Alex Bellos's Adventures in Numberland Psychology

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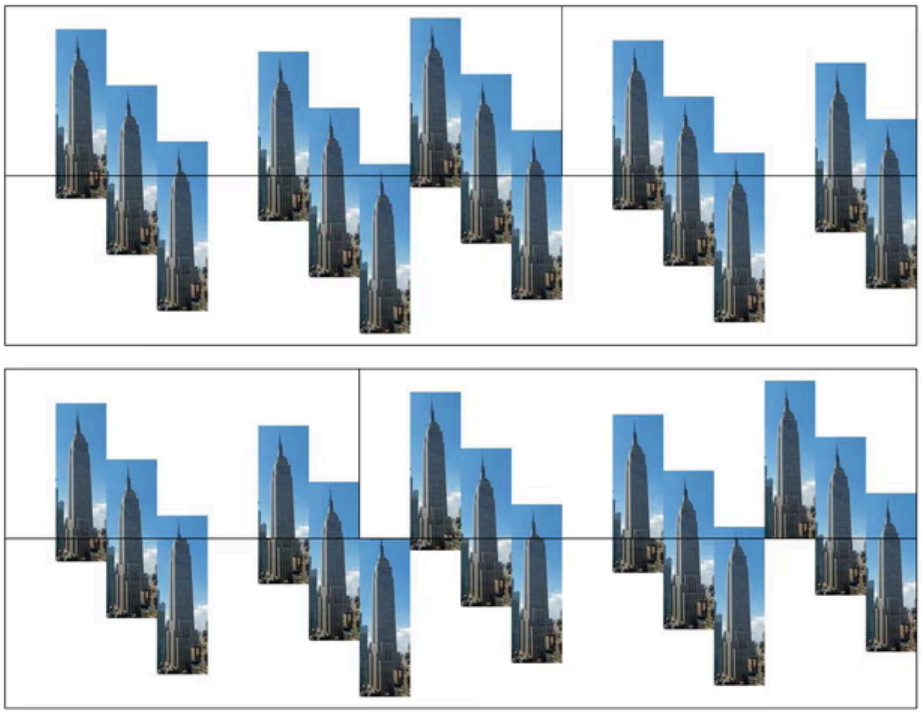
Empire State Building vanishes: amazing images of geometrical illusion

A mathematician has updated a classic geometrical puzzle – and explained how it works

The Vanishing Leprechaun, the Disappearing Dwarf and the Swinging Sixties Pin-up Girls – in pictures



By rearranging the three rectangular pieces, there are either 14 or 15 pictures of the Empire State. Image: Tim Chartier, Photograph: David Shankbone Photograph: Tim Chartier/David Shankbone

Alex Bellos

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This puzzle will fry your brain. It did mine the first time I saw it. I couldn't quite believe what my eyes were telling me.

Look closely at the two images above and count Empire State Buildings. The skyscraper appears 14 times in the top image and 15 times in the one below.

Both images are made from the same three rectangular pieces. All that changes is that two of the pieces are repositioned.

If you dont believe me, print it out, cut along the lines and see. (This is not an April fool!)

How on Earth can it be that a simple rearrangement creates a new Empire State Building and then makes it disappear?

head explodes

The puzzle is best known as the Vanishing Leprechaun after a version using 14/15 mythical Irish imps became popular in the late 1960s and early 1970s.

In his delightful new book Math Bytes, mathematician Tim Chartier of Davidson College, North Carolina, has revisited the leprechauns and

provided the clearest explanation I've read of why it works - and how to make your own version.

Look at the images below. There are 14 black columns. When you slide the top section leftwards along the horizontal line you create 15 black columns.

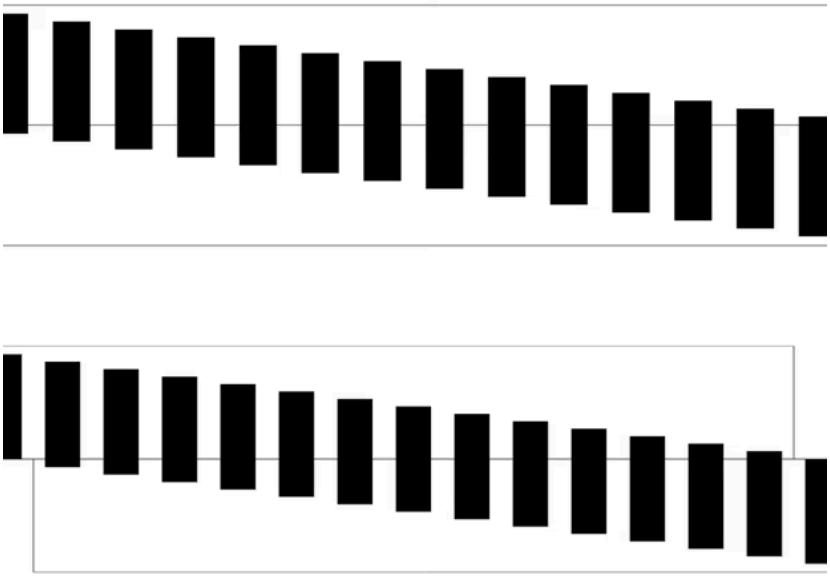

Image: Tim Chartier/ Math Bytes Photograph: Tim Chartier

It looks like we have created something from nothing. But actually, the 14 columns on the left are slightly shorter columns than they were before. They are missing a slice.

Exactly the same process is happening in the leprechaun puzzle. There are 14 columns in 15 positions, and the slices are then rearranged so that there are columns in all 15 positions, of which 14 are slightly smaller than they were before.

The stroke of genius is to realise that there is an arrangement of columns such that you can go from 14 to 15 by swapping two pieces, rather than sliding as we did above.

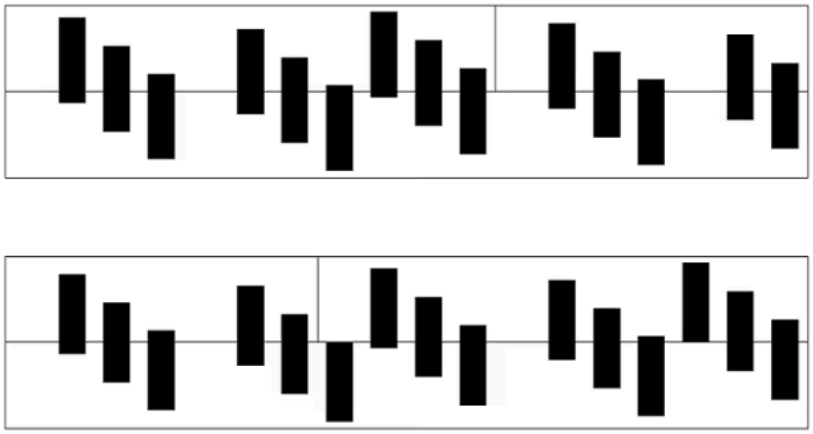

Image: Tim Chartier/Math Bytes Photograph: Tim Chartier

It is possible to make a leprechaun style puzzle from pretty much any image. In keeping with the green theme, Chartier in Math Bytes designs one using Kermit the Frog.

The earliest Vanishing Leprechaun-style puzzles are from the 19th century, and I have published a gallery of designs on another blog post.