



CUT IN HALF

EFFECT:

A volunteer tries to put a piece of paper in half, only to discover that it's joined itself back into one piece!

DESCRIPTION:

You and a volunteer will both take a large loop of paper each and a pair of scissors. Then you will both cut right around the middle of the loop to produce two loops: which is exactly what your piece of paper will do. Theirs, however, will still be one continuous loop, only now it will be twice as long!

Then you can get two other people to try with two new loops. One of them will actually get two loops only they'll be joined together and the other will get one bigger loop but now there will be a knot tied in it!

HOW IT WORKS:

These are not normal loops, but rather they are twisted loops. The properties of twisted loops were first investigated by the mathematician August Möbius in 1858, so they are often called Möbius Loops.

The four loops are:

Zero Twists: This is the normal loop that you can successfully cut in half.

One Twist: This is the loop you give your first volunteer that, when cut in half, gives one bigger loop.

Two Twists: This will give two different loops, but they will be linked together.

Three Twists: This will give one big loop that will have a knot tied in it.

The act of twisting a loop before joining it together means that the left side of one end is connected to the right side of the other and vice-versa. This is why cutting it in half gives you one big loops. Two twists connects the left side back to the left side but only after it has been wrapped around the right side. Three twists again connects the left sides to the right sides, but it's also wrapped around itself; this becomes the knot when it's cut in half.

HINTS AND TIPS:

If the loops are sufficiently long, then it's difficult to spot that there are any twists in them. You can also experiment with using fabric or ribbon instead of paper as they can be easier to cut. In fact, if you use fabric and have a starting point, then your volunteers can just rip the loop in half with no need for scissors.

Before you try this magic trick, do a test-run with smaller loops of paper so you can easily see the twists and can clearly see what is happening when they are cut in half.

For the big magic presentation: make small secret marks on the loops, or use different colours, so you can easily spot which one has a certain number of twists.

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HISTORY:

The area of mathematics which looks at how shapes are linked and connected is called topology. August Möbius was one of the first mathematicians to develop topology.

Magicians have been using mathematical shapes in illusions for many years. In the early 1900s this Möbius loop trick was known as the "Afghan Bands".

