Health & Science

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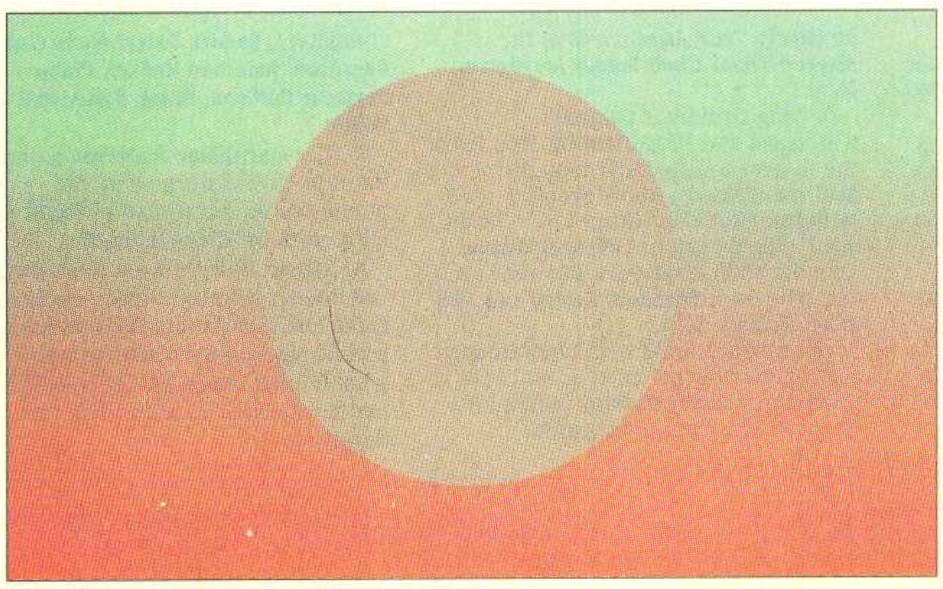
In the mind's eye

The brain completes what the eye receives. Scientists know that much from how we perceive art. To explore the process further, researchers are taking up brushes themselves.

For The Inquirer / DAVID SWANSON

Paintings illuminate science *at Rutgers University, where Dr. Thomas Papathomas studies vision.*



Robert Shapley *of New York University painted "instability" to demonstrate "illusory contour." The gray circle is broken, but the brain both completes the pattern and adds color from the background.*

By Faye Flam
INQUIRER STAFF WRITER

Vision is a mystery.

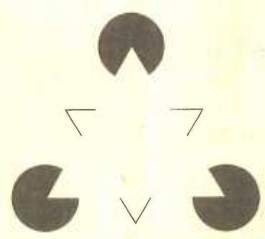
The way the eye focuses light is simple and understandable. But scientists are just beginning to probe what happens after that in the dark recesses of the brain, where streams of data flowing from the optic nerve are transformed into a picture of the world.

Some clues to the process come from artists, who with just a few simple lines or brush strokes can suggest a face, a body, branches or flowing waves. In an attempt to represent nature, artists are in fact taking advantage of the brain's pattern-recognition ability.

"The artists are sometimes a bit ahead of the scientists," says vision researcher Thomas Papathomas of Rutgers University in New Brunswick, N.J.

Some scientists are beginning to

See **VISION** on C4



The Kanizsa triangle *is another example of an illusory contour. It appears among the V's and Pac-man-shaped figures as the brain hunts for an orderly pattern to interpret in the image.*

Using art to unlock secrets of the mind's eye

VISION from C1

make art creations of their own in an attempt to understand how the brain and eye work together to see.

Robert Shapley of the Center for Neural Science at New York University has created a work called *instability*. [*See illustration on Page C1.*] It features two pieces of a broken circle, but to the eye it looks like a complete circle. The brain, Shapley says, fills in the missing parts of the boundary, something known as the "illusory contour."

It is an effect that Italian psychologist Gaetano Kanizsa popularized in the 1950s with a figure called the Kanizsa triangle — three Pac-man-shaped figures whose arrangement forces most people to see a triangle pop out among them. [*See illustration on Page C1.*]

"The brain is hunting for order," explains Shapley. "And it finds order, even if it is given indirectly."

He calls this imposition of order on the world "very intelligent process," though it happens instantaneously and mindlessly. The brain carries on a kind of unconscious problem-solving, he says, taking in visual signals and finding a "solution" that corresponds to a picture of the world.

Sometimes more than one solution is possible, as in the case of the Kanizsa triangle, which can appear as either a triangle or as three open-mouthed Pac-men, depending on how you look at it.

Shapley doesn't think that the brain is fooled in either case — it just has to choose between two valid interpretations.

He believes that our tendency to see illusory contours comes from an interplay between "lower" brain functions that take in size and positions of objects in space, and "higher" functions that help us recognize objects by matching them to shapes and forms stored in memory. It is a process that may explain why people unconsciously see faces and animals in clouds, or pictures in the stars.

In an unusual coming together of art and science this fall, Shapley and other scientists displayed some of their artwork at a New York gallery. Shapley's *instability* was featured. He wanted to experiment with adding color to an illusory contour figure, so he took the broken circle, which seems to be whole, and painted the inside gray. Then he added pink and blue to part of the background.

At first glance, the inside of the circle appears gray, but slowly pink and blue creep in and flow, or shift, like clouds in a sunset.

"The idea that you can see your perception change over a long time is quite amazing," he says, and adds that what you are witnessing is your brain searching for an interpretation. The nature of the picture forces the brain to take seconds or even minutes to make a decision it usually performs in a fraction of a second.

Rutgers' Papathomas is experimenting with the ways prior experience can affect visual perception, and how people can will themselves to see things in different ways.

He illustrates this with a piece called *Now you see it, now you don't, or don't you?* [*See painting in photo on Page C1.*] It demonstrates how people can consciously suppress certain details of a picture in order to pull out patterns that would otherwise be lost.

His picture used a series of red and green dashes arranged in the form of block letters — some of which became hard to see unless the viewer made an effort to look at just the red or just the green dashes and suppress the others.

This work, he says, illustrates the way the neurons in the brain parcel out the task of perception. Some are "tuned," he says, to certain colors, others to certain orientations in space. There are no neurons that are good at detecting both color and position at the same time, so when both cues are thrown at us at once, the figures become hard to see.

In the New York art show, psychologist Denis Pelli of NYU showed what appeared to be blank canvases — a technique not unknown to art — but in these works, very faint letters would take shape after a few seconds. His work, like Shapley's, forces the brain to take seconds to do what it usually does in microseconds.

The show also featured a work by artist Chuck Close, who is known for creating strikingly detailed and realistic images of faces, building them up from tiny squares, like the dots that make up a newspaper picture or the pixels in a digitized image.

In some of his more recent work, he has used not simple building blocks, but complex ones — ovals, and other more contorted shapes colored like party balloons. These pieces, he says, have nothing to do with the final image, and they tend to disappear when a viewer's brain takes in the entire picture.

Close said he doesn't like computers, nor has he ever considered himself good at math or science. Vision researchers, however, consider him one of their own. His work is a constant series of experiments, and in doing them he reveals something about how we see.