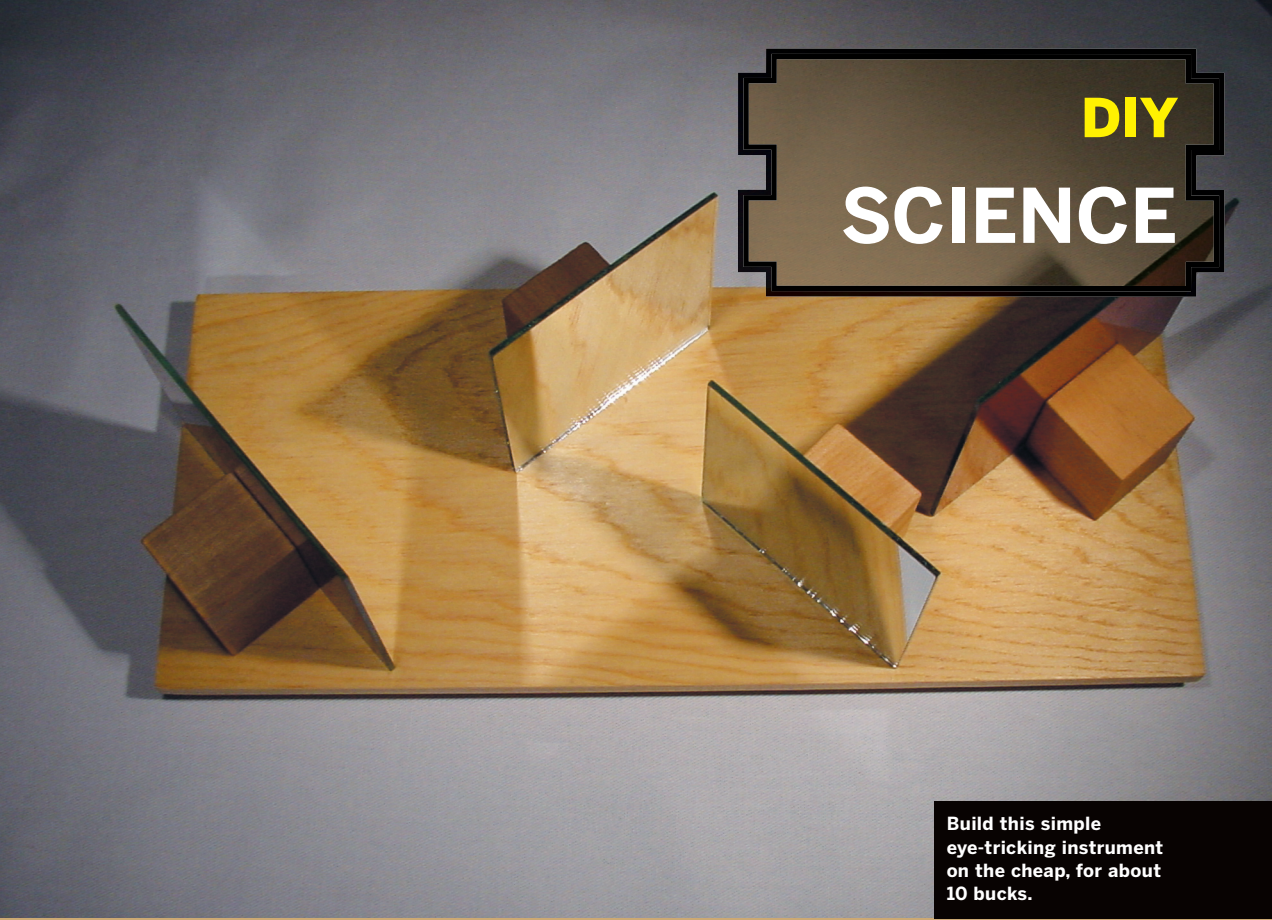

DIY SCIENCE

Build this simple eye-tricking instrument on the cheap, for about 10 bucks.

TEN DOLLAR PSEUDOSCOPE

See everything inside out through this classic optical instrument. By Rob Hartmann

The pseudoscope is a device that plays a trick on the eyes, switching the perception of near and far by reversing stereoscopic vision. It was invented by the great Victorian-era scientist Charles Wheatstone, and M.C. Escher used one to help create some of his famous perspective-bending illustrations.

You can buy one of these unusual devices for about $800 from Grand Illusions, so I decided to build a simple one of my own. Actually, I've built a couple of them now, with varying degrees of complexity, but here I'll show you how to make the easiest one for much less money: about $10.

Assemble It

I built the pseudoscope the way you'd guess just by looking at it. First, I measured and drilled the holes in the board. Then I drilled the cubes, glued the mirrors to the cubes, and screwed the cubes onto the board. I didn't glue the cubes to the baseboard because you need to be able to rotate the mirrors to align them depending on the distance to the subject matter.

Countersink the holes in the base so that the screws won't scratch table surfaces. Also, drill the holes in the cubes before you attach the mirrors.

Wooden cubes from craft stores, like the ones I used, aren't all perfectly square. For each cube,

Photograph courtesy of Rob Hartmann

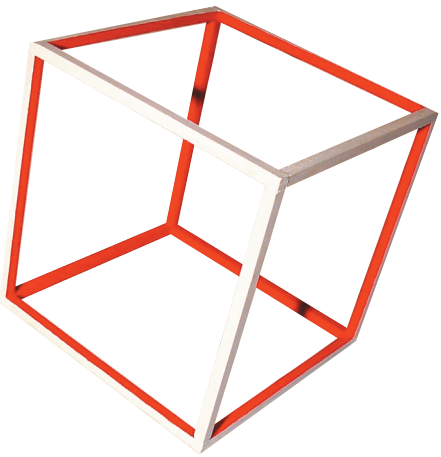

Fig. 1

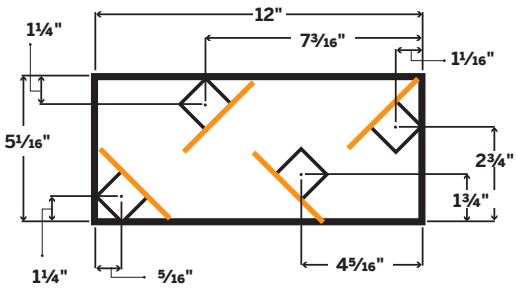

Fig. 2

MATERIALS

Two 3"x3" mirrors
Two 3"x4" mirrors
Four 1¼" wood cubes
One piece of wood, 5"x12"x¼" thick (make sure it's perfectly flat)
Four ¾" flathead screws
Glue

TOOLS:

Drill and drill bits
Screwdriver

M.C. Escher did it: With four mirrors mounted at exact right angles, you can easily create powerful illusions. Here are the dimensions I used for the screw holes (see Fig. 2). I don't think it's critical to use these exact dimensions; being a fraction of an inch off here or there shouldn't matter much.

you need to find two adjacent faces at exact right angles from each other, one side to serve as the base of the cube, where you drill the hole, and the other side to glue the mirror onto.

To find the good sides, check with a right triangle or push cubes together on a flat surface at different orientations until you find two that sit perfectly flush against each other. Just hope that the two cubes aren't off-angle by perfectly matching amounts.

To keep the mirrors at exact right angles, use a thin layer of glue, and glue them in pairs, pressing the blocks and mirrors together with the mirrors face-to-face.

Experiments and Enhancements

Your brain uses multiple cues for depth perception rather than relying entirely on comparing left eye versus right eye. As a result, inverted perceptions from looking through a pseudoscope can appear and disappear, depending on what you're looking at. The effect generally works better when you're sitting still rather than moving, and it's fun to experiment with what works and what does not.

One vivid pseudoscope experiment is to watch framework solids rotate, especially if their inside and outside faces are of different colors. I built a framework cube using twelve 6"x¼"x¼" pieces of basswood, and painted the inside faces red and the outside faces white (see Fig. 1). I hung the cube up and slowly spun it; through the pseudoscope, the cube looked red on the outside and like it was spinning in the opposite direction. When I closed one eye, the cube reverted back to its normal appearance. This illusion is best seen with strong lighting.

Always clean the mirrors before using the scope — fingerprints and smudges will greatly diminish the illusions. To take things up a notch, you can use front-surface mirrors, which eliminate the slight ghosting effect of conventional mirrors. Prices for these vary widely, so you should query different glass shops and look online.

I found some slightly larger front-surface mirrors for a good price at C and H Sales (aaaim.com/CandH), and used them to build a fancier pseudoscope with a custom-shaped walnut base.

Rob Hartmann is an electrical designer who lives in Fairfield, Ohio and enjoys mechanical puzzles and science projects.

Illustration by Damien Scogin