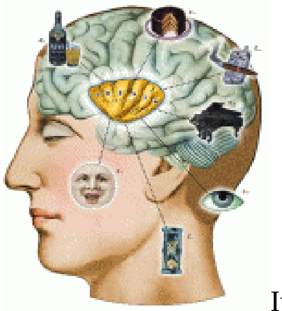
Make A History

Unlocking the Mysteries of The Artistic Mind



It might seem bizarre that science is using art to learn about the mind—looking for hard facts in the most ethereal of places. But great artists turn out to be the world's first neuroscientists. Consider the flightless fluffs of brown otherwise known as herring gull chicks. Since they're entirely dependent on their mothers for food, they're born with a powerful instinct. Whenever they see a bird beak, they frantically peck at it, begging for their favorite food: a regurgitated meal.

But this reflex can be manipulated. Expose the chicks to a fake beak—say, a wooden stick with a red dot that looks like the one on the end of an adult herring gull's beak—and they peck vigorously at that, too. Should the chicks see a wood stick with three red dots, they peck even faster. Abstracting and exaggerating the salient characteristics of a mother gull's beak strengthens the response. The phenomenon is known as the "peak-shift effect," since a peak pecking response comes from a shifted stimulus. In it lies one of the core principles of visual art.

The Truth in the Lie

In 1906, Pablo Picasso was determined to reinvent the portrait and push the boundaries of realism, and one of his early subjects was Gertrude Stein. After months in his Paris studio, carefully reworking the paint on the canvas, Picasso still wasn't satisfied. He didn't finish the painting until after a trip to Spain.

What Picasso saw there that affected him so deeply has been debated—the ancient Iberian art, the weathered faces of Spanish peasants—but his style changed forever. When he returned to Paris, he gave Stein the head of a primitive mask. The perspective was flattened and her face became a series of dramatic angles. Picasso had intentionally misrepresented various aspects of her appearance, turning the portrait into an early work of cubist caricature.

Despite the artistic license, the painting is still recognizable as Stein. Picasso took her most distinctive features—those heavy, lidded eyes and long, aquiline nose—and exaggerated them. Through careful distortion, he found a way to intensify reality. As Picasso put it, "Art is the lie that reveals the truth."

What's surprising is that such distortions often make it easier for us to decipher what we're looking at, particularly when they're executed by a master. Studies show we're able to recognize visual parodies of people—like a cartoon portrait of Richard Nixon—faster than an actual photograph. The fusiform gyrus, an area of the brain involved in facial recognition, responds more eagerly to caricatures than to real faces, since the cartoons emphasize the very features that we use to distinguish one face from another. In other words, the abstractions are like a peak-shift effect, turning the work of art or the political cartoon into a "super-stimulus."

The sly connection between the instincts of baby gulls and abstract art is the work of V.S. Ramachandran, neuroscientist and director of the Center for Brain and Cognition at the University of California at San Diego. Ramachandran believes the peak-shift effect explains a wide variety of art, from abstract expressionist paintings to ancient religious sculptures like a 12th-century Indian sculpture of the goddess Parvathi with exaggerated feminine features. These creations are all examples of the "deliberate hyperbole" that defines the artistic process, says Ramachandran.

In this sense, the job of an artist is to take mundane forms of reality—whether a facial expression or a bowl of fruit—and make those forms irresistible to the human brain. As Ramachandran puts it, "If herring gulls had an art gallery, they would hang a long stick with three red strips on the wall; they would worship it, pay millions of dollars for it, call it a Picasso, but not understand why they are mesmerized by it. That's all any art lover is doing when buying contemporary art: behaving exactly like those gull chicks."

Ramachandran is a leader in neuroaesthetics, a new scientific field that uses the tools of modern neuroscience, like brain imaging, to unravel the mysteries of art. While much of this research focuses on modern art—it's easier to study visual "hyperbole" in a Picasso than a Vermeer—the scientists believe their findings apply to all artists, even so-called realists. "A Martian who came to earth would be very curious about why all these people go to museums and look at 2D representations," Ramachandran says. "Why does art work? That's the question we're trying to answer."

Reverse-Engineering the Mind

At first glance, the premise of neuroaesthetics seems bizarre: Scientists are using artists to learn about the mind. They're looking for objective facts in the most subjective of places, using paintings and sculptures as sources of experimental data. Sometimes, it seems as if the scientists are simply trying to catch up with insights long ago "discovered" by artists.

"The artist is, in a sense, a neuroscientist, exploring the potentials and capacities of the brain, though with different tools," observes Semir Zeki, a neurobiologist at University College London and director of the Institute of Neuroesthetics. Picasso had an intuitive understanding of the mechanics of vision—which he expressed in his paintings. Likewise, the power of a Rembrandt self-portrait is not an accident: The Old Masters knew how to captivate the eye and the mind, which is why we still gaze at their canvases in museums. Scientists can learn about the mind by reverse-engineering art.

But neuroaesthetics is also trying to bring precision to the study of art. Unlike traditional approaches, which treat the artwork as a product of historical and cultural forces, neuroaesthetics looks at art through the lens of neuroscience. Neuroaesthetics researchers want to decipher the power of a Picasso or a Rembrandt, to explain the sublime in terms of the visual cortex. All the adjectives we use to describe art—vague words like "beauty" and "elegance"—should, in theory, have neural correlates. According to these scientists, there is nothing inherently mysterious about art. Its visual tricks can be decoded. Neuroaestheticians hope to reveal "the universal laws" of painting and sculpture, to find the underlying principles shared by every great work of visual art.

Blame it all on an astonishing set of experiments conducted by David Hubel and Torsten Wiesel in the 1950s. Scientists long assumed the eye was like a camera, and that our visual reality was composed of dots of light, neatly arranged in time and space. Just as a photograph is made up of a quilt of pixels, so must our eyes create a two-dimensional representation of reflected light, which scientists thought was then seamlessly transmitted to the brain.

But Hubel and Wiesel demonstrated that the brain is much stranger than that. Instead of responding to pixels, cells in the visual cortex respond to straight lines and angles of light. The neurons prefer contrast over brightness, straight edges over curves; contrasts allow us to more efficiently pick out objects. Hubel and Wiesel became the first scientists to describe what reality looks like before it has been perceived, when our mind is still creating our sense of sight.

The findings wowed the scientific community and won Hubel and Wiesel the Nobel Prize. It turns out that the raw material of vision is incomprehensibly bizarre, that all of our visual perceptions begin as a jigsaw puzzle of lines, edges, and angles. The experimental results help explain the aesthetic appeal of abstract paintings.

Teasing the Brain's Limits

Artists have learned to exploit other features of the visual system, too. The brain is an evolved machine, subject to all sorts of biological constraints. All of our color perception, for example, is wrangled from the responses of three different photoreceptors in the eye. Great art manages to translate these "limitations" into riveting creations.

When Mark Rothko painted an entire canvas in three shades of maroon, or Josef Albers painted his intensely colorful Homage to the Square in five slightly different shades of yellow, these abstract artists were tickling the parts of our visual cortex concerned with the processing of color. The visual cortex excels at perceiving contrasts between different colors, such as blue and yellow, but these paintings deliberately avoided sharp contrasts of color. The result is that the subtly distinct shades seem to shimmer and shift before our very eyes. We are riveted by these stimuli we can't understand.

The strategy of taking advantage of the brain's imperfections isn't confined to modern art. Consider Leonardo da Vinci's portrait of the Mona Lisa, perhaps the most famous painting in the world. The smile is notoriously enigmatic, a precise summary of an ambiguous emotion. But what is it about those slyly upturned lips that make the portrait so intriguing?

Margaret Livingstone, a neuroscientist at Harvard and author of Vision and Art, argues that da Vinci exploits the peculiar structure of the retina. The facial expression of the Mona Lisa fluctuates depending on which part of our retina we are using to look at her mouth, she explains. When we first look at the painting, our eyes are automatically drawn to her eyes, which means our peripheral vision perceives her smile. This part of the retina naturally focuses on the shadows cast by her cheekbones, which serve to exaggerate the curvature of her lips. As a result, our peripheral vision concludes that the Mona Lisa is smiling. Livingstone demonstrated this by blurring the entire painting with Adobe Photoshop to replicate what we would see if we were relying solely on peripheral vision. The end result: a much happier Mona Lisa.

But when we focus on her mouth, the retina ignores the shadows—the blurriness disappears. Instead, we fixate on the lips of the Mona Lisa, which are virtually expressionless. All of a sudden, she is no longer happy: The painting has literally changed before our eyes. This ambiguity is intriguing, Livingstone argues, as we keep staring at the painting to figure out what she's actually feeling. "I do not mean to take away the mystery of Leonardo," Livingstone told the New York Times. "It took the rest of us 500 years to figure out what he was up to."

10 Perceptual Principles of Great Art

PEAK SHIFT: We find deliberate distortions of a stimulus even more exciting than the stimulus itself—which is why cartoon caricatures grab our attention.

GROUPING: It feels nice when the distinct parts of a picture can be grouped into a pattern or form. The brain likes to find the signal amid the noise.

BALANCE: Successful art makes use of its entire representational space, and spreads its information across the entire canvas.

CONTRAST: Because of how the visual cortex works, it's particularly pleasing for the brain to gaze at images rich in contrast, like thick black outlines or sharp angles—or, as in the geometric art of Mondrian, both at once.

ISOLATION: Sometimes less is more. By reducing reality to its most essential features—think a Matisse that's all bright color and sharp silhouettes—artists amplify the sensory signals we normally have to search for.

PERCEPTUAL PROBLEM SOLVING: Just as we love solving crossword puzzles, we love to "solve" abstract paintings such as cubist still lifes or Cézanne landscapes.

SYMMETRY: Symmetrical things, from human faces to Roman arches, are more attractive than asymmetrical ones.

REPETITION, RHYTHM, ORDERLINESS: Beauty is inseparable from the appearance of order. Consider the garden paintings of Monet. Pictures filled with patterns, be it subtle color repetitions or formal rhythms, appear more elegant and composed.

GENERIC PERSPECTIVE: We prefer things that can be observed from multiple viewpoints, such as still lifes and pastoral landscapes, to the fragmentary perspective of a single person. They contain more information, making it easier for the brain to deduce what's going on.

METAPHOR: Metaphor encourages us to see the world in a new way: Two unrelated objects are directly compared, giving birth to a new idea. Picasso did this all the time—he portrayed the bombing of Guernica, for example, with the imagery of a bull, a horse, and a lightbulb.