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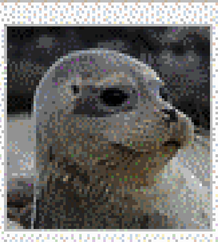
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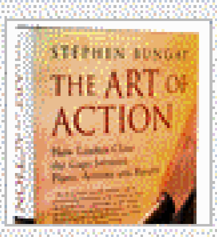
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VISUALIZER: 'SLEIGHTS OF MIND'

Brain Tricks

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In "Sleights of Mind: What the Neuroscience of Magic Reveals About Our Everyday Deceptions" (Henry Holt, 2010), authors Stephen L. Macknik and Susana Martinez-Conde, with Sandra Blakeslee, explain the secrets of illusions—from the way magicians take advantage of the brain's own logic to perform their tricks, to why a static drawing of lines will appear to be moving to our eyes.

The authors, based at the Barrow Neurological Institute in Phoenix, spent several years following magicians for their book. They explain the mechanics of tricks like sawing a woman in half, bending a spoon and making a ball disappear. They also look at visual illusions dating back to the trompe l'oeil paintings of the 15th century. Here's a look at some visual tricks.


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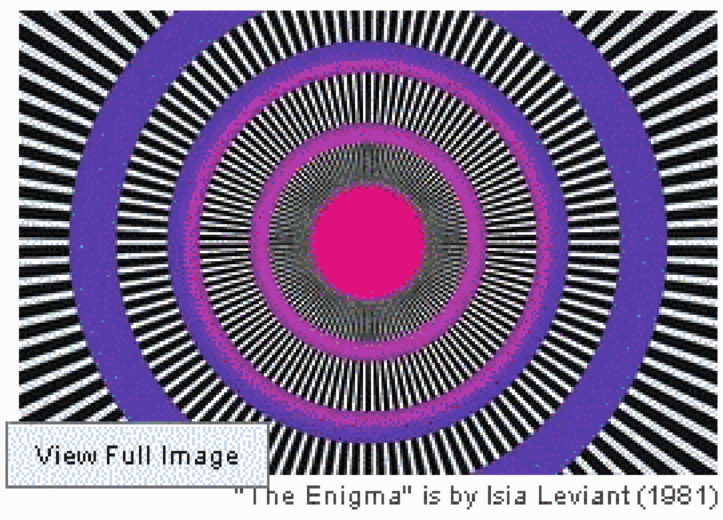
By Margaret S. Livingstone/ Harvard Medical School
The central area of the eye, the fovea, is where you pick out details.

Mona Lisa's puzzling smile can be explained by peculiarities of our visual system. When you look at her mouth, her smile is not apparent. When you gaze away from her mouth, her smile appears. The reason: The central area of the eye, the fovea, is where you pick out details. The peripheral area, surrounding the fovea, is where you see gross details, motion and shadows.

When your gaze centers on Mona Lisa's eyes, your peripheral vision picks up shadows from her cheekbones that enhance her smile. When your eyes go to her mouth, your central vision does not integrate the shadows, and the smile is gone. The images above show her smile as seen in the far periphery, near periphery and center of gaze, with her smile more pronounced in the left and middle panels.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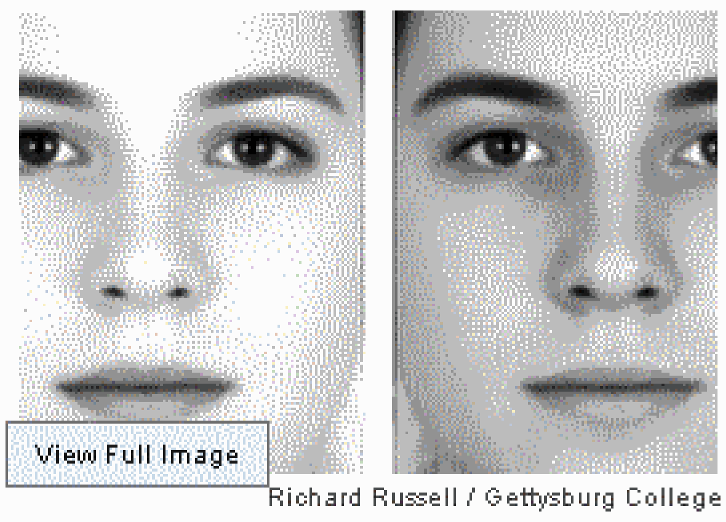
"The Enigma" is by Isia Leviant (1981)
"Enigma" demonstrates the illusion of motion.

In "Enigma," an image that was first created in 1981, the pattern is static but it seems to be moving. For decades, scientists weren't sure whether this illusion of motion starts in the eyes or the brain. A 2008 experiment by Dr. Martinez-Conde, Dr. Macknik and their collaborators at Barrow found that it starts in the eyes.

The authors asked subjects to say when the motion sped up or slowed down as they looked at the image; at the same time, the subjects' eye movements were being recorded. Before the subjects reported periods of faster motion, their rate of microsaccades—tiny eye movements that occur any time when we're looking at an object—increased. Our eyes are constantly moving, making the pattern look like it's moving.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Richard Russell / Gettysburg College
The only difference between these two faces is their degree of contrast.

The only difference between these two faces is their degree of contrast. Yet the face on the left appears female and the one on the right looks male. That's because female faces tend to have more contrast between the eyes and mouth and the rest of the face than males. (Makeup often further exaggerates that contrast.)

Richard Russell, the Harvard University neuroscientist who created this illusion, found that increasing the contrast of a face makes it more feminine. Conversely, reducing contrast makes it look more masculine.


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Frederick Kingdom, Ali Yoonessi and Elena Gheorghiu / McGill University.
Our visual system treats the two images as if they were part of a single scene.

The two images of the Leaning Tower of Pisa at right are identical, but to a viewer it seems that the tower on the right leans more. This is because our visual system treats the two images as if they were part of a single scene. Normally, two neighboring towers will rise skyward in parallel, with their outlines converging as they recede from view.

This is one of the iron-clad laws of perspective, and it's so invariant that your visual system automatically takes it into account. Since the outlines don't come together as the towers rise in the images above, our visual system is forced to assume that the two side-by-side images must be diverging—and that the tower on the right is tilting more to the right. And this is what you "see," no matter how hard you try to view each image as distinct.

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