MIRROR IMAGES

DAVID HOCKNEY'S BOLD THEORY THAT CARAVAGGIO, LEONARDO AND OTHERS USED LENSES TO CREATE THEIR MASTERPIECES HAS TURNED THE ART WORLD UPSIDE DOWN

By Jennifer Lee Carrell, *Smithsonian*, February 2002

I AM STANDING IN A SMALL, DARK ROOM with artist David Hockney. On a canvas in front of us floats the image of a toga-clad youth, his dark curls twined with fruit, his cherubic lips pursed in a sly smile, and his body soft with a grace that will edge toward flaccid with age. For now, though, the boy's luminous beauty is as ageless as it is startling.

In a Los Angeles movie studio, David Hockney re-created Caravaggio's 1595-96 painting *Bacchus* using a camera obscura (right, in a Hockney rendering). With this optical tool, light passes into a dark room through a hole, or lens, to project an upside down and inverted image against a surface.

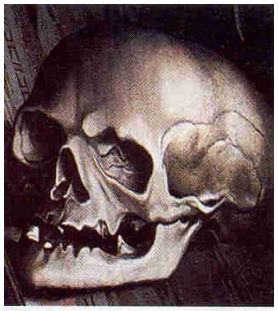
True, he is upside down, reclining at a table apparently suspended from the ceiling. Even so, what captivates the eye are the dramatic, high-contrast lighting, the deep, opulent colors, and the sheen that skates off smooth surfaces. I've seen an image like this in only one other place: Caravaggio's famous carousing Bacchus that hangs in the Uffizi Gallery, in Florence.

But this is not a painting, or even a reproduction. It's a live projection made with nothing more than a glass lens, a closed-curtained room and bright light—exactly the way Caravaggio may have created his own Bacchus, four centuries ago-at least, according to a bold theory advanced by the acclaimed British artist David Hockney.

Hockney claims that he has rediscovered a lost trade secret of Western art's grand masters-not just Caravaggio, but also van Eyck, Holbein, Leonardo da Vinci, Van Dyck, Velazquez, and perhaps even Rembrandt. For centuries, their luxuriant, nearly photographic realism has been celebrated as the inexplicable product of artistic genius tinged with a dash of magic.

Hockney has caused jaws to drop with the provocative idea that these masters had a little help, working their magic not with smoke and mirrors but rather with mirrors and the strong, hot light of the noonday sun. From the early days of the Renaissance to the dawn of modern photography, Hockney believes, painters secretly used lenses—both concave mirrors and the more common transparent glass sort—to enhance the realistic details of their pictures. If Hockney is correct, for more than 400 years such redoubtable artists as Jan van Eyck and Robert Campin in the 1430s to Jean-Auguste-Dominique Ingres, who died in 1867, used optics to reflect the images of models and objects directly onto their panels and canvases. These projections compress a scene's complex, three-dimensional masses, gradually shifting light and color into clear, two-dimensional shapes whose outlines can be quickly and confidently traced.

Hockney believes that *The French Ambassadors*, painted in 1533 by Hans Holbein, makes the case for the use of lenses. The German painter most likely created the distorted skull in the foreground by projecting the image of a skull with a lens and then tilting the canvas. Hockney restored the skull by reversing the process with a computer. Other clues include a perfectly rendered globe and a foreshortened lute, both shapes that are very hard to render accurately without the use of tools.



"You mean they were cheating!" exclaims almost everyone I tell about Hockney's theory. That's one illusion Hockney is eager to dispel. "Optics don't make marks," he insists. "Only artists do that. If you think you can look at a projection, pull out a paintbrush and produce a van Eyck or a Caravaggio, think again," he says sternly. "You can't."

The room in which we speak is cut off from the rest of a filmset on the Panavision lot in Los Angeles by plush burgundy draperies. The British Broadcasting Corporation is here making a documentary about Hockney's theory.

"We're standing inside a camera, essentially," he is saying. Nowadays, that word makes people think of a small black box filled with mysterious machinery, but the word "camera" comes from "camera obscura"-a phrase that Hockney points out means "dark room" in Latin. "The operative part is nothing more than a curved bit of glass," he says.

A peek through the curtains reveals a startlingly garish scene. Just outside sits the "real" Bacchus—a doe-eyed actor who arrived on the set sporting a nipple ring and purple nail polish, his eyes puffy from some likely carousing of his own. Now he's draped in a sheet, wilting under the hottest, brightest lights Hollywood can muster. (In Caravaggio's day, the only light strong enough for the job would have been direct sunlight.) His skin is a blinding, washed-out white; his blue-black wig, jeweled grapes, and the Knudsen's Razzleberry juice that passes for wine glitter like cheap trumpery.

As the curtains fall closed, though, we see an altogether different version of that scene inside the camera obscura. A bright beam of light streams through a transparent glass lens that is fitted into a small opening in the curtains. That lens gathers light rays from the scene outside and bends them as they pass through the glass, on their way to striking the white canvas propped near the opposite end of the darkened room. This phenomenon, called focusing, reverses images left to right, and top to bottom, which is why the Bacchus on the panel appears upside down.

The process also loses a great deal of light, dimming the scene considerably, jacking up the contrast and compressing the color palette to deep, rich tones. It creates, in other words, the characteristic look of a Caravaggio painting, termed "chiaroscuro," or "bright darkness."

"Bacchus, god of Razzleberry, have a drink," commands Hockney with impish glee to the model. The film crew gasps collectively as the Bacchus on canvas yawns and picks up a goblet whose cherry-red contents have deepened into

burgundy. Even to people who spend their lives making films and videos, this looks like magic: with no more techno-wizardry than a small, curved piece of glass, Hockney has brought to life a scene worthy of a master.

Had Jan van Eyck turned over the convex mirror hanging on the wall in his *Arnolfini Wedding*, he would have held an optical tool suitable for creating the meticulous detail found here. Note the chandelier, a study in complicated foreshortening. Unlike any other object in the painting, the chandelier, says Hockney, "was done without any detailed underdrawings or corrections."

"We're not only talking about artists having seen and used photographic images," he says. "Some people were watching color movies 600 years ago."

Hockney's discovery began nearly three years ago, when an exhibition of Ingres' portrait drawings in the National Gallery in London sparked his professional curiosity. Nineteenth-century French painter Jean-Auguste-Dominique Ingres is renowned for his exquisitely detailed portraiture. How, Hockney wondered, had he achieved such accuracy at so small a scale?

"Everything seemed right," says Hockney. "Even the mouths. If you're an artist, you know how difficult that is." Hockney certainly does. In addition to his work with photo-collage and stage design, Hockney is an accomplished draftsman. He quotes John Singer Sargent: "A portrait is a painting with something wrong with the mouth."

In his studio, Hockney enlarged reproductions from the catalog to study the drawings more closely. Ingres' lines showed none of the tentative groping that is characteristic of an artist drawing from life. They reminded him of the works of pop artist Andy Warhol.

It was an unlikely but key connection: Warhol's boldness stemmed, essentially, from tracing; Warhol cast slide projections onto his canvases and then reduced complex figures to a few suggestive lines. Perhaps, Hockney surmised, Ingres' similarly bold lines also stemmed from using some kind of optical tool.

On a hunch, he experimented with a contraption called a camera lucida, basically a prism mounted on a movable arm. While this technology, invented in 1806, does not actually project an image, Hockney taught himself to look through it in such a way that a small image of a person sitting in front of him seemed to appear on drawing paper held beneath. With practice he was able to draw from life and the prismatic image at the same time.

"It's not easy to use," says Hockney. Nor does it do away with either drawing skill or artistic style. An artist still has to move pencil across paper, so an Ingres drawing made with a camera lucida still looks like an Ingres, while a Hockney looks like a Hockney.

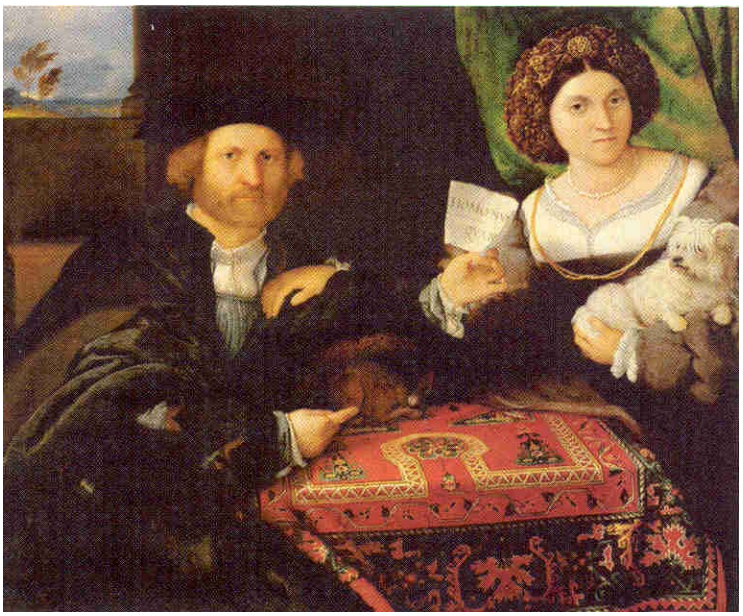
Hockney's curiosity spread to other artists. He began creating what he now calls the "Great Wall," a 70-foot visual time line that starts around C.E. 1150 with Byzantine icons and ends with the works of Cezanne and van Gogh in the 19th century. Along the top half, he and his assistants pinned up color copies of paintings from Northern Europe; images from Southern Europe range along the bottom.

"Caravaggio, Velazquez, Georges de La Tour," he says, gesturing to the wall in his Santa Monica studio, "remind me of film directors. They must have composed their scenes like Zeffirelli, telling models to lift their hands or tilt their faces just so, into the light."

The masters on these walls have caught fleeting expressions, extraordinary detail in feathers and fur, and complex textures in baskets, velvet, fruit rinds and fish scales. "There's no awkwardness," he says, running one finger along a pattern that

slithers through the folds of Florentine painter Bronzino's sumptuous fabrics. "You try doing that without a guide," he challenges. "It's hard, virtually impossible." It took a working artist, he notes, to draw this conclusion and think through the consequences.

On the far right of his wall, the date 1839 looms large, signifying the year when a chemical means to fix projected images on paper was discovered. For a few decades, painting and photography twined around each other: paintings were made to look like photographs, and photographs were made to look like paintings. By the 1870s, however, artists had turned away from photography and begun to explore other perspectives. The lens, explains Hockney, is monocular and stationary. "But humans don't see like that. We have two eyes, and we move." He lingers over several paintings by Cezanne, who, he says, "looked at the world with both eyes. Which made him doubt the exact whereabouts of things." This fascination with multiple points of view led straight toward Picasso and Braques and to Cubism, which presents figures from many angles at once. Within a generation or two, optical knowledge and skills—closely guarded trade secrets, Hockney believes—were lost. As, for a time, was Hockney. Theories remain theories until they are proved, and Hockney's ideas were supported only by speculation. Enter Charles Falco, a many-faceted professor of optical sciences at the University of Arizona. Reading the January 31, 2000, issue of the New Yorker, Falco was instantly intrigued by an article by Lawrence Weschler reporting Hockney's hypothesis: two Falco obsessions-optical science and art-had crossed paths with significant consequences. After meeting Hockney and scanning the Great Wall, Falco realized that the smoking gun would be found not in the paintings' remarkable accuracy but in their distortions, which could only have been created by the use of a lens.



The keyhole pattern on the carpet in Lotto's *Portrait of Husband and Wife* falls out of focus. This is caused by a lens, Hockney posits, which cannot focus continuously as does the human eye. He also believes that use of a lens to bring the rear of the carpet into focus introduced a second telltale distortion in the painting.

One painting in particular stood out: Lorenzo Lotto's *Portrait of Husband and Wife*, now in the Hermitage, in St. Petersburg, Russia. Certain details glowed vividly in Falco's mind's eye, including a section of the painting that quite clearly went out of focus.

That doesn't happen with the healthy human eye, Falco now tells me in his high-tech optics lab ten stories above Tucson, Arizona. The eye adjusts its focus continuously-and thus never goes out of focus. A simple lens, however, has a specific, narrow depth of focus. Objects lying outside the range become blurry. He leans forward, talking fast. "I realized that I could calculate the properties of that lens," he says.

Falco found a good reproduction from the university library and began calculating. By the time he had finished, it was 2 a.m. "I was toast," he says. He took out his contact lenses, lay down, and was almost asleep, when he sat up and climbed out of bed to look again at the painting. Sure enough, he had seen another aberration.

Lotto's couple sits behind a table draped with an oriental carpet; in the center of that carpet, a keyhole pattern blurs as it recedes from the edge of the table. This was the distortion that originally drew Falco to the painting. Off to the right, a thin border extends back diagonally in a straight line. Now Falco saw that at the same depth where the keyhole pattern goes out of focus, that line shifts direction by three degrees: the result, he says, of moving either the lens or the canvas to refocus.

Refocusing even slightly, though, changes both magnification and alignment. Working on the simple linear pattern, Lotto was able to fudge the line slightly; the change in direction is slight enough to go undetected unless you're looking for it with a straightedge. The more complex keyhole section in the middle of the table presented Lotto with a problem: there was no way to refocus and still make the pattern's edges line up. So, Falco sums up, Lotto let it go out of focus. (Later, artists would cover deep tables with white cloths, to escape this dilemma.)

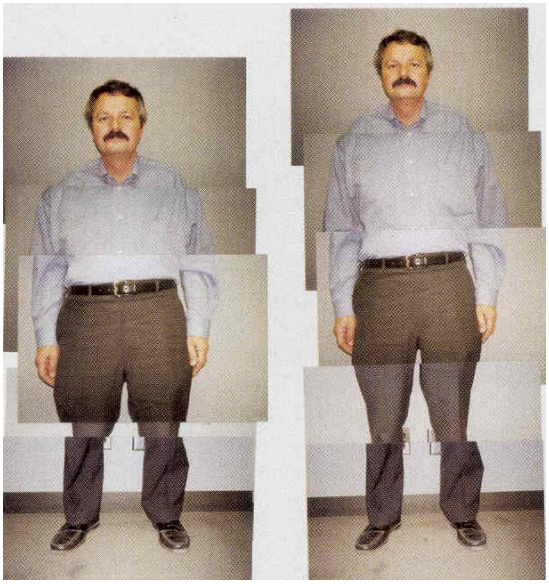
Neither eyeballing nor geometrically planned perspective produces either type of distortion, but a projection made with a lens accounts for both. "You could convict O.J. with this evidence," says Falco.

"This isn't a story," Falco goes on. "It's not your version versus my version. This is fact. This is science." You could, he admits grudgingly, come up with another explanation, but it would be a complicated and far-fetched theory. "Or," he brightens, "you can just say 'lens.' Everything fits."

But even to Falco, technological history posed an initial conundrum: Lotto painted his portrait in 1543. A glance along Hockney's wall reveals that the "optical look" stretches all the way back to portraits by Flemish artists van Eyck and Campin. Neither Falco nor Hockney could explain it. That is, until Falco mentioned in passing that concave mirrors can project images. A lightbulb went on. With this insight in mind, Falco turned his office into a camera obscura. Using nothing more high-tech than a shaving mirror, he had soon cast a good-quality image.

The case for the use of optics had just leapfrogged clear back to van Eyck and Campin. In fact, both of these artists famously included convex mirrors in their paintings. In their days, mirror-makers did not back the silvering with a coat of black, as is standard practice today, so these curved mirrors would have been reversible. Pull the convex mirrors from the back walls of van Eyck's *Arnolfini Wedding* or the *St. John the Baptist* panel of Campin's *Werl Altarpiece*, turn them around, and the result is a concave mirror, capable of projecting an image good enough to paint from.

Buy into Hockney and Falco's theory and van Eyck and Campin become as mischievous as Edgar Allan Poe's thief in "The Purloined Letter," who hides stolen correspondence in plain view. The difference here is that the artists' secret tools have been seen but not recognized for almost six centuries.



Will the real Charles Falco please stand up? To illustrate one technique used by old masters, Hockney patched together portraits of his colleague from photographs taken head-on. In Van Dyck's 1626 portrait, the technique could explain the distorted proportions of the mother (note her extremely long legs) and the straight-on perspective of the child (despite the view from below).

Hockney's book, *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters*, published in October, lavishly sets out much of the story, including other ways artists used lenses, and their ingenious methods for wriggling around the limitations and distortions of optical tools. (The BBC documentary, filmed in Ghent, Bruges and Florence, has no U.S. airdate as yet.) In December, the New York Institute for the Humanities sponsored a well-attended weekend symposium examining the validity of Hockney's theory. The verdict? Mixed. Many in the art community raised grave doubts. Based on his own informal experiments, the Metropolitan Museum of Art's Keith Christiansen questioned whether a lens could create an image containing enough detail to be useful. Why, he continued, would artists such as Michelangelo and Caravaggio, who routinely made freehand sketches before painting, need the aid of blurry, upside-down images? Other objections centered around the ability of early painters to generate enough light with candles to form a strong image. A computer scientist pointed out that the mirror in van Eyck's *Arnolfini Wedding* was not nearly large enough to reflect Arnolfini, his wife and the dog.

Critics also question why none of the models used by the grand masters ever noted or made reference to the use of lenses or mirrors. After all, they were on the scene. Hockney scoffs at this comment. "Can you imagine? A sitter rushing home to write, 'Dear Diary, today I sat for Mr. van Eyck. He used a mirror 5 inches in diameter.' It's preposterous. No: If a sitter saw anything, they'd chalk it up to magic artist stuff." And artists also had good reasons to keep mum. At various times and places, getting caught messing around with mirrors, commonly thought to be the tools of sorcerers, could have meant a death sentence.

These days, both Hockney and Falco are in high demand to lecture about their findings. At a talk sponsored by the Los Angeles Museum of Contemporary Art, a sold-out crowd of 1,200 strains to listen as Hockney explains yet another aberration. Transparent lenses, he says, not only turn images upside down but reverse them left to right: a problem artists didn't face with the older mirror lenses. (Mirror lenses actually reverse images twice, once while focusing and once while reflecting. In this case two wrongs add up to a right.) When artists first moved to using lenses, says Hockney, there were suddenly a lot of left-handed drinkers in European painting, including Caravaggio's *Bacchus*.

"Multiple viewpoints create a far bigger space than can be achieved by one," Hockney notes about his *Pearblossom Highway*. The photomontage appears to have a central viewpoint but actually comprises hundreds of different perspectives. Such artistic explorations helped Hockney form his theory about widespread optical use by the masters.

As the audience titters, Hockney projects onto the screen a Dutch painting of two rowdy peasant men, a woman and a lascivious monkey peering up her skirt. "Look at that," he says. "Every last one of them leading with the left hand. Even the monkey. What are the chances that the artist found not only three left-handed models, but a left-handed monkey to boot? Or was he using a lens?"

The crowd bursts into laughter, and Hockney beams. Later, he says, artists learned how to combine lenses and mirrors to re-reverse the images, and everyone went back to drinking with their right hands.

"It's not hard to see," Hockney reflects later in his home in Los Angeles. "In fact, once you see the optical look, it's hard not to see it." The great beauty of this discovery, say both Hockney and Falco, is its simplicity. "We're not talking about sophisticated science here," says Falco. "It's baby optics."

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By Jennifer Lee Carrell

Freelance writer Jennifer Lee Carrell, a former medieval scholar, wrote last about Arabian horses.
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