Warped Perceptions

The work of famous painters reveals how visual and neural pathologies can shape great art

All visual art is illusory in that it involves a departure from reality, a filtering through the mind of the artist. This subjectivity applies not only to abstract works but also to representational art, in which the artist translates his or her perception into a physical object capable of inducing a similar perception in the viewer.

Painters render the three-dimensional world on a flat surface. These representations are enough to suspend our visual system's disbelief and trigger barrages of neuronal firing that become illusions of bathers, bridges and water lilies. It is never about reality but about how the artist sees and wants to portray it. This artistic vision is a mishmash of expectations, memories, assumptions, imagination and intent. It is also, in a sense, a reflection of neural shortcuts and basic visual processes.

The picture becomes even more complicated when painters suffer from pathologies of the eyes or brain that force them to see their surroundings in ways that diverge from standard experience. The artwork produced by such artists allows us to participate in their perception—and misperception—of the world.

For example, failing vision can translate into an eerie loss of precision and detail in paintings. The pictures of American artist Georgia O’Keeffe became flatter and less intricate as she developed bilateral age-related macular degeneration, a retinal disease that affects central, high-resolution vision. The later works of American painter Mary Cassatt similarly show an uncharacteristic absence of delicacy in faces as she developed cataracts. French impressionist Claude Monet also had cataracts, which rendered his paintings imprecise and muted in color. After he underwent successful cataract surgery, his paintings regained definition and vibrancy.

As the examples in this column attest, the effects of vision or brain diseases can sometimes be traced in great works of art.
The 16th- and 17th-century paintings of El Greco are populated by famously elongated figures. These curious forms have kindled speculation that the painter may have suffered from astigmatism, an optical defect. The reasoning goes that spectacle lenses could have overcorrected El Greco’s astigmatism, producing retinal images that were stretched horizontally, thus causing the master to paint tall and skinny objects that appeared normal to him.

To test this idea, vision scientist Stuart Anstis of the University of California, San Diego, transformed experimental subjects with normal eyes into “artificial El Grecos” with a special telescope that stretched their retinal images horizontally by 30 percent. When the subjects attempted to draw a square from memory, they drew a tall, thin rectangle instead. But when they tried to copy an actual square, they drew a flawless replica. That is, there was an “El Greco” effect in the drawings made from memory but not in the copies. Then, to simulate lifelong astigmatism, Anstis persuaded a volunteer to wear the distorting telescope for two days straight. She copied squares and drew squares from memory four times each day. The copied squares were always picture-perfect, but the squares from memory were not always so: they started 50 percent too tall and grew progressively shorter with time. By the end of the second day, she was drawing impeccable squares. Anstis concluded that even if El Greco suffered from astigmatism, he would have quickly adapted to it.

So why would El Greco employ such strange figures? Artistic evidence offers a different explanation. El Greco sketched his subjects with standard proportions first and only elongated them in his paintings. And he did so selectively, portraying angels as taller and slimmer than people. The fact that El Greco did not always employ an elongated style suggests that the lengthening was an aesthetic choice.

French artist Edgar Degas, who lived from 1834 to 1917, experienced progressive visual loss in the last 30 years of his life. In 2006 ophthalmologist Michael F. Marmor used information from Degas’s correspondence and computational simulations of the painter’s perception in an attempt to diagnose Degas and better understand how the artist would have experienced the world.

Marmor concluded that Degas’s central vision, where acuity is sharpest, weakened in his later years. Many aspects of Degas’s art, such as the shading, color and overall composition of his paintings, were remarkably robust to his visual loss, however. As his central vision grew blurry, his paintings became coarser and lost refinement. Yet Degas himself might not have noticed a fundamental difference between his earlier work and later paintings, such as this depiction of ballerinas from his later years. This is because he would have been equally unable to focus his central vision on the older paintings. Marmor suspects that Degas’s later works looked smoother and more natural to the painter (filtered through his own visual pathology) than to viewers with healthy eyes.
REMORRANT'S STEREO BLINDNESS

Close your left and right eye in quick succession, and you will notice that each eye has a slightly different perspective. Neurons in the visual cortex of the brain use the horizontal shift between the two eyes to produce stereoscopic vision, one of the primary ways in which we are able to see depth in the world. Because our two retinas are fundamentally two-dimensional structures, our perception of the third dimension is an illusion, a brain construct.

In 2004 neuroscientists Margaret S. Livingstone and Bevil R. Conway, both then at Harvard Medical School, observed that 17th-century Dutch painter Rembrandt van Rijn’s eyes were often misaligned in his self-portraits, so that one eye appeared to look directly at the viewer, whereas the other eye looked off to the side. Livingstone and Conway wondered whether Rembrandt had painted himself with ruthless accuracy, which would suggest that the painter was actually walleyed. They measured aspects of Rembrandt’s gaze in 36 self-portraits and found that if these paintings were true to life, Rembrandt did not have normal stereovision. In short, he would have struggled to see depth with stereoscopic cues.

Rembrandt’s poor stereovision may have been advantageous. Art students routinely learn to close one eye to replicate the three-dimensional world onto a flat medium with greater accuracy. Stereo blindness, or the inability to use the horizontal shift between our eyes to see in 3-D, can therefore aid artists in rendering the world in two dimensions.

Livingstone and Conway went on to show that art students have poorer stereovision than students not majoring in arts and that the eyes of established artists have a more pronounced misalignment than the eyes of non-artists. Stereo blindness may not make you an artist—many established artists have normal stereovision, and most stereo blind people are not artists—but the early sketches of stereo blind artists may be more accurate than those of people with normal stereovision. Thus, people with poor stereovision may feel more encouraged to persevere in their artistic training.

FURTHER READING

- A Neurological Disorder Presumably Underlies Painter Francis Bacon Distorted World Depiction. Avinoam B. Safran et al. in Frontiers in Human Neuroscience, Vol. 8, Article No. 581; August 29, 2014.

SELF-PORTRAITS OF A CRUMBLING MIND

American artist William Utermohlen received a diagnosis of probable Alzheimer’s disease in 1995, at the age of 61. For the next five years, as his dementia worsened, he used his art to track the disintegration of his mind. Utermohlen’s self-portraits, such as the sketches above from 1996, offer a window into the artist’s experience of the progression of Alzheimer’s. Many of the stylistic changes in the depictions are likely the result of the quick decline of Utermohlen’s visuospatial and motor skills over the course of a few short years. Yet the portraits are also heartbreaking in that they expose a mind trying against hope to understand itself despite deterioration.