

THE SCIENCE OF MAGIC

Wisconsin State Curriculum Alignment:

Science C.4.2 – Use the science content being learned to ask questions, plan investigations, make observations, make predictions, and offer explanations.

Science C.4.6 – Communicate the results of their investigations in ways their audiences will understand by using charts, graphs, drawings, written descriptions, and various other means, to display their answers.

The success of a magic trick or illusion often has a lot to do with the science behind it. In other words, many magic tricks and illusions are based on relatively simple scientific principles combined with sleight of hand or misdirection, and it is because of science that magic works. Let us take a look at a couple of magic tricks made possible by science.

The first is called the “Hydrostatic Glass.” It is a trick done by a magician named Friedhoffer, “The Madman of Magic,” and explained in his book *Magic Tricks, Science Facts*.

Effect: Water miraculously stays in a glass that is turned upside-down.

Routine: The audience will watch you fill a clear glass to its rim with water. You will then cover the mouth of the glass with an index card.

Holding the card in place, turn the glass upside down and “order” the water to stay in place. Take your hand off the card. Amazingly, the water and card stay put! After a moment “command” the water and card to fall – just make sure you’re standing over a bucket or sink. The water and card obey.

Props: A clear plastic drinking glass

An index card larger than the mouth of the glass – a 4” x 6” card should work well

A bucket of water

Method:

- 1) Drill a small (about 1/16”) hole into the side of the glass near the bottom (see the illustration.)
- 2) Pick up the glass with one hand, covering the hole with your thumb. You need to completely cover the hole with your thumb so that when you pour water into the glass, the water won’t run out.
- 3) Fill the glass by dipping it into the bucket.
- 4) Using your other hand, cover the mouth of the glass with the index card. Place your hand lightly on the index card keeping the card over the mouth of the glass, slowly turn it upside down. Make sure that your thumb stays over the hole at the bottom of the glass.

- 5) Remove your hand from the index card. If you have done the trick correctly, the water will stay in the glass covered by the card.
- 6) After a short while, “command” the water to fall by moving your thumb slightly away from the hole. Make sure you are holding the glass over the sink or bucket when you do this.

Why it works:

Air pressure caused by air pushing up on the card forces the water to stay inside of the glass. As soon as you move your thumb away from the hole, air moves into the glass creating air pressure inside the glass that equals the air pressure outside the glass. Now, gravity can work properly – combined with the air pressure inside the glass, it is not the stronger force – and the index card and water will fall.

To learn more about air pressure, check out the *Household Science for Kids* website at <http://www.fatlion.com/science/airpressure.html>

Another trick that works because of the principles of science is called “Quick Money.” It is found in a book called *Magic . . . Naturally* by Vicki Cobb.

Effect: You offer a dollar bill as a prize to anyone who can catch it as you let it fall. Yet time after time, it eludes their grasping fingers. It appears that no one can hang onto the money except you.

The Routine: Announce to your audience that anyone who catches the bill when you let it drop can keep it. Hold the bill vertically by one end. Have a friend put his or her fingers around the bill. Tell the audience that this will allow your friend to be “as ready as possible” to catch the money as it drops. However, your friend should not touch the bill until you let go. As long as you follow these instructions, no one else should be able to catch the bill. But you should be able to drop the bill yourself and always be able to catch it (as will anyone who both drops and catches.)

Props: All you need for this trick is a fairly new, unwrinkled dollar bill.

How it works:

The short amount of time it takes us to move our muscles in reaction to something we see is called *reaction time*. The reaction time needed to respond to the sight of the dollar bill falling through our fingers is very short – less than $\frac{1}{10}$ of a second for most people. But, this very short period of time still isn’t fast enough, for by then the bill has already fallen past the grasping fingers.

However, when you drop and catch the bill yourself, you are not using the sight of the falling bill as a signal to grasp it. Instead, you are reacting to the internal feeling you get when you let go. Your body can coordinate the grasping motion with this internal muscle signal quickly enough to catch the bill.

To learn more about reaction time, try the Reaction Time activity on the Science Net Links website (<http://www.sciencenetlinks.com/lessons.cfm?DOCID=68>). This activity will give you ideas about how to test your reaction time and strategies for improving your reaction time. After completing the activity, make a prediction regarding the “Quick Money” trick. What do you think would happen if the catcher practiced catching the bill ten times? Would his or her reaction time improve? Would he or she be able to catch the bill? Create a chart to log reaction time using a stopwatch. Is the catcher able to improve his or her reaction time? Is he or she ever able to catch the bill?