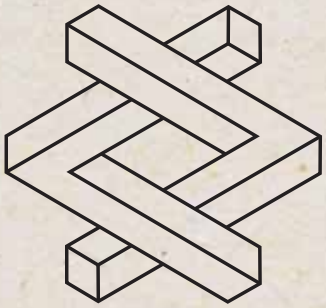
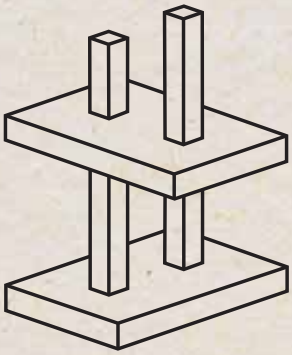
Welcome to The Wonderland of Impossible Objects!

Three-dimensional representations of Escher's confounding images



Tricky L-shaped blocks



Playful posts

My name is Professor Cedarfield.
I'm an avatar of Professor Sugihara.
I'll be your guide to our
Wonderland of Impossible Objects.
Let's start with a question.
Take a look at the figures shown
above. Do they look a bit odd?
Could these objects actually exist
in our world?

Answer:Yes

Let's examine how the figures look odd and what the real shapes are .

The two illustrations on the cover are optical illusions called pictures of "impossible objects". They look like three-dimensional objects. At the same time they don't look like they could physically exist. It turns out we can actually create these objects although they are called "impossible".

Tricky L-shaped blocks

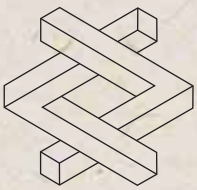
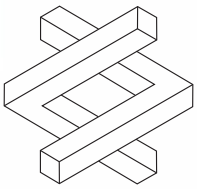


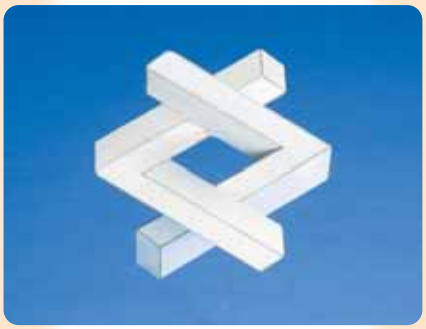
Figure incorporating optical illusion

The two L-shaped blocks have actual thicknesses, so they can't be crossed in the way shown here. The optical illusion is easily recognized by comparing it to the normal illustration shown below.



Normal illustration

Creates a three-dimensional object



Here's an actual three-dimensional object realizing the above "tricky L-shaped blocks" impossible figure. Because this object incorporates a *trompe l'oeil*, it presents a strange shape when viewed from a certain this angle.

Viewed from another angle

Here's the trick. The object looks very odd when viewed from another angle.

Playful posts

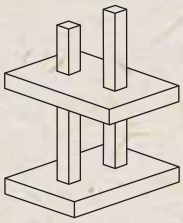
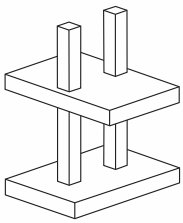


Figure incorporating optical illusion

On the lower level, the right post is positioned at the back. But on the upper level, it's the left post that is positioned at the back. Normally, the right post should be positioned at the back also on the upper level, as shown below.



Normal illustration

Creates a three-dimensional object

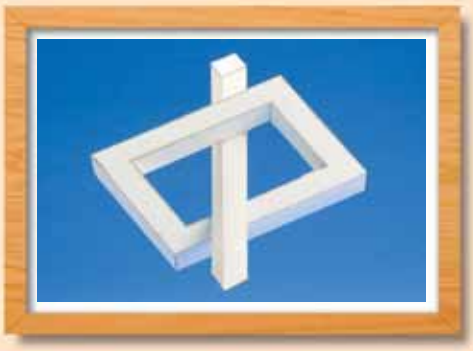
We can also transform the above illustration into a three-dimensional object. We didn't use any "unfair" tricks (like disconnecting the post at a hidden location).

Viewed from another angle

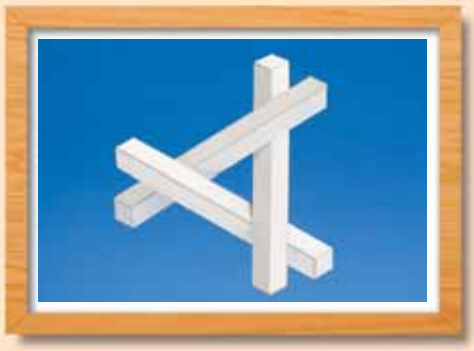
The trick behind this "impossible object" is the optical illusion created by the inclined posts. These posts look vertical when viewed from a certain angle.

Professor Sugihara's Gallery of Impossible Objects

Professor Sugihara continues to create one "impossible object" after another.



Whimsical ring



Three ambivalent posts

Endlessly ascending steps

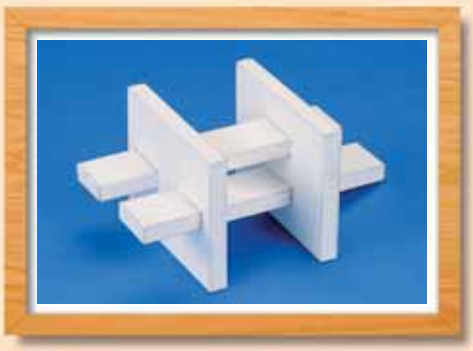
Playful V

Playful U

Eccentric windows

Irrational rings

Skillful walls

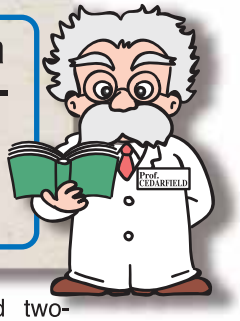


Conflict between horizontal and vertical

Playful twin towers

Prof. Kokichi Sugihara
Meiji Institute for Advanced Study of Mathematical Sciences, Meiji University

The surprising solutions provided by a computer designed to understand two-dimensional figures helped inspire Professor Sugihara start creating "impossible objects."

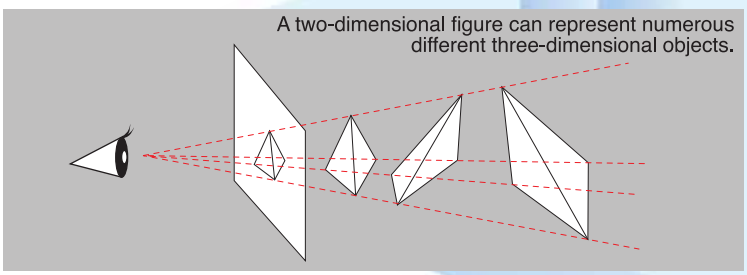


During research done with a computer to understand two-dimensional figures, I showed various drawings to the computer to see how it would interpret them. When I showed it "impossible objects," I expected the computer to conclude no such objects exist. Instead, to my surprise, the computer recognized certain figures as potentially real-world three-dimensional objects. Investigations showed this wasn't a bug in the computer program—some of these "impossible objects" were actually possible.

Now we know some of the tricks underlying "impossible objects." Before probing these tricks, let's consider some of the natural assumptions that create optical illusion.

1 Natural assumption regarding visual depth

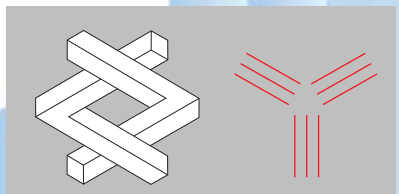
A three-dimensional object has width, height, and depth. On the other hand,two-dimensional figures don't have information on depth. But humans have the capacity to perceive a two-dimensional figure as a three-dimensional object. That's because our natural assumptions subconsciously add information on depth. These assumptions are generally correct, allowing us to interpret most drawings correctly. When we see an illustration of an "impossible object," we subconsciously try to perceive the object based on our natural assumptions. We end up concluding such objects couldn't exist. On the other hand, a computer examines all possibilities, and thus can discriminate between realizable objects and impossible objects correctly.



A two-dimensional figure can represent numerous different three-dimensional objects.

2 Natural assumption regarding right angles

The drawings of "impossible objects" in Professor Sugihara's Gallery have a common feature—the main components of each illustration are drawn with a set of three parallel lines. When we see such drawings, we tend to assume the faces are connected to each other at right angles. If the faces were connected at right angles, the objects would indeed be impossible. That's why they're called "impossible objects."



Only sets of three parallel lines are used in the illustration.

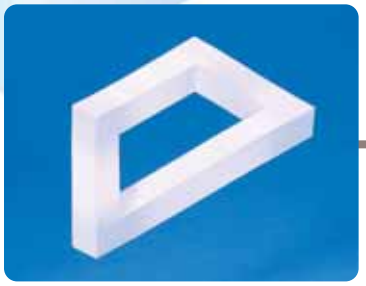
Some tricks used in "impossible objects" are classic. A new one was discovered by Professor Sugihara

These three objects might look the same, but each relies on a different trick to achieve its optical illusion.

Classic trick 1

The "hidden discontinuity" trick

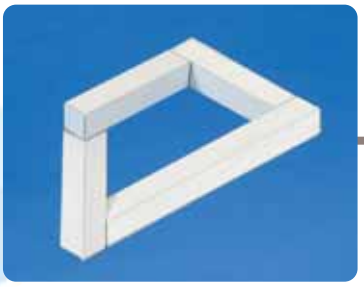
A section of the object is discontinuous along the axis of depth, despite looking continuous in the two-dimensional figure. This is one of the well-known tricks used to create an "impossible object."



Classic trick 2

The curved surface trick

Making a curved surface look flat in the two-dimensional figure creates an optical illusion. This is another well-known trick used to create an "impossible object."



New trick discovered by Professor Sugihara NEW

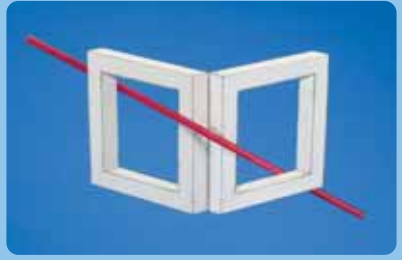
The non-right angle trick

Professor Sugihara discovered a way to create "impossible objects" without using the "unfair" tricks mentioned above. With this method, sections that appear connected in the two-dimensional figure are actually connected and surfaces that appear flat in the figure are actually flat. This trick involves using non-right angles where the faces look perpendicular in the two-dimensional figure.

Creating impossible motion

By applying the non-right angle trick, we can create motion that appears impossible.

Antigravity slide
A ball seems to roll up the inclined surface against gravity from the lower position to the higher position.



Magical windows
A stick passes through windows in a way that appears impossible.

Introducing “impossible objects” effectively into our daily lives and various aspects of our society makes our world a lot more fun!

Consider the potential applications of “impossible objects”

Monuments in parks and streets

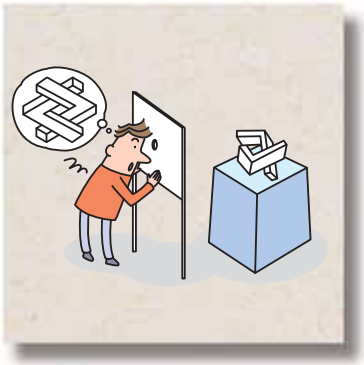
The monument might look like a strange (but relatively ordinary) object when you walk by, but you’ll be surprised to see an “impossible object” when you see it from certain perspectives—say, an observation deck.

Post marks for orienteering

Orienteering is a recreational activity in which participants try to find specified points on a course. Using “impossible objects” as post marks adds more fun to this sport. For example, in addition to finding the points, participants have to find a perspective from which each post mark looks like an “impossible object,” and then take a picture of the object from that perspective.

Trick art displays

When viewed through the hole, the object on display creates the optical illusion of an “impossible object.” It creates a second surprise when the viewer approaches to get a closer look, only to perceive the “real” shape of the object.

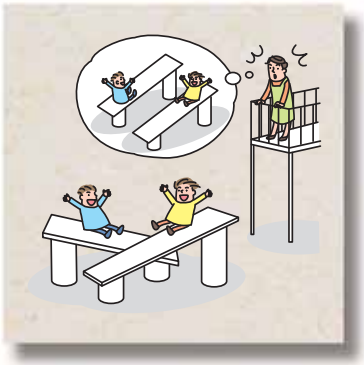


Desktop ornaments or stationery

Pick up an “impossible object” from your work desk and turn it this way and that to find the angle that creates an optical illusion. A fun way to enjoy a brief moment of relaxation in your busy workday!

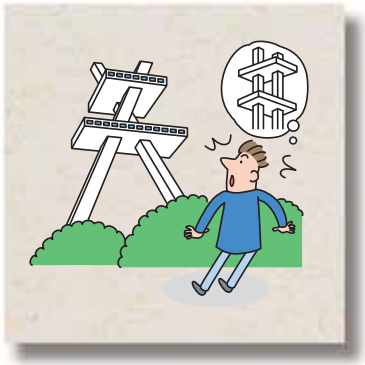
Play equipment in children’s parks

By incorporating the principle of “impossible objects,” we can make children look like they’re sliding up against gravity, rather than sliding down.



Architectural structures

An odd-looking architectural structure creates an optical illusion when viewed from a certain location, creating an ever-present arresting spectacle against the cityscape to passersby.



Contact address

Kokichi Sugihara kokichis@isc.meiji.ac.jp
Meiji Institute for Advanced Study of Mathematical Sciences, Organization for the Strategic Coordination of Research and Intellectual Property, Meiji University 1-1-1 Higashimita, Tamaku, Kawasaki 214-8571, Japan.Tel: +81-44-934-7674, Fax: +81-44-934-7660