

Debate Over Optics in Early Art Is Focus at OSA Gathering

The controversy over the use of optical aids by early Renaissance painters is cross-disciplinary and emotionally charged.

Did Martha Stewart need to engage in insider trading? Did she engage in insider trading? University of Arizona physicist Charles Falco asks these questions as a way of emphasizing that whether early Renaissance artists needed to use optical aids in their paintings is a separate question from whether they actually did use them.

The hypothesis that painters used optical aids as early as the 1420s was put forward a few years ago by artist David Hockney in his book *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters* (Studio Books, 2001). Hockney said the use of optical aids would explain a sudden increase in realism in art; if he's right, the date artists are recognized as having used optical aids will be pushed back some 200 years.

This fall, an Optical Society of America meeting in Rochester, New York, brought together Falco, the leading scientific voice supporting Hockney; David Stork, the chief scientist at Ricoh Innovations in Palo Alto, California, and the most vocal scientific opponent; and historians of both art and science. "The last time I saw something as animated as this was [at the American Physical Society meeting in 1987] after the discovery of high-temperature superconductors," says OSA president Peter Knight. "One side wants to believe that artists worked by trickery. The other side thinks it's blasphemy. We spent the rest of the week arguing about it."

Knowledge and materials

"I find the optical evidence overwhelming," says Falco. He points to his calculations using Lorenzo Lotto's 1523–24 painting *Husband and Wife*. From the painting's 56% magnification—deduced by assuming that the woman's shoulders are of average width—Falco calculates that the artist used a lens or concave mirror with a focal length of 54 cm. Given that, distortions in the perspective of the carpet design can be explained only by the artist's having twice ad-

justed the lens to bring different parts of the design into focus, he says. "My calculations agree with the measured changes in magnification to within 0.2%." Where the carpet looks fuzzy, he adds, it's outside the lens's depth of field. It's such calculations on geometrical distortions that convince him: "We're not saying that lenses are the only way to get the perspective right," Falco said in his talk in Rochester. "We're saying that lenses are the only way to get the perspective wrong in precisely the way I am showing you they got it wrong." Most of any given painting would have been done by eyeball, he says. "But certain features, perhaps 5% of a painting's surface, was done with the aid of optics; 95% was not."

Stork counters that other explanations for the same distortions are more plausible. For example, studies show all surviving Lotto-like carpets are asymmetric, he says. "Hockney and Falco are fitting noise. It com-

pletely undercuts their evidence." Walter Liedtke, a curator at the Metropolitan Museum of Art in New York City, says the distortions in the carpet could come from the painting's canvas having been stretched. And, he stresses, there's no reason to assume the artist was painting everything from life. "Many of the rooms are obviously made up, artistic conventions. The idea that a painting represented an existing room wouldn't have occurred to [art historians]." Stork notes that pinpricks show that Jan van Eyck's 1432 portrait of Cardinal Albergati was magnified mechanically, with a proportional compass. "All the evidence is against [optical aids]," he says. Artists in the early Renaissance "didn't have the knowledge, and they didn't have the materials."

The dispute turns on the state of the art of glass and mirrors. Were the necessary optics knowledge and materials available in the early Renaissance? No, says Harvard University's Sara Schechner, a science historian and curator specializing in early scientific instruments. "I don't think they had any knowledge of image

Do deviations from symmetry in the geometrical carpet design in Lorenzo Lotto's *Husband and Wife* indicate that the artist used optical aids? The scientists most closely associated with the debate are proponent Charles Falco (standing) and opponent David Stork (inset).

GROVER A. SWARTZLANDER JR./UNIVERSITY OF ARIZONA



projection from mirrors onto a screen in the 15th century.” Even if evidence is found that they did have the knowledge, she adds, “it’s not going to change my argument that they didn’t have the materials.”

But for many meeting attendees, the door was left open by the thriving spectacles-manufacturing business in 15th-century Florence described by University of Massachusetts historian Vincent Ilardi. “The optical knowledge was certainly available. If the manufacturing capability was available, I see no reason why artists would not have been able to project images,” says David Lindberg, a University of Wisconsin historian of early optics. At the meeting, he adds, “the acrimony was electric. It was in the air.”

Art appreciation

Among physicists, the jury is still out. “There was no smoking gun for Falco,” says Knight, who left the meeting leaning toward the con arguments. But others, such as John Wood, chief optical engineer for the *Hubble Space Telescope*, are swayed by the evidence suggesting that early Renaissance painters could have used optical aids. “Falco used basic optics calculations to show focal lengths. It’s proceeded like a scientific inquiry,” he says. “I think appreciation of art is being advanced with everyone being interested in this.”

Liedtke, for his part, allows that Renaissance artists may have used some optical aids, but he says, “for the

vast majority of art history, it’s a footnote. These questions are irrelevant, trivial, for art historians.” Moreover, he adds, the optics claims “depend on very narrow measurements. It all seems so unnecessary. By the time an artist had it all set up, he could have knocked it off freehand. [The optics claims] underestimate the skill of the artists.” Referring to a 1420s painting by Robert Campin, for which Hockney and Falco claim optical aids were used in painting latticework on the back of a bench, he adds, “Why don’t they step back and think, Why is the bench there anyway? An artist would say it makes a framing device for an important head. Can’t people just appreciate the painting?”

Toni Feder

Van Allen, at 90, Sifting Data, Writing Papers, and Enjoying Icon Status

Growing up on a small Iowa farm, James Van Allen enjoyed a “closely knit family which had a strong resemblance to that of earlier pioneer families.” It was that solid beginning that spurred him on to a life of scholarship.

If physicist James Van Allen wanted to look back over his career, all the way back to his first experimental research as an undergraduate at Iowa Wesleyan College in 1931, the task would be daunting. Although his papers are conveniently gathered at the main library of the University of Iowa, the school where Van Allen earned his physics PhD in 1939, the collection stretches across more than 210 feet of shelf space.

And Van Allen, who was honored by the university in early October on the occasion of his 90th birthday, continues to add to the collection. Five days a week, he goes to his office on the top floor of a building that bears his name and delves into the massive amount of data his Geiger Tube Telescopes gathered on their decades-long journeys through the solar system aboard the *Pioneer 10* and *11* spacecraft. The last bit of the data came from *Pioneer 10* in February 2003, when NASA finally shut down communications with the small spacecraft. “It was about 80 astronomical units away,” Van Allen said, and detecting its 8-watt signal across more than 11 billion kilometers of space was “terribly demanding. I had the only instrument on board still operating so I had a hard time justifying keeping going. So I didn’t kick on [the



Van Allen

decision to abandon the spacecraft].”

Best known for his 1958 discovery of the Van Allen radiation belts surrounding Earth, Van Allen has spent much of his life in his native Iowa, including 53 years on the faculty at the University of Iowa. The Van Allen celebration, which included talks by some of his 80 graduate students, several of whom have already retired,

was, in Van Allen’s words, “a delicious occasion.” With his birthday festivities over and the celebration of his 59th wedding anniversary with his wife, Abigail, just past, Van Allen took a deep breath and talked with PHYSICS TODAY about his research and the changes he’s seen in physics.

PT: For several years you hoped one of the two *Pioneer* spacecraft would be the first to reach the heliopause, the edge of the Sun’s influence. When the craft were launched in the early 1970s, how far away did scientists believe the heliopause was?

VAN ALLEN: There were some preliminary indications that the heliopause would be at 5 or 6 astronomical units, just beyond the orbit of Jupiter. That was the prevailing expectation at the time we launched *Pioneer 10*. And it’s sort of been like a rabbit on a racetrack. It’s kept ahead

of us all of these years.

PT: That must have significantly changed your thinking about the Sun’s influence in the solar system.

VAN ALLEN: It’s changed my acceptance of theoretical expectations. They [theoretical physicists] are a lot of fun, but you can’t take them too seriously.

PT: You’ve been involved in the US space program since the beginning, yet you’ve written that you don’t favor the manned space program. Why?

VAN ALLEN: I recently wrote an article for *Issues in Science and Technology* called, “Is Human Space Flight Obsolete?” I compare the history of human space flight with the history of manned ballooning. I have personal knowledge of that going back into the 1930s, when it was being advocated as a revolutionary new technique for doing scientific work with human crews carried aloft by balloons. That soon was recognized as a very poor way to do it, and that expectation faded away. But unmanned balloons remain valuable for scientific work. Manned ballooning has survived only as an adventurous sport.

From the perspective of 2004, I consider that human space flight has had a parallel history and is now best regarded as an adventurous sport, appropriate perhaps to the private sector but not to governmental support. Current human space flight makes minor contributions to scientific knowledge and virtually no contribution to the pervasive role of space technology in modern life. All of [the] great advances in science of the Earth and all of the planetary exploration have been done