The Illusions of Love

How do we fool thee? Let us count the ways that illusions play with our hearts and minds

By Stephen L. Macknik and Susana Martinez-Conde

On Valentine's Day, everywhere you look there are heart-shaped balloons, pink greeting cards and candy boxes filled with chocolate. But what is true love? Does it exist? Or is it simply a cognitive illusion, a trick of the mind?

Contrary to the anatomy referenced in all our favorite love songs, love (as with every other emotion we feel) is not rooted in the heart, but in the brain. (Unfortunately, Hallmark has no plans to mass-produce arrow-pierced chocolate brains in the near future.) By better understanding how the brain falls in love, we can learn about why the brain can get so obsessed with this powerful emotion. In fact, some scientists even see love as a kind of addiction. For instance, neuroscientist Thomas Insel and his colleagues at Emory University discovered that monogamous pair bonding has its basis in the same brain reward circuits that are responsible for addiction to drugs such as cocaine and heroin. Their study was conducted in the prairie vole, a small rodent that mates for life. But the conclusions are probably true for humans, too, which may explain why it is so hard to break up a long-term romantic relationship. Losing someone you love is like going through withdrawal.

In this article, we feature a number of visual illusions with a romantic motif. We hope that you and your special one will enjoy them. And remember, even if love is an illusion, that doesn't mean it's not meaningful and real (to our brains, anyway).

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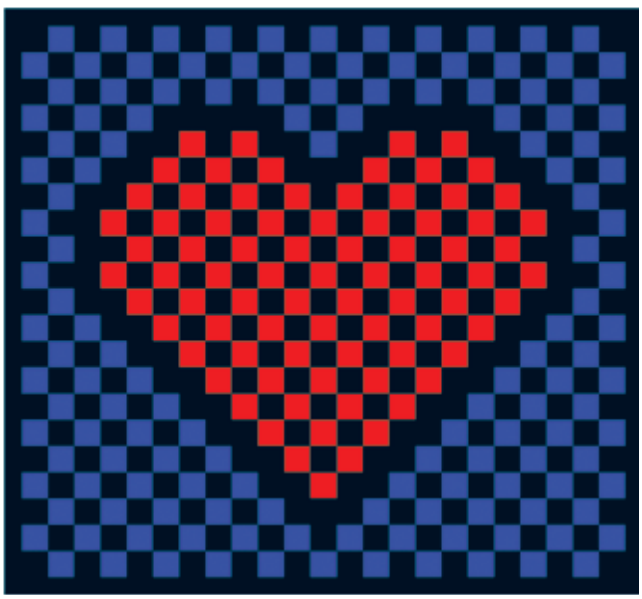

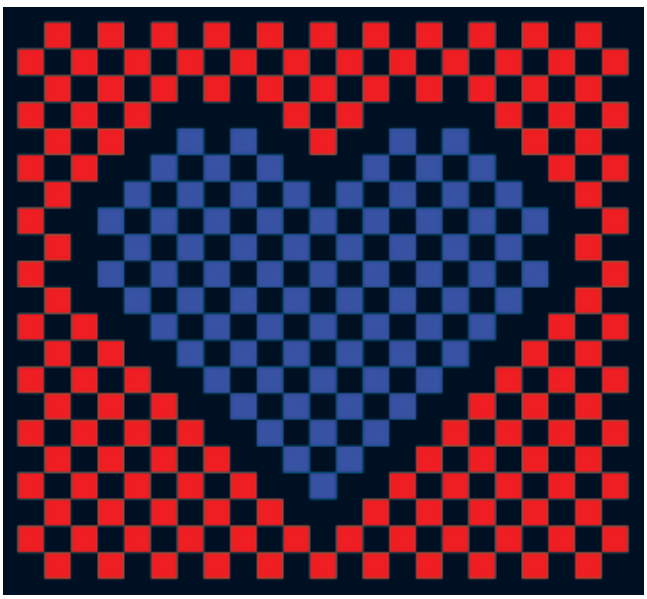

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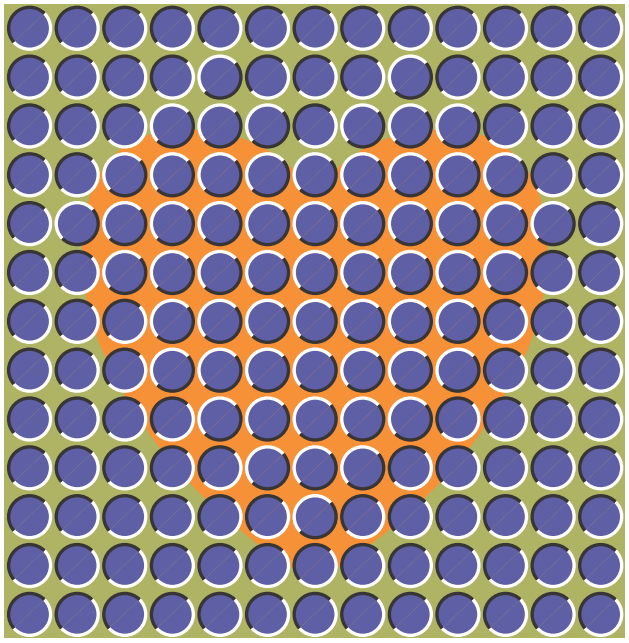
POP! GOES MY HEART

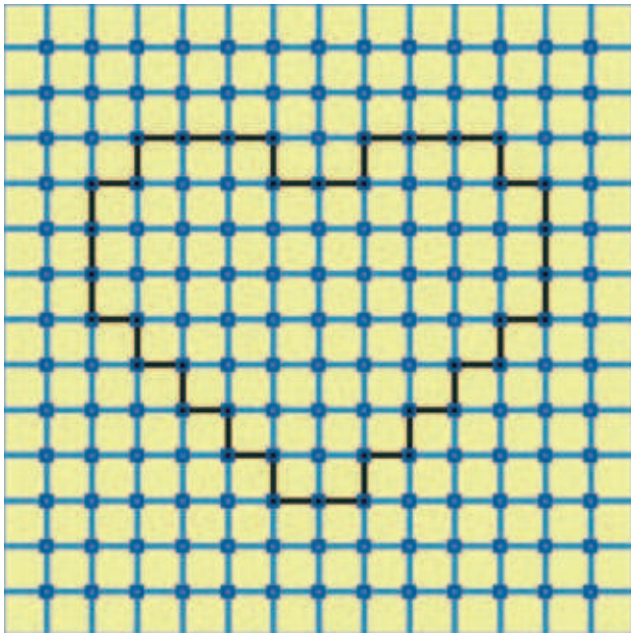
Nothing is more romantic than curling up in front of a fire with your loved one on Valentine's Day as you lovingly whisper "chromostereopsis." Okay, maybe it's not as passionate as a sonnet—unless you are a vision scientist. Look at the red and blue hearts and examine their depth with respect to the background. Most people find that the red heart pops in front of the blue background, whereas the blue heart sinks beneath the red background.

This illusion comes about because the lenses in our eyes refract blue light more than red. This phenomenon is called chromatic aberration; another example of this effect is seeing a rainbow when you shine white light through a prism. When both eyes view the red and blue images simultaneously, the cornea and lens of the eyes refract different amounts of the colors. The brain deals with this sensory aberration by imagining depth—the red heart is in front of the blue background, and vice versa—even though none actually exists.



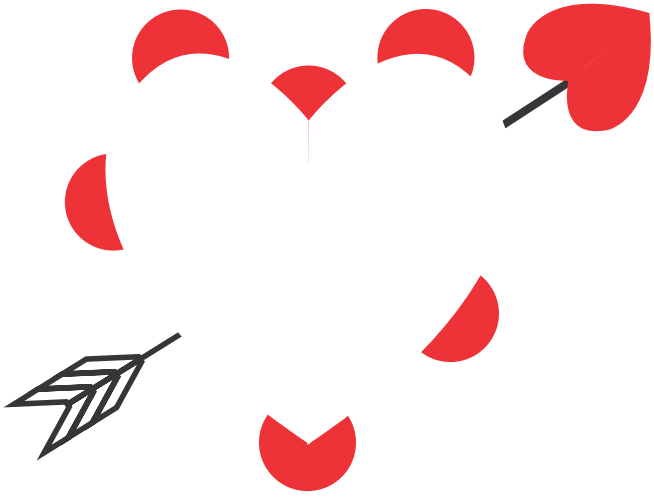
ILLUSIONS THAT MOVE THE HEART

Your wandering eyes pull at your lover's heartstrings. In this illusion, the heart appears to move and even pulsate as you look around the image. When your eyes move, they shift the retinal images of the black-and-white edges in the pattern, activating the motion-sensitive neurons in your visual cortex. This neural activation leads to the perception of illusory motion. Notice that if you focus your gaze on a single point, the illusory motion slows or stops.



ILLUSORY NEON HEART

Notice that the yellow fields inside the heart seem paler than the fields forming the contour of the heart, which appear to be a darker shade of yellow-orange. Right? Wrong. Actually all the yellow fields in the figure are identical. Any differences that you see are all in your mind. This effect is called neon color spreading, because it resembles the effect of the light spreading from a neon lamp. The neural underpinnings of this effect are not yet understood.



IS LOVE AN ILLUSION?

Spanish essayist Miguel de Unamuno said, "Love is the child of illusion and the parent of disillusion." Is this view cynical or biologically based? Illusions are, by definition, mismatches between physical reality and perception. Love, as with all emotions, has no external physical reality: it may be driven by neural events, but it is nonetheless a purely subjective experience. So, too, is the wounded heart we have drawn here. Where the arrow enters and exits the heart, there is no heart whatsoever, only an imaginary edge defined by the arrow.

This effect is called an illusory contour. We perceive the shape of the heart only because our brains impose a shape on a very sparse field of data. Neuroscientist Rüdiger von der Heydt and his colleagues, then at University Hospital Zurich in Switzerland, have shown that illusory contours are processed in neurons within an area of the brain called V2, which is devoted to vision. The illusory heart even looks slightly whiter than the background, although it is actually the same shade. Much of our day-to-day experience is made up of analogous feats of filling in the blanks, as we take what we know about the world and use it to imagine what we do not know.

MELISSA THOMAS, ADAPTED FROM WWW.AMAZING-ILLUSION.COM (*top*); G. SARCONE (*middle*); SUSANA MARTINEZ-CONDE AND STEPHEN L. MACKNIK (*bottom*)

A MATCHED SET
Is it a broken heart or two people kissing? Both, in the case of this two-piece Newman digital audio player. One for him and one for her.

LOVE AND AMOR
Here we see that love and amor are two sides of the same ambiguous object. This sculpture is an ambigram—an artwork or typographical design that can be read from two different viewpoints. Judith Bagai, editor of *The Enigma,* the official journal of the National Puzzlers' League, coined the term by contracting the words "ambiguous" and "anagram" (many ambigrams feature the same word seen from different directions).

AMBIGUOUS EMBRACES
Ambiguity is affected by our frame of mind. In the image on the left, *Message of Love from the Dolphins,* adult observers see two nude lovers embracing, whereas young children see only dolphins. If you still can't see the dolphins (we promise you they are there), look for more than two. In the image on the right, a Valentine's Day rose predicts the outcome of the evening's festivities.

BEIJING NEWSMY IDEAL DIGITAL TECHNOLOGY CO., LTD. (*top left*); FRANCIS TABARY (*top right*); SANDRO DEL PRETE (*bottom left* and *right*)