

Fantastic Feats and Physics Magic

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The notes below are of necessity brief. Fuller explanations are often available elsewhere, or contact me personally. I hope the photographs aid understanding, for those who were not at my lectures.

Mirrors

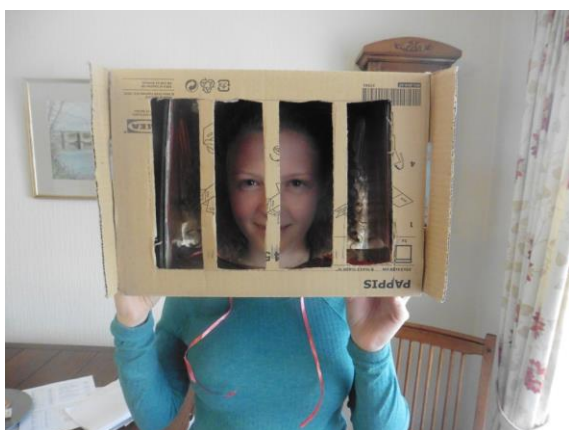
Many illusions have used mirrors. Basically the image is as far behind the mirror as the object is in front.

1 The empty box – Uses a mirror at 45 degrees inside the box, producing the illusion of an empty box. From the image of the “empty half” in front of the mirror, various items can be hidden behind the mirror. Some teachers have produced end of term certificates/prizes. Puzzle money boxes have a 45° mirror, and carefully patterned wallpaper to give the same illusion.



2 Empty Tube – The plane mirror sits across a diameter of the tube, hiding whatever is behind. Similar illusions are available from “magic shops”.

3 Headless body – Uses two mirrors which can be swung in front of the head of the demonstrator, creating the illusion of an empty box. Each mirror produces an image of part of the box. Again, the pattern on the lining paper is critical: stripes in line with the mirror.



Inertia

It is easy to think of examples where a cloth or card can be pulled away without disturbing what is resting on top.

1 Tablecloth and items – To leave the items in situ: make sure there is no hem on the cloth, and always pull down (as shown), so the cloth does not raise the objects.



2 Note under bottle – A bank note is placed under an upturned glass bottle. The challenge is to remove the note without upsetting the bottle. Again, important not to raise the note. Do this by striking the held note in a karate chop, below the surface of the table.

An alternative is to roll the note very slowly against the neck, and yet another way is to bang with your fist on the table and pull the note out quickly.

A greater challenge is to use two bottles as shown above on the right. Get your students to think about the impulse.

3 Bean bags, and tubes on a place mat – As long as the place mat is struck firmly, the bean bags fall vertically down. Or use eggs into water filled glasses.



Reaction

1 Catching the rod – Reaction time... When you drop a vertical ruler, it falls 25 cm or so before you react to catch it. A horizontal rod which is dropped cannot be caught in the first 25 cm or so of its fall, but must be caught near the ground. Bend your legs! So your hands travel with an acceleration $> g$.

What about the reaction time to a sound, or a tap on the shoulder?



Magnetism

1 Magnetic scarves in a tube – Tie tiny neodymium magnets in the corners of “silk” scarves with small single knots. When pushed separately and carefully into a tube, the magnets “find each other” (magnetism is a non contact force). The handkerchiefs can be blown or pushed from the tube, apparently tied together.

2 “Cube explosion” – This is a commercially available “magic trick” which illustrates well the different properties of steel and plastic. A steel dice which is hollow, conceals eight smaller plastic dice. The steel is attracted to the magnet in the top of the pot, leaving the plastic dice.

The small neodymium magnets give opportunities to create your own “magic”. Pupils can “invent” magic!

Miscellaneous

1 Cork Drop – Using moments to erect the cork, or the toilet roll. Hold the cork horizontal-

ly and drop it to the surface. It strikes the surface first at one end and flips over.



2 Circular Motion – Keep the water in the bucket, rotating the bucket overhead. Rotating objects on a Frisbee disc suspended on three strings is a little more spectacular as different objects are placed on the disc. End with a conical beaker full of liquid. (Hint: roughen the surface of the disc slightly, and make sure it is not damp.)

3 Card Drop – Try dropping a playing card directly into a hat below. It will be almost impossible, unless you hold the card horizontally to drop it.



Full details of many of these, have been and will be eventually published in *Science in School*. See <http://www.scienceinschool.org/content/fantastic-feats> (Editions: March 2017, and March 2018).

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