

## Science in culture

### Through a looking glass

Did major artists use optical devices to plot points to help them paint?

Rex Dalton

Last year, as artist David Hockney was working on his soon-to-be-published book on lens use in creating paintings, a common fascination with optics brought him together with Arizona physicist Charles Falco. The resulting collaboration may leave a lasting imprint on the worlds of art and science.

Hockney holds, controversially, that before the advent of photography in the mid-nineteenth century, major European artists used optical devices for over 500 years to help capture exactness of expression or perspective in their pictures.

Hockney's best known works include huge collages constructed of hundreds of small photographs, giving him a special eye for creating pictures at some distance with a lens. In 1999, he started to develop his theory of lenses as artists' aids after attending a London exhibition of the works of the early nineteenth-century French painter Jean-Auguste-Dominique Ingres, where he was struck by their extraordinarily confident detail. Like a detective with a refined draughtsman's eye, Hockney then began examining paintings to build a wealth of evidence from the Renaissance to the nineteenth century. Artists he contends used a lens include Caravaggio, Velazquez, van Eyck, Holbein, Leonardo and Lotto.

Hockney's views are controversial on several counts. Ideologically, they offend a traditional notion that the creative process is independent of any form of 'copying'. And on the practical front, there is no documentation of optical devices being used. But Hockney argues that few artists — if any — give away their individual tricks.

With optical science and mathematical formulas, Falco, a condensed-matter physicist at the University of Arizona, Tucson, has helped to affirm many of Hockney's theories. After an article in the *New Yorker* (31 January, 2000) described Hockney's theories, Falco contacted the artist, offering his assistance. In a lengthy series of correspondence — much of which is included in Hockney's book — Falco buttressed Hockney's artistic finds with scientific facts. In particular, Falco showed Hockney that a curved mirror is itself a lens, something not widely understood by art historians. This allowed Hockney and Falco to use mirrors to recreate centuries-old conditions to mimic how paintings may have been created.

For instance, if the geometry of a painted scene and the size of the canvas are known, the focal length of the lens can be calculated. And if the



All done with mirrors: Hockney (left) believes many masters used optical aids; how else could van Eyck achieve such detail in this fifteenth-century portrait?

focal length and the depth of field are known, the lens diameter can be determined. Then a lens can be created to test its use for a painting.

In one of the more vivid examples, Falco helped to dissect an AD 1543 painting by Lorenzo Lotto entitled *Husband and Wife*. In a fax to Hockney, reproduced in the book, Falco calls it "a smoking gun" providing "extremely strong scientific evidence" for Hockney's theory. With assumptions based on measurements of the subjects in the painting, Falco calculated fairly precise properties of a lens for the painting. The focal length of the lens was determined, then the lens's curvature. Such lenses were available more than 100 years before Lotto's painting. Knowing the theoretical properties of the lens, Falco reconstructed it, and used it to recreate distortions in a pattern in a tapestry in the painting, showing how Lotto may have sketched the piece.

Falco, who is an art collector and aficionado of industrial design, particularly classic motorcycles, says he is enjoying the opportunity of a lifetime. Working with Hockney has opened up new research vistas for him in applied optical sciences. The feeling is mutual. "He really gave me a boost," says Hockney of Falco. "He allowed us to confirm things." For a BBC documentary to be shown in October, Hockney went to Florence, Italy, to examine the work of Filippo Brunelleschi,

universally credited with first creating perspective in about AD 1420. "The birth of perspective came from an optical projection," says Hockney, shared up by a re-enactment in Florence. "Art historians have never said that. But the evidence is very strong; the science can't be denied."

Some prominent art historians are impressed by Hockney's theories and writing, although not all are convinced by every example. "It is absolutely fascinating what Hockney is doing," says Martin Kemp of Oxford University. "He is making us look at things afresh." Falco's contribution, he adds, "is most valuable. It is not proof in the strictest sense; but it is supportive and shows no contradictions." But there are doubts among art historians such as Walter Liedtke, a curator of European paintings at the Metropolitan Museum of Art in New York City. "I think Hockney goes too far with his ideas," says Liedtke.

It is important to remember that "each artist has a personal style," notes Liedtke. "We have a brain; the camera or lens does not. Experience and imagination will always intervene." Hockney, of course, agrees on the importance of style. But he feels he is unmasking a secret artistic technique. ■

*Rex Dalton is Nature's West Coast correspondent based in San Diego. Secret Knowledge; Rediscovering the Lost Techniques of the Old Masters, by David Hockney will be published in October (US: Viking Studios/Penguin Putnam; UK: Thames & Hudson).*