerang looks smaller than the green boomerang under it.



The green boomerang looks smaller than the red boomerang under it.



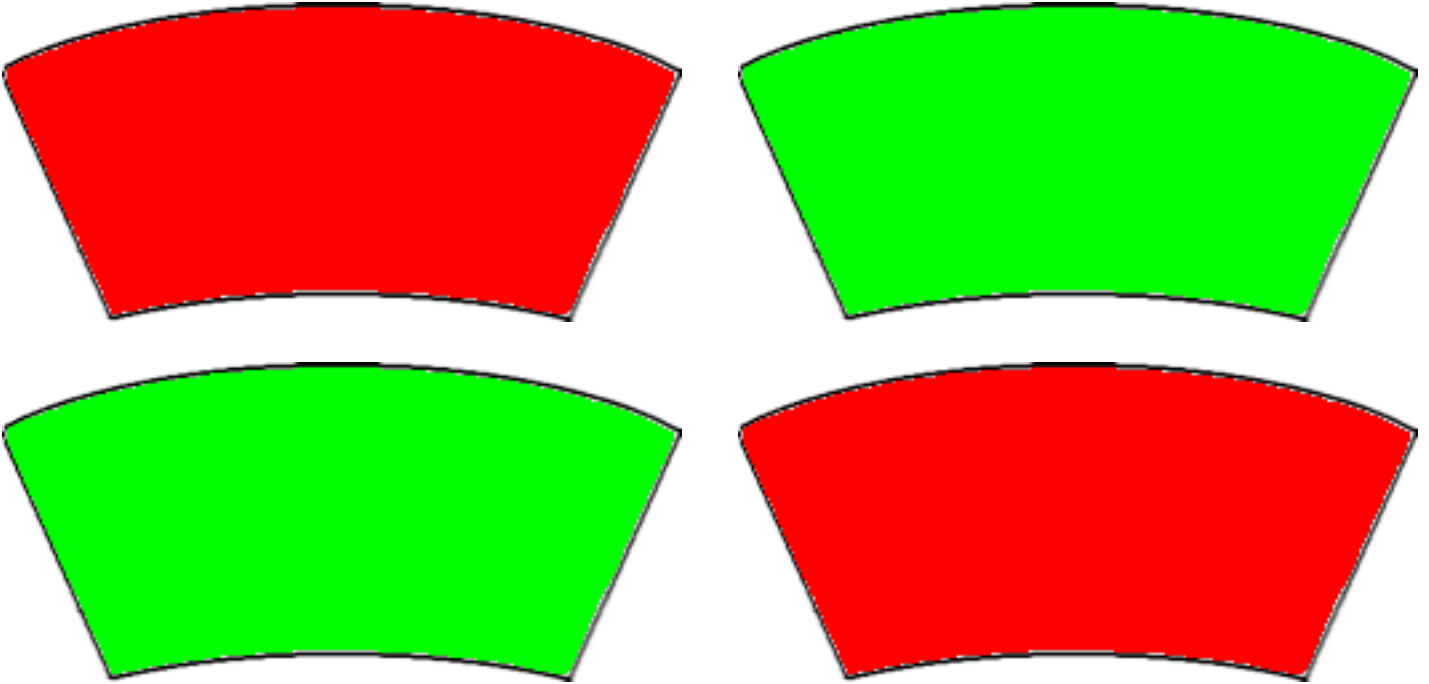
Amazing as it seems, **the boomerangs are exactly the exact same size.**  
If you cut them out and lay one on top of the other they will be a perfect match.

The secret is that whichever boomerang is on the bottom looks longer. This is because you are comparing the smaller inner diameter of the top boomerang against the larger outer diameter of the bottom boomerang. It's an optical situation that fools the judgment capabilities of our eyes and brain. By simply placing one boomerang over the other one, the one on top will appear to be smaller. If you move the top one to the bottom it will look larger.

If you have skills with illustration programs on a computer, you should be able to create two concentric circles on the screen, and then turn them into "arcs" or "boomerangs" and then print them out. It's nice to make the two boomerangs look different. You can make each one a different color using a paint program like I did with the ones above or print the black line masters I have on the next pages on different sheets of colored paper.

You can also make these "arcs" or "boomerangs" from physical objects found around the house. For a pattern, find two dinner plates of different sizes and trace around their edges onto paper or cardboard to make two concentric arcs, one inside the other. You can experiment with the basic shape of the boomerang by varying the length and width. Some combinations seem to look more convincing than others. Many magic stores sell this effect and most beginner magic kits containing a version. A web search will provide many hits. U-tube has several different presentations.

## Presentation

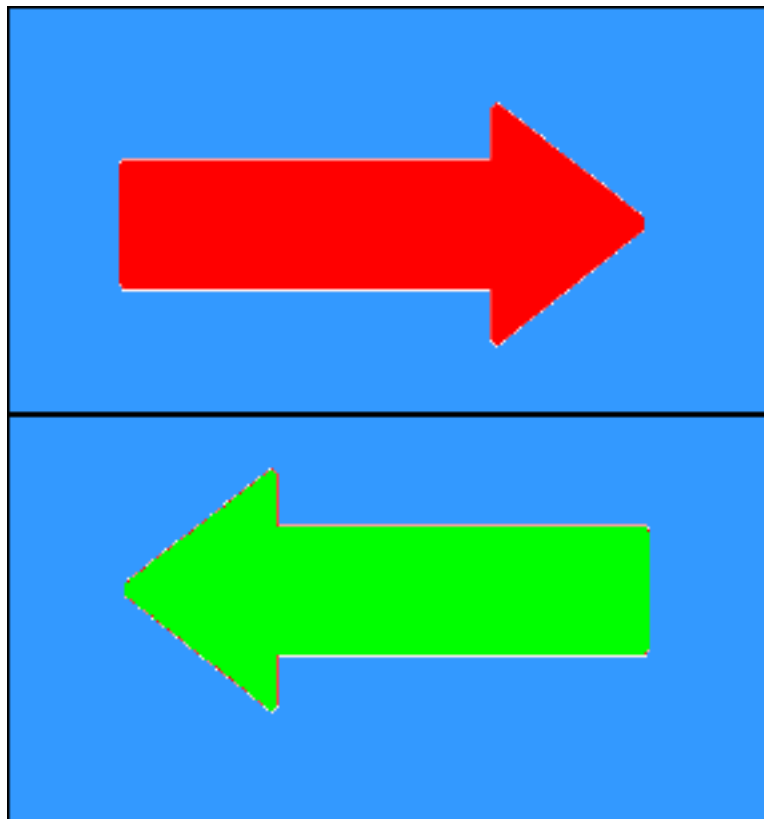
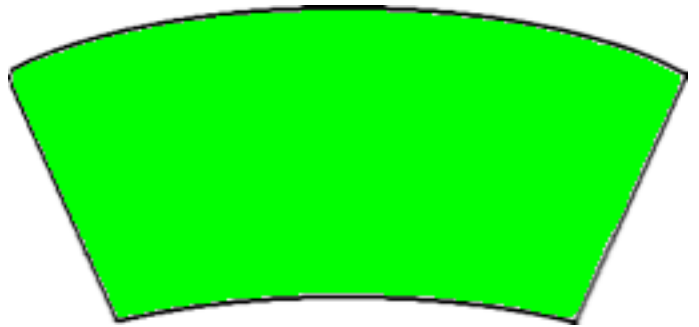


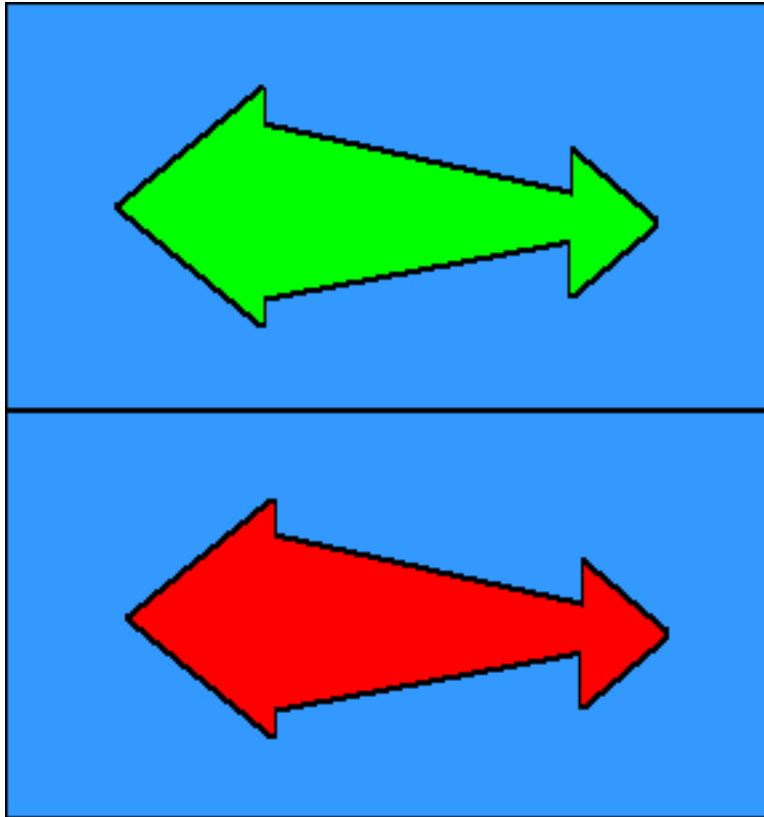
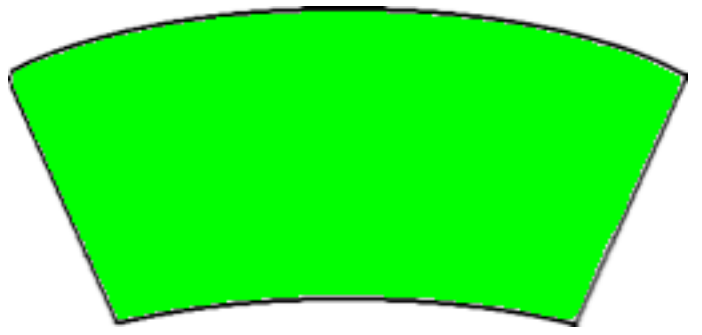
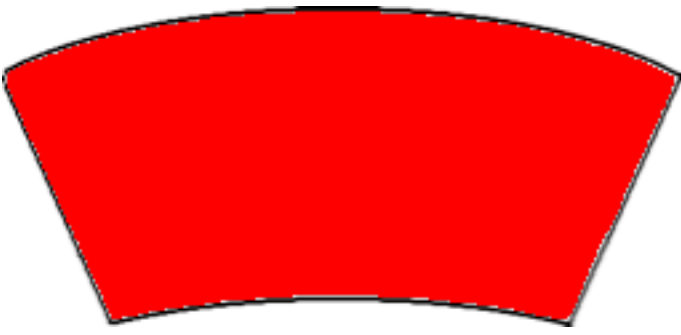
**Basic Presentation:** Place the red boomerang down on the desk. Place the green boomerang under it and ask the student which one is larger. They will say the green one. Pick up the green boomerang and pull on the ends saying that you will try and make it longer. Set it down away from the red one. Pick up the red boomerang and push the ends together saying you will make it shorter. When you set the red boomerang down be sure and set it down **CENTERED UNDER THE GREEN ONE**. The red one will now appear larger. Do the same procedure to make the lengths change a second time. Now take both boomerangs in your hands and put them together and then press and rub on the ends. Now put them together one on top of the other. Hold them up at the ends and show that they are the same size.

Some presenters extend the switching of the red and green boomerangs a few times before they show the boomerangs to be the same size to try to get more out of this effect. It does amaze students but after 2 or 3 times of changing places and then showing them the same size you have captured the major idea.

## Additional Ideas for Presentation

Make a rectangular flat tube by cutting out the pattern below (or make your own) and fold and tape it to form a flat tube. I explain that as the boomerang passes through the tube it shrinks or lengthens depending on the direction the boomerang goes in. Pass the red boomerangs through the left end and pull it out the right end to make it longer. Pass it through backwards to shrink it. DO the same with the red boomerang. This puts the focus on the tube instead of the boomerangs. Students will claim you have a set inside the tube and ask to see the inside. This distracts them from thinking about the boomerangs and makes it a bit more like magic.

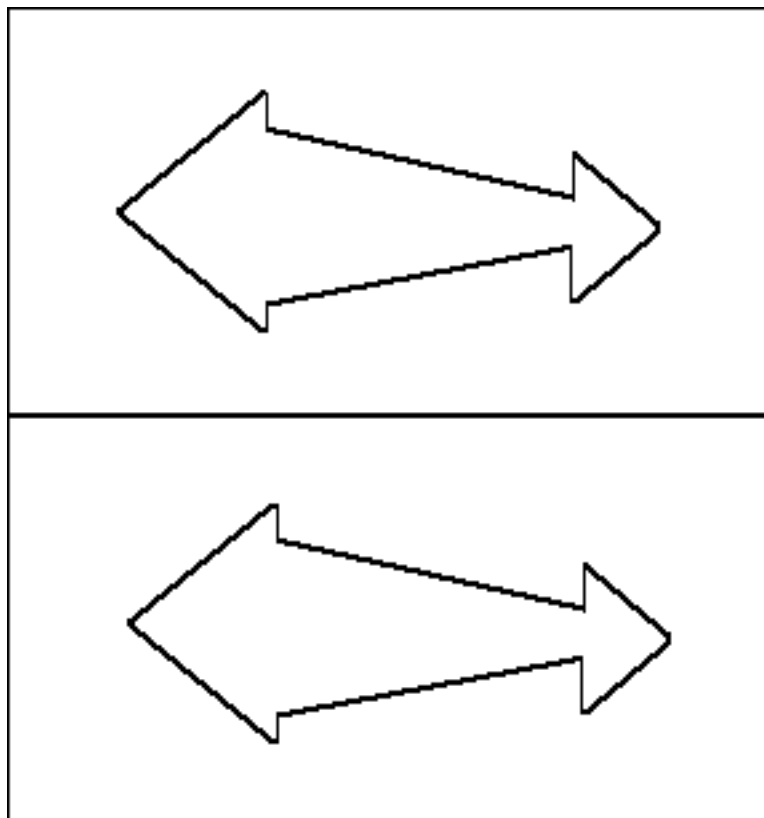
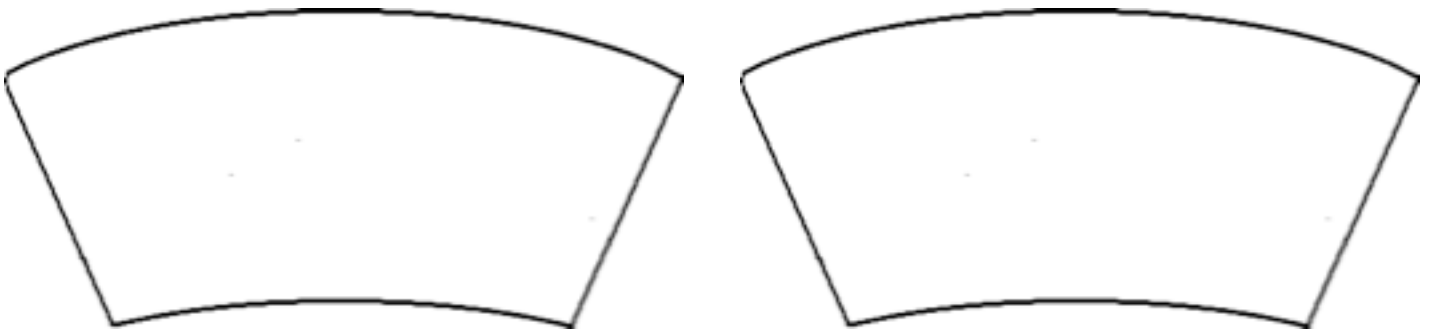




**Additional Ideas for Presentation:** If you have a longer version of the boomerangs you can have the student use a scissors to cut an end of the one that looks longer to try and get them to be the same length. Putting them together will show that did not work. You may get 2 or 3 cuts before you run out of boomerang.

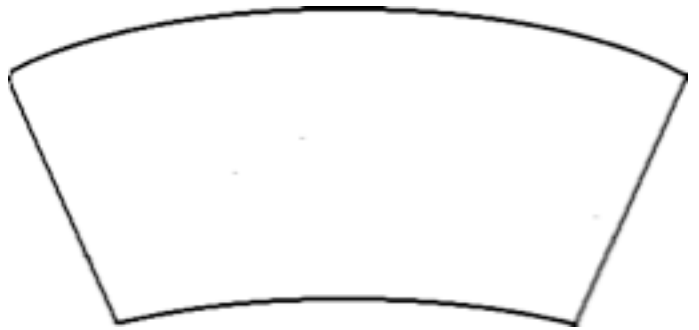
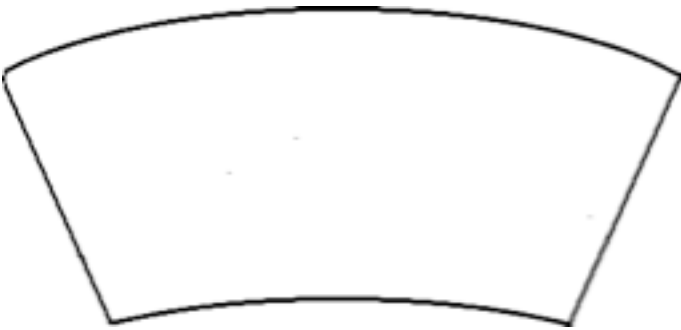
### Student Involvement

Try to be sure that you send each student out of the class with a se. Just watching them try this out on other students is real fun. I am sure they will also like trying it out oat home. You can print out class sets and have the students cut them out to save you time. If you give them the set printed on white paper have them decorate and color them so they have a personalized set. Otherwise print the set on colored paper and let them all have the generic set. Its much more fun to have them make their own sets and cut them out if time allows.

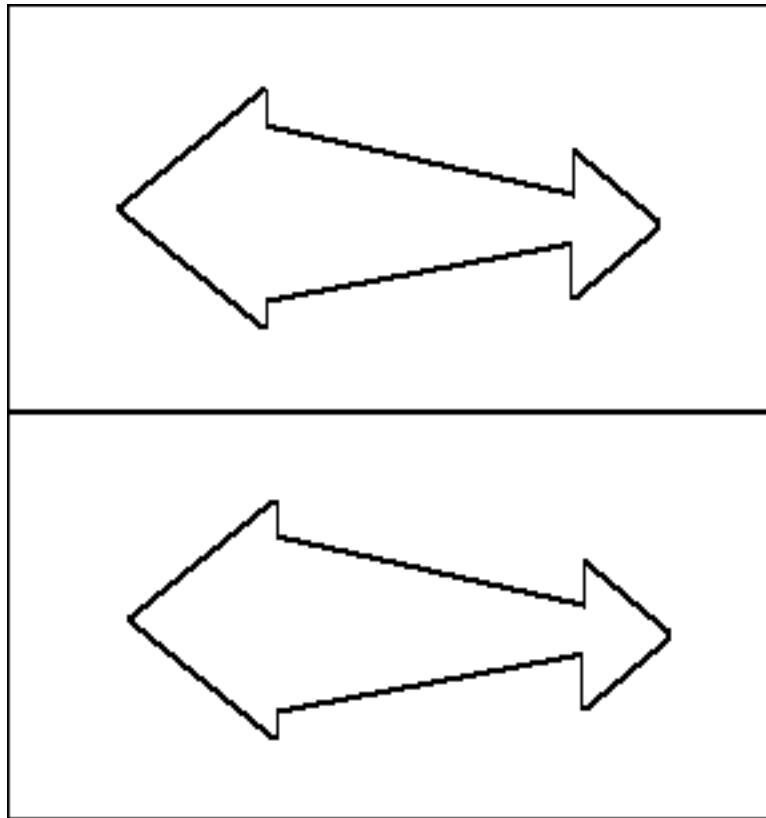
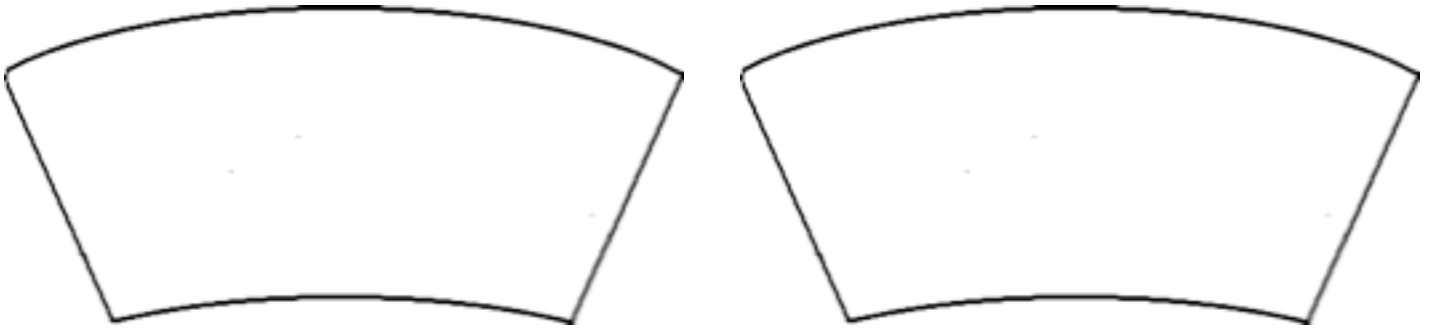


## Black and White Masters for a small set

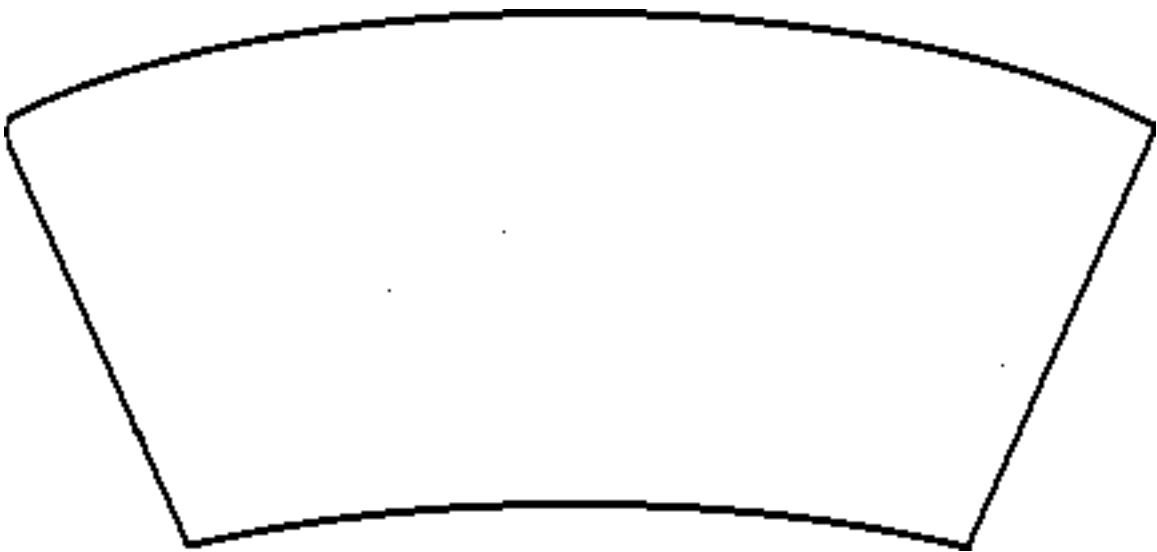
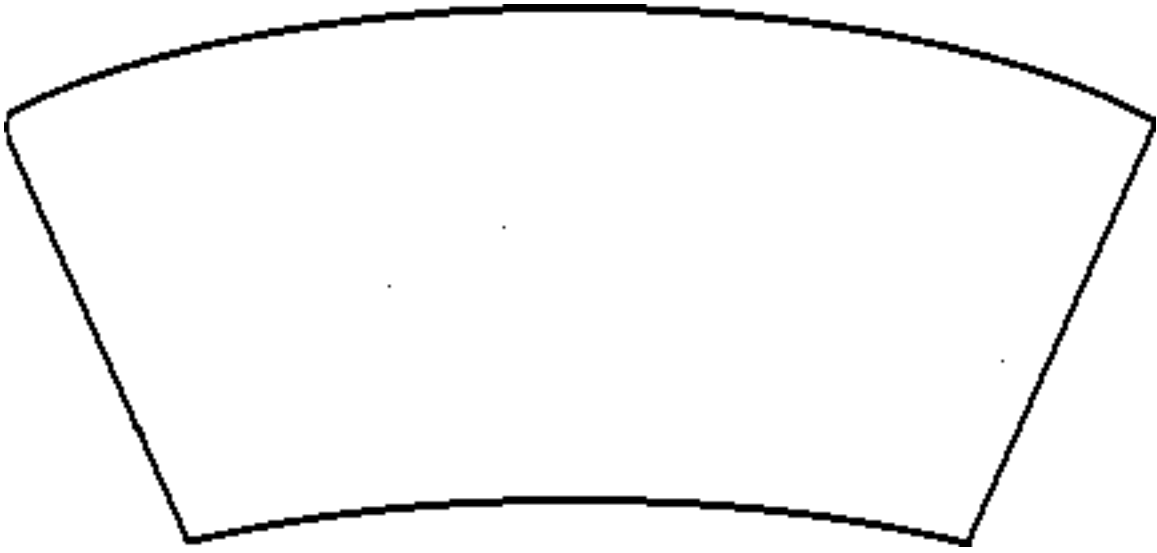
Note: The effect does not work as well in black and white. Use these masters if you are having the students decorate their one set. Contrasting colors work better than pastels.



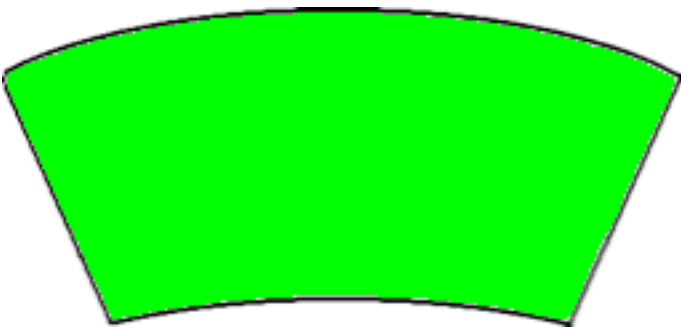
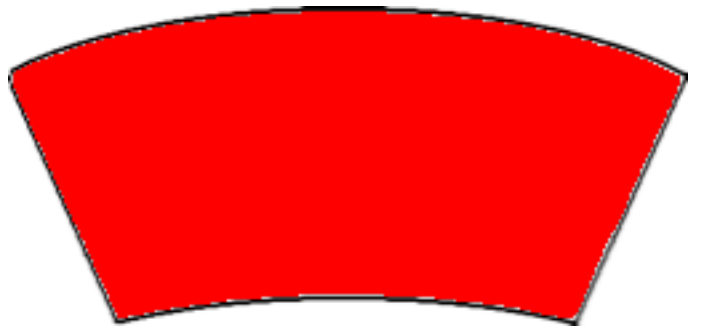
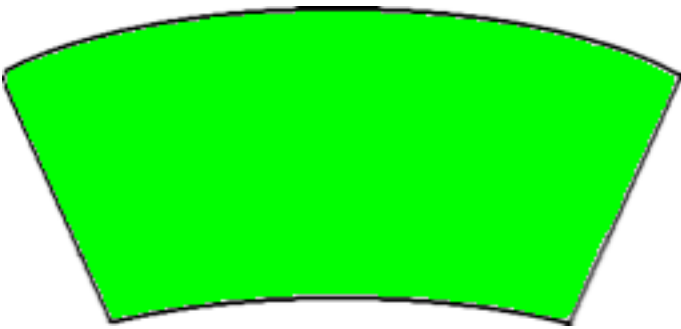
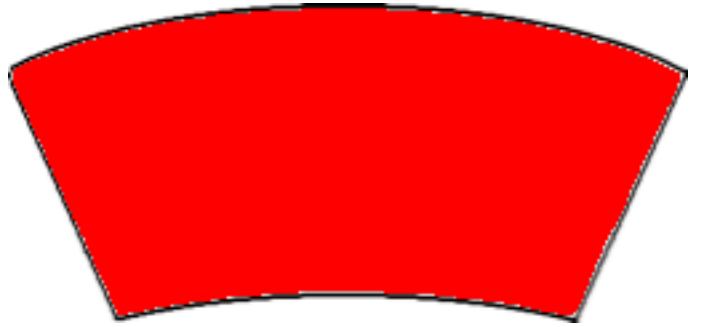
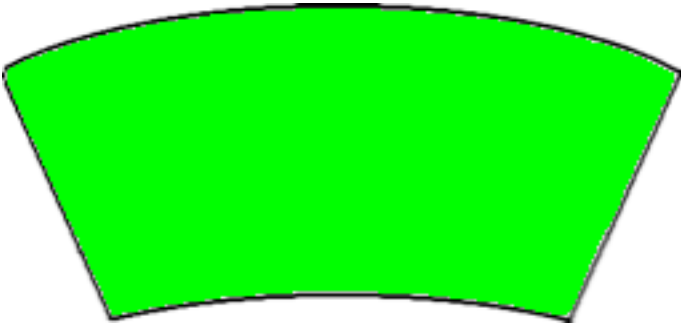
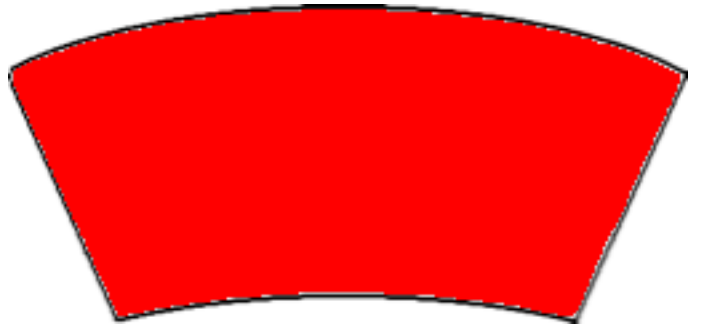
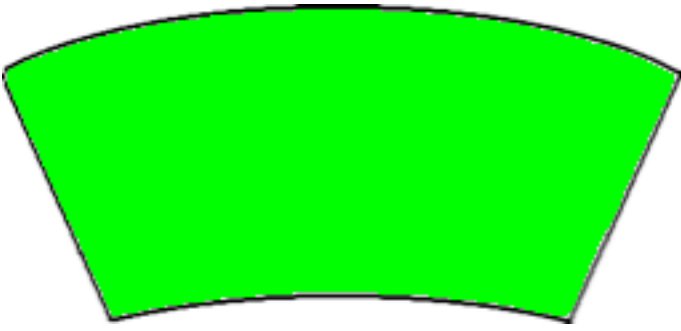
A set with the tube to shrink or expand the boomerang

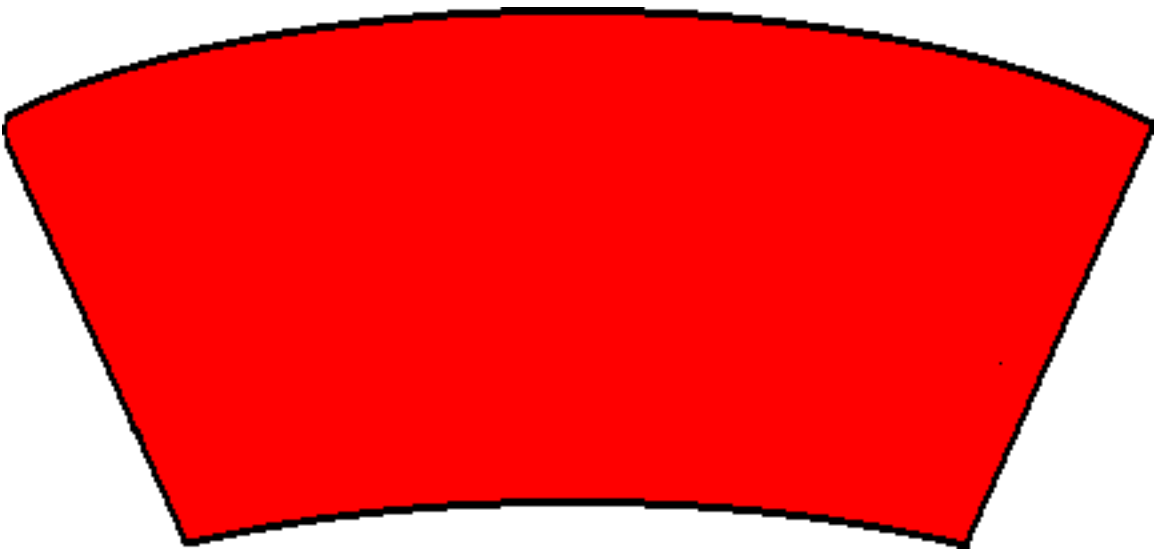
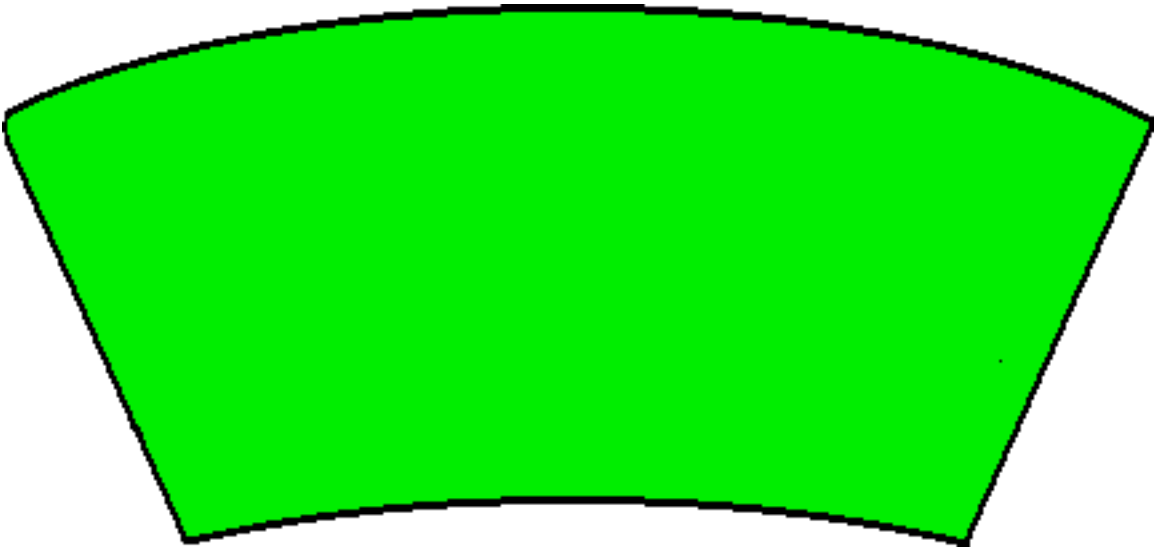


Black and White Masters for a larger set

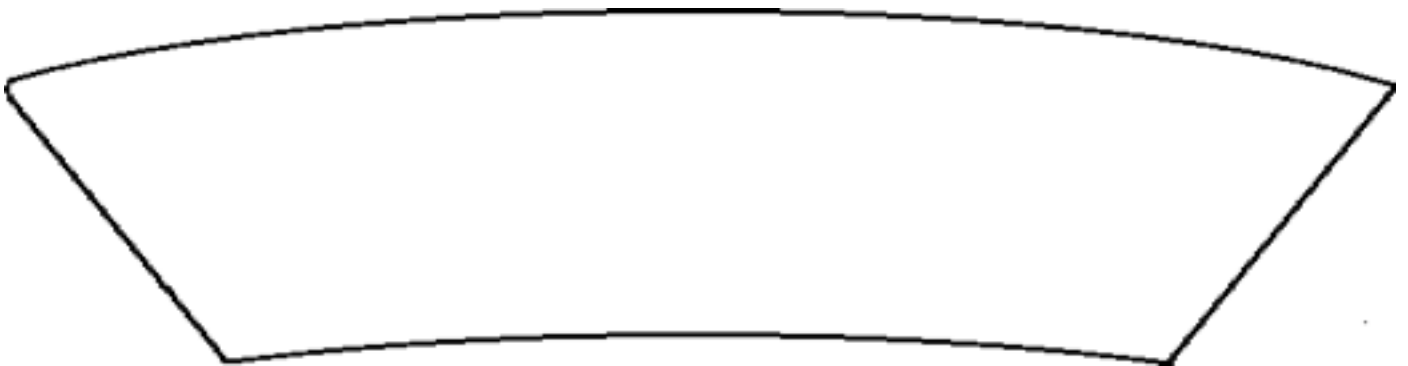
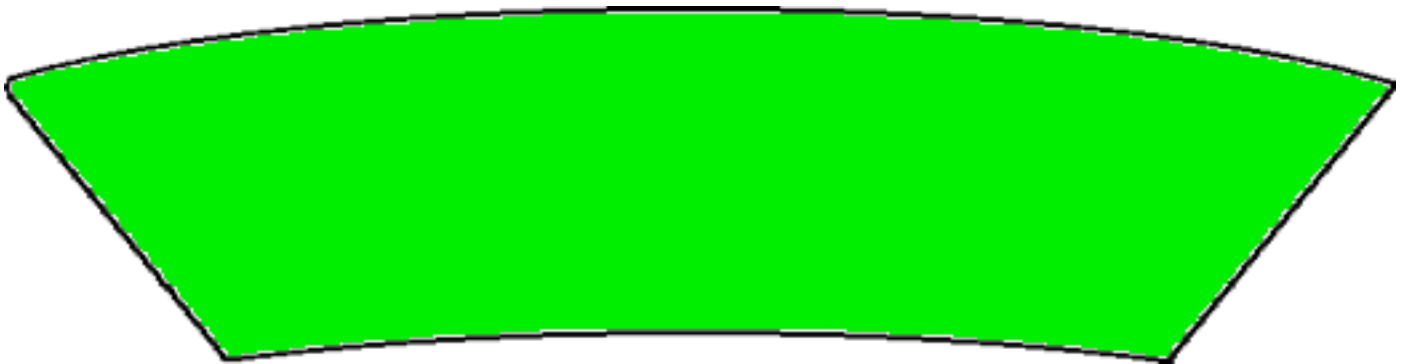
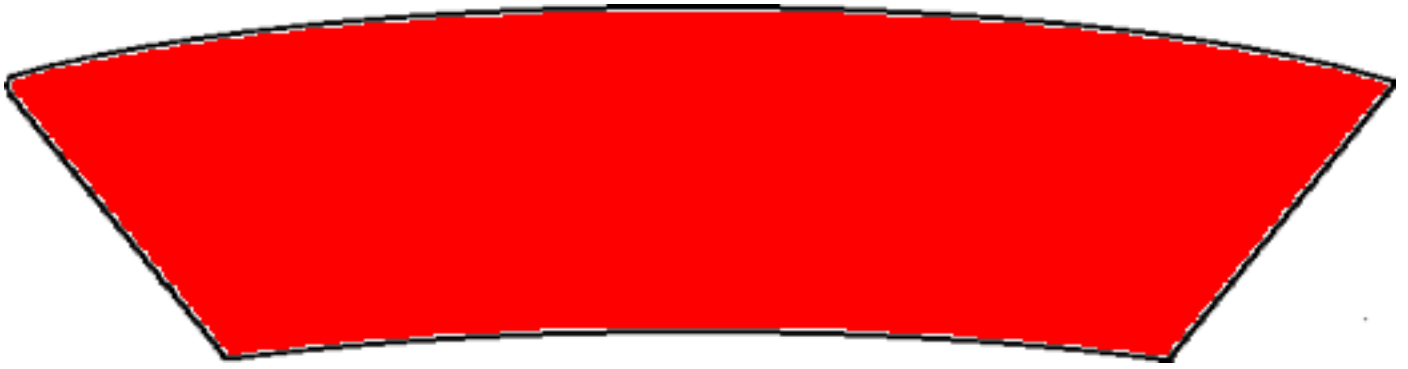








A long skinny version that I often use.

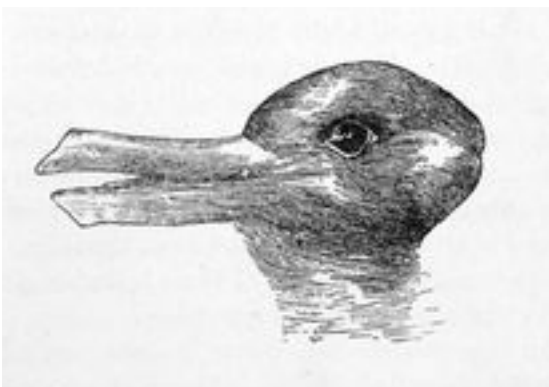


## A History of the Illusion



Joseph Jastrow (1863 – 1944) was an American psychologist, noted for inventions in experimental psychology, design of experiments, and psychophysics. Jastrow was the first American to receive a doctorate in psychology, in 1883. He joined the faculty of the psychology department at the University of Wisconsin. There he built the first psychology laboratory that specialized in investigations of the senses. He examined involuntary movement, stereoscopic vision, deception, hypnosis, the mental acuity of conjurers, reasoning processes, and the formation of judgments. His studies of optical illusions carried his name around the world, and several of his illusions — still known as Jastrow Objects — continue to appear in psychology textbooks. A number of well-known optical illusions were either discovered or popularized in his work. Two of the best known ones are shown below.

**Duck – Rabbit**



**Baffling Boomerangs**

