Cracking the Da Vinci Code

What do the Mona Lisa and President Abraham Lincoln have in common?

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SPANISH PAINTER EL GRECO often depicted elongated human figures and objects in his work. Some art historians have suggested that he might have been astigmatic—that is, his eyes' corneas or lenses may have been more curved horizontally than vertically, causing the image on the retina at the back of the eye to be stretched vertically. But surely this idea is absurd. If it were true, then we should all be drawing the world upside down, because the retinal image is upside down! (The lens flips the incoming image, and the brain interprets the image on the retina as being right-side up.) The fallacy arises from the flawed reasoning that we literally "see" a picture on the retina, as if we were scanning it with some inner eye.

No such inner eye exists. We need to think, instead, of innumerable visual mechanisms that extract information from the image in parallel and process it stage by stage, before their activity culminates in perceptual experience. As always, we will use some striking illusions to help illuminate the workings of the brain in this processing.

Angry and Calm

Compare the two faces shown in a. If you hold the page about nine to 12 inches away, you will see that the face on the right is frowning and the one on the left has a placid expression.

But if you move the figure, so that it is about six or eight feet away, the expressions change. The left one now smiles, and the right one looks calm.

How is this switch possible? It seems almost magical. To help you understand it, we need to explain how the images were constructed by Philippe G. Schyns of the University of Glasgow and Aude Oliva of the Massachusetts Institute of Technology.

A normal portrait (photographic or painted) contains variations in what neuroscientists such as ourselves term "spatial frequency." We will discuss two types of spatial frequency: The first is "high"—with sharp, fine lines or details present in the picture. The second is "low"—conveyed by blurred edges or large objects. (In fact, most images contain a spectrum of frequencies ranging from high to low, in varying ratios and contrasts, but that is not important for the purposes of this column.)

Up close, one face frowns and the other looks calm. Viewed from farther away, the two faces change. How?