

The Eyes Have It

Eye gaze is critically important to social primates such as humans. Maybe that is why illusions involving eyes are so compelling

By Susana Martinez-Conde and Stephen L. Macknik

The eyes are the window to the soul. That is why we ask people to look us in the eye and tell us the truth. Or why we get worried when someone gives us the evil eye or has a wandering eye. Our language is full of expressions that refer to where people are looking—particularly if they happen to be looking in our direction.

As social primates, humans are keenly interested in determining the direction of gaze of other humans. It is important for evaluating their intentions and critical for forming bonds and negotiating relationships. Lovers stare for long stretches into each other's eyes, and infants focus intently on the eyes of their parents. Even very young babies look at simple representations of

faces for longer than they look at similar cartoonish faces in which the eyes and other features have been scrambled.

In this article, we investigate a series of illusions that take advantage of the way the brain processes eyes and gaze. It turns out that it is fairly easy to trick us into thinking that someone is looking somewhere else.

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GHOSTLY GAZES

Not knowing where a person is looking makes us uneasy. For this reason, it can be awkward to converse with somebody who is wearing dark sunglasses. And it is why someone might wear dark sunglasses to look “mysterious.”

A recently identified visual illusion takes advantage of the unsettling effect of uncertainty in gaze direction. The “ghostly gaze” illusion, created by Rob Jenkins of the University of Glasgow in Scotland, was awarded second prize in the 2008 Best Illusion of the



Year Contest, held in Naples, Fla. In this illusion (*left and center*), twin sisters appear to look at each other when seen from afar. But as you approach them, you realize that the sisters are looking directly at you!

The illusion is a hybrid image that combines two pictures of the same woman. The overlapping photos differ in two important ways: their spatial detail (fine or coarse) and their direction of gaze (sideways or straight ahead). The images that look toward each other contain only coarse features, while the ones that look straight ahead are made up



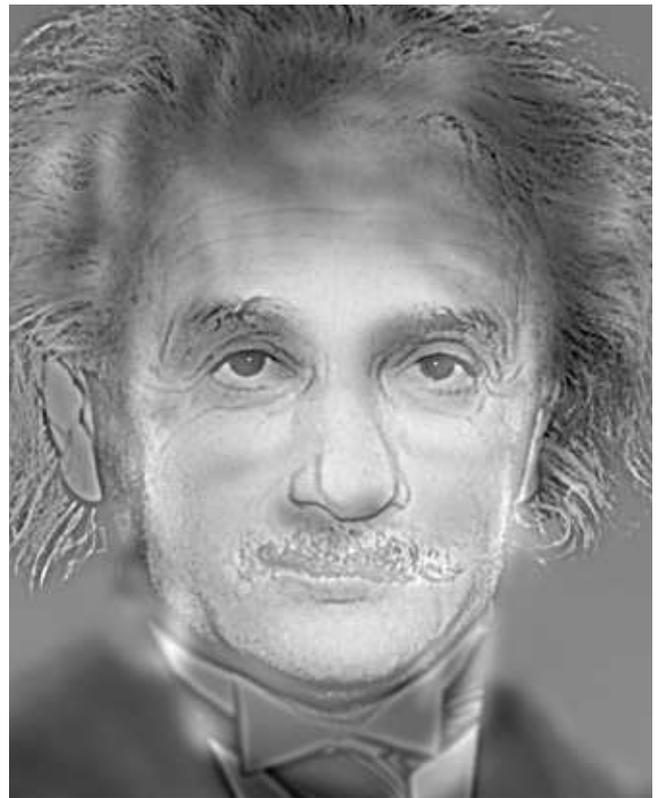
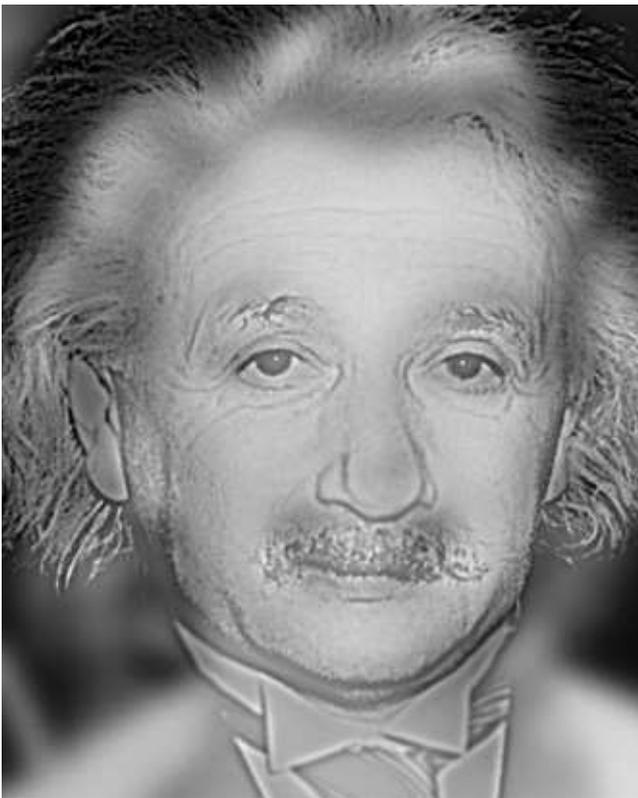
of sharp details. When you approach the pictures, you are able to see all the fine detail, and so the sisters seem to look straight ahead. But when you move away, the gross detail dominates, and the sisters appear to look into each other's eyes. See an interactive demo at <http://illusioncontest.neuralcorrelate.com/2008/ghostly-gaze>.

In another example of a hybrid image (*right*), a ghostly face appears to look to the left when you hold the page at normal reading distance. Step back a few meters, however, and she will look to the right.

COURTESY OF ROB JENKINS University of Glasgow

CONTEXTUAL CUES

Contextual cues, such as the position of the face and the head, also influence the perceived direction of gaze. In this illusion created by Akiyoshi Kitaoka, a professor of psychology at Ritsumeikan University in Japan, the girl on the left appears to gaze directly at you, while the girl on the right appears to be looking to her left. In reality, the eyes of both girls are identical. This illusion was first described in 1824 by British chemist and natural philosopher William Hyde Wollaston, who also discovered the elements palladium and rhodium.



EINSTEIN'S ALTER EGOS

The ghostly gaze illusion is based on a hybrid-image technique created by Aude Oliva and Philippe G. Schyns of the Massachusetts Institute of Technology. In a shocking example of how perceptual interpretation of hybrid images varies with viewing distance, Albert Einstein, seen from up close, becomes Marilyn Monroe (*left*) or Harry Potter (*right*), when seen from a few meters away. For more hybrid images created by the Oliva laboratory, visit the hybrid image gallery at http://cvcl.mit.edu/hybrid_gallery/gallery.html.

COURTESY OF AKIYOSHI KITAOKA, Ritsumeikan University (top);
COURTESY OF AUDE OLIVA, M.I.T. (bottom)



SEEING DOUBLE?

What if you duplicate some of the features of a portrait without overlapping them completely? It is relatively easy to create images in Photoshop in which the eyes and the mouth, but no other facial features, have been doubled. The results are little short of mind-bending: as the brain struggles (and fails) to fuse the doubled-up features, the photograph appears unstable and wobbly, and observers experience something akin to double vision.

The neural mechanisms for this illusion may lie within our visual system's specialized circuits for face perception. If you double up the eyes and mouths in a portrait, the neurons in the face-recognition areas of the brain may not be able to process this visual information correctly. Such failure could make the faces unsteady and difficult to perceive.



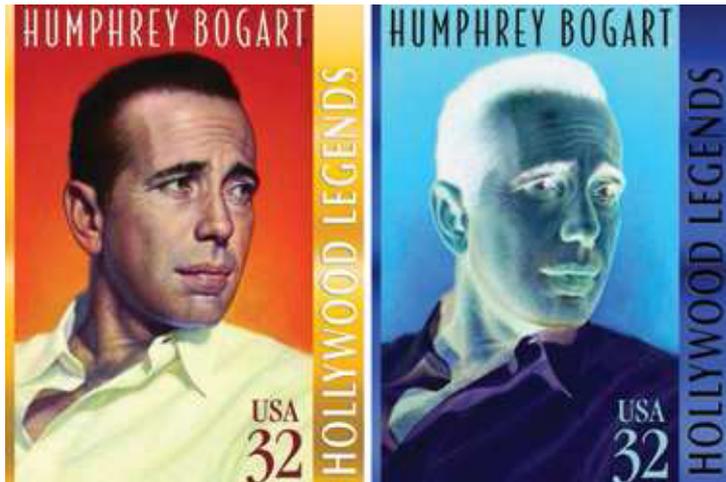
THE IRIS ILLUSION

This illusion, by vision scientists Jisien Yang and Adrian Schwaninger of the Visual Cognition Research Group at the University of Zurich, was one of the top 10 finalists in the 2008 Best Illusion of the Year Contest. It shows that context, such as the shape of the eyelids and face, affects the apparent distance between the irises. Consider the pair of Asian faces

shown here: the distance between the left eye of the right face and the right eye of the left face seems short. In the Caucasian faces, the separation looks wider. Notice the reconstructions of the eyes and irises below each face: without the context of the face and eyelid shapes, it is clear that the irises are equally spaced. Visit <http://illusioncontest.neuralcorrelate.com/2008/yang-iris-illusion> for more details.

HERE'S LOOKIN' AT YOU, KID

Vision researcher Pawan Sinha of the Massachusetts Institute of Technology shows us with this illusion that our brains have specialized mechanisms for determining gaze direction. In the normal photograph of Humphrey Bogart (left), the actor appears to be looking to his left, but in the photo negative (right) he appears to be looking in the opposite direction. Yet Bogart's face does not look backward; only the eyes are reversed. Why? The answer is that we have specialized modules in our brain that determine gaze direction by comparing the dark parts of the eyes (the irises and pupils) with the whites. When the face is negative, the whites and irises appear to swap position. Our knowledge that irises are light rather than dark in a negative does not change our perception of this illusion.



COURTESY OF WALDEMAR JUNQUEIRA (top); COURTESY OF JISIEN YANG AND ADRIAN SCHWANINGER, University of Applied Sciences Northwestern Switzerland and University of Zurich (middle); COURTESY OF PAWAN SINHA AND TOMASO POGGIO, M.I.T. (bottom)