THE PHOTOGRAPHIC EYE

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Photographic—Accurately portraying life or nature; minutely accurate; mechanically imitative.—Oxford Dictionary.

Though magnifiers, drawing machines, and cameras have been used in making works of art for a long time, their connection with technique and style has received only passing mention. Yet devices that affect the way we see are bound to affect style in art, since style both reflects and conditions ways of seeing.

Everybody’s seeing is constantly changing. The hat that startled at Easter looks normal in May and will be dowdy by August. In the first Cézannes that I remember facing, at the age of twenty-three, I could not identify the objects represented. Like the Australian bushman who was shown a photograph of himself, I asked “What is it?” Yet it took only a few months for valley views and stone villages to reveal themselves in Cézanne’s coloring and rhythms.

A history of seeing can be demonstrated by the widely differing kinds of pictures that were considered lifelike in their day. Near Eastern painting, which charms us like a bright patchwork, was to its makers and patrons a window into a real world. In the tenth century a poet described an embroidered tent at Antioch by saying,

“Whenever the tent side billows with the wind
The horses ramp and lions outwit their prey.”

According to Vasari the laurel in the background of the Museum’s Madonna by Girolamo dai Libri was so “truly a living tree, graceful and most natural,” that birds used to fly into the church where it hung to perch on its branches. This charming but rather prim tree would probably not fool today’s sparrows any more than the grapes that Zeuxis painted.

The first inventions that modified man’s seeing, and thereby affected art, were probably magnifiers, which seem to have been used very early in the mass production of engraved seals. Seals were indispensable to law and commerce in antiquity, when a man impressed his seal to padlock his tied-up deeds and his wine jars or to sign letters and documents and perhaps lent it as his power of attorney. Since every man of property kept his seal on his person even in his bath and his bed, he had to have it as portable as an amulet, preferred it to be pretty, and was wise if he got it hard enough to wear for a lifetime without noticeably debasing the impression. For these reasons most surviving ancient seals are small and durable, proofed against forgery by their individuality.

Three or four thousand years ago seal-makers in the Near East were already grinding designs on stone and shell with little disks and drills substantially like those that whirl today under more convenient power. But the scale of early seal-engraving gradually ceased to be comfortable to the naked eye, as the Minoans and even more the classical Greeks succeeded in engraving figures as tiny as a baby’s thumb-nail and yet so finished that when photographs of them are enlarged to wall-size the rhythms seem still more alive and the details more exactly proportioned. This perfection in minuteness recurs too often to be attributed altogether to

precocious geniuses or to those unusual eyes that see better close up as they grow older. Though the eighteenth century carried its adulation of classical antiquity to the point of postulating a vanished race of men with superior eyes, Greek and Roman eyes must have ached like any of ours for Pliny the Elder to report that gem-engravers and painters strengthened their sight by eating bread sprinkled with rue and that engravers refreshed their eyes by gazing into the cool green of emeralds.

That antiquity should have left us no account of the gem-engraver's use of magnifiers is not surprising, since most ancient critics confined themselves to appreciating finished works of art and passed over the workshop's sweaty, sloppy, dusty inevitabilities. In our machine age, however, these very technical processes preoccupy the many archaeologists who have debated this question of lenses in antiquity. Their discussion is excellently summarized in Gisela M. A. Richter's Catalogue of Engraved Gems of the Classical Style, which is the source of most of the facts stated here. The upshot seems to be that the ancients knew and used the phenomenon of magnification, but there is little certainty what kind or how early.

One thing is certain; glass, now the commonest material for magnification, was so used very late. In the first century after Christ, Seneca said that small and indistinct writing looked big and clear through a glass globe full of water, and graves in various parts of the Roman Empire have yielded solid glass lenses shaped either like half oranges or like balls that have been squeezed in a tube. Both of these magnifiers could only have been made after the first century B.C., when the art of glass-blowing was invented and really transparent glass was produced in addition to the earlier colored, opaque glass.

The Greek gem-engraver's use of lenses may perhaps be determined from the form of the gems themselves. About 1600 B.C. the Minoans invented seals of a double convex shape—the so-called lentoid gems that look like pills an inch or less across and half as thick (see ill., p. 15). Before engraving the design on one side, both sides were probably polished, or such at least was the procedure over a thousand years later in making a Hellenistic gem that has survived half finished. When a Minoan gem-cutter polished a lentoid blank in rock crystal (a material he often used), he had in his hands as good a short-focus lens as man was to possess until Galileo's time. A rock-crystal lens is probably what is referred to in Aristophanes's Clouds (423 B.C.) when a character says that with one of the druggists' transparent stones for making fire he will focus the sunlight to melt away the letters on a wax tablet as fast as the law clerk inscribes them. Pliny's Natural History (dedicated in 77 A.D.) recommends rock crystal for focusing sunlight to cauterize wounds.

The Egyptians had at least two devices for magnifying that could have served an artisan. Nora E. Scott has pointed out that from an early period their statues and coffins were given eyes with rock-crystal corneas. Several of these would make strong short-focus plano-convex lenses if the flat back were polished like the convex front, and even as they are they magnify quite well if the unpolished back is slicked by wetting. Though the Egyptians may not have had the dime-novel notion of stealing their statues' eyes to improve their own, they used the principle of magnification in their metal hand mirrors, which, even in the early dynasties, they made flat, convex, or concave. Egyptian jewelers may well have found concave mirrors as convenient for exquisitely exact work as dentists do today.

In short, the Egyptians, the Minoans, and the Greeks might quite possibly have used a variety of magnifiers for their microscopic craftsmanship too commonly to attract the notice of ancient writers.

Man held short-focus magnifying glasses for ten or twenty centuries before it occurred to him to free both hands by balancing a pair of long-focus lenses on his nose. The emerald through which Nero watched slums burn and gladiators bleed was probably not mounted like eyeglasses, which would seem to have been invented in the late twelve hundreds in Italy and were first prescribed instead of herbs for treating eye trouble around 1300. What may be the earliest picture of a man wearing them occurs
in a fresco of 1352 in Treviso, less than twenty miles from the great glassworks at Venice.

If short-focus lenses seem to have made possible a more minute accuracy in works of art, what effect might eyeglasses have had? Testimony from an eyewitness—in the most literal sense—comes from the oddest of sources, a letter in the Library of Congress, written to Jefferson by Charles Willson Peale when he was seventy-six. “Since I have resumed my Pencil I make use of a pr. of thos Spectacles of 3 feet focus, which enables me to see my Sitter and also my picture nearly as well as I could at a much earlier time of life, therefore I am enabled to give a higher finish to my work than I had done of late. . . . Soon after I had resumed my practice of painting portraits, I found that the Heads which I painted with Spectacles were smaller than life, which I have ever considered a bad taste, unless they were very considerably small. Therefore I afterwards found it best to paint the first sitting without Spectacles, by which I could make the general effect in proportion and even a strong likeness, but my painting was very rough, afterwards I blended the various tints together and thus softened the work to please the common Eye.” The fact that details blur and colors blend into opalescence in the circles of confusion of aging eyes may explain why the old and all but blind Degas drew figures of dreamlike amplitude.

It has been pointed out that the adoption of eyeglasses, by enabling old men to keep on reading and writing, contributed to the huge increase in scholarship that marked the late Middle Ages and the Renaissance. Could it also have contributed to that new realism in painting associated with the Van Eycks? If glasses made Peale paint smaller than life and with a higher finish, may they not have helped the Van Eycks to achieve unity and grandeur in pictures sometimes no bigger than this page? A lens held in the hand would not do for them, as it could quite comfortably have done for their miniaturist predecessors, niggling over diaper patterns and jewel-like but scattered details. Unlike earlier miniaturists, the Van Eycks considered the whole of a picture every time their brush touched it; for their still unrivaled achievement was to paint in detail while subordinating each stroke to a unity of shape and color observed in nature. If their eyes blurred—as most would at such a rate of use—it is hard to see how they could have kept on working without resorting to eyeglasses.

During the last years of Jan van Eyck’s pioneer investigation into what happens when colored shapes slope into shadow, an Italian was working out the mathematics of perspective. With the Van Eycks to show how to paint color in light and shade and Alberti to show how to draw objects in depth, a painter was for the first time equipped to represent a room as the camera sees it. But perspective is not easy for every man. It demands a combination of mathematical interest and sensuous awareness that was rarer north of the Alps than in Italy.

After Dürer had struggled with the problem for most of his life, he made four woodcuts of four mechanical devices for drawing in perspective without bothering about the mathematics. These drawing machines of about 1525 show the spread of the revolutionary renaissance ambition to represent a depth of air furnished with objects all seen from a single point of view. The most practical of Dürer’s drawing machines consisted of a peephole fixed on top of a stick a foot or so in front of an upright pane of glass (see p. 19). The artist kept his eye steady by gazing through the peephole while he outlined his subject on the glass in paint or fatty crayon or soap. If the artist found it hard to copy off the proportions and perspective thus obtained, he could transfer his outlines mechanically by pressing a sheet of paper against the glass to print off the greasy lines he had drawn there. Joseph Meder says that such oily outlines are to be seen on some of Holbein’s portrait drawings, which are indeed the most crisp, flat, monocular charts of faces ever drawn. Some mechanical aid must have helped Holbein in his specialty of catching likenesses of preoccupied courtiers, who undoubtedly sat as Dürer’s woodcut shows a prince, tapping the arm of a chair for a moment grudged between appointments. The suspicion is confirmed by the fact that quite recently Emil Orlik was ob-
taining Holbein's flat accuracy in portraits made with Dürrer's drawing machine.

Dürer's drawing machine was reinvented by John Constable, who, "when he was studying the art of painting in his native place, unaided by others," bolted a pane of glass to his easel and kept his eye steady in front of it by tying four strings to the four corners and gathering the loose ends between his teeth. “On this glass, thus held and secured from shifting, he traced with colour the outline of the view. From this sketch he made his painting. Afterwards studying in the schools of art, he followed the rules of those schools, and fell into the popular errors as he admitted and regretted.”

Less than fifty years after Dürrer had made the earliest pictures of drawing machines, a way was found to focus an image through a lens directly onto a piece of paper strongly and sharply enough to trace with a pen or pencil. Aristotle had long before remarked that the image of an outdoor scene could be projected through a little hole into a dark chamber. The ancients cannot have failed to notice that an even stronger projection, though too small for easy experimentation, was cast by their short-focus lenses.

After the basic machinery of the photographic camera had lain unassembled for centuries,

it was finally put together by a Venetian diplomat and writer on architecture, Daniele Barbaro, who in 1568 printed the first description of a camera obscura with lens. The clarity and poetic vividness of his account make it worth quoting.3 “If you wish to study the outlines, colors, and shadows of things as nature spaces them in distance, make a hole in a window shutter and set in it a thick lens from an old man's eyeglasses (not a thin lens made for a young man). Now close all the shutters and doors until no light enters the chamber except through the lens, and opposite it hold a sheet of paper, which you move forward and backward until the scene appears in the sharpest detail. There on the paper you will see the whole view as it really is, with its distances, its colors and shadows and motion, the clouds, the water twinkling, the birds flying. If you partly cover the lens to leave only a small aperture, the image grows sharper. By holding the paper steady you can trace the whole perspective outline with a pen, shade it, and delicately color it from nature.” Note that the first description of a usable camera obscura puts it immediately at the service of the draftsman of views. As ever in Italy, science and art went hand in hand.

The number of subsequent accounts of the camera obscura shows that it must have become a usual tool for accuracy when drawing views, portraits, and scientific illustrations. Without such a short cut to the complications of architectural perspective, the manufacture of inexpensive copperplate views, which grew into a widespread industry only to be ruined by Daguerre, could hardly have made money. During the eighteenth century alone, Augsburg and Paris turned out thousands of so-called vues d'optique—rough etchings of places all over the world that bear several lines of description at the bottom and a line of mirror printing at the top. These forerunners of the stereoscope and the travel movie were manufactured in a fairly standard size so as to fit the viewers, which consisted of an upright lens as big as a shaving mirror through which the print was reflected swimmingly in a tilted looking-glass. These

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3 Daniele Barbaro, Pratica della perspettiva (Venice, 1568-1569), p. 192.
viewers, which must have been in every home, to judge by the quantities of prints made for them, were no more complicated than the portable models of the camera obscura, as illustrated on page 18.

Allyn Cox has suggested that the camera obscura might have been used by one of the most exquisitely deliberate painters, Vermeer himself. It may be objected that while the camera obscura as described by Barbaro casts a reversed image, Vermeer's paintings show everything the right way around. For instance, the painter in the Czernin's Studio (ill. p. 21) holds his brush in his right hand; and the four maps that appear in five of Vermeer's paintings are all correctly rendered. But he could perfectly well have righted a camera image by using two convex lenses, as Kepler recommended for drawing about twenty years before Vermeer was born, or by placing a forty-five-degree mirror above a horizontal single lens as has been done in the camera shown on page 18. It might also be objected that Vermeer could not have achieved his impeccable assemblage of shapes—a finality of repose established like the entablature of the Parthenon—by arranging actual objects before a lens. Yet since no other painter, with all the liberty in the world, has ever surpassed that last gravity of balance, why should Vermeer not have painted from a camera image?

4 Johann Kepler, *Dioptrice* (Augsburg, 1611), proposition xxcix (88).
just as well as direct from nature?

The assumption that he painted from a camera obscura would explain a number of peculiarities in his art. In the image cast by a lens Goethe noticed that “everything is covered with a faint bloom, a kind of smokiness that reminds many painters of lard, and that fastens like a vice on the painter who works from the camera obscura.” Such an effect is one of the fascinations of Vermeer, who used more colors than almost any other great painter, yet blended every combination as perfectly as the ground glass of a camera. Also the high lights on objects in the immediate foreground—the carved lion-head of a chair or the bright threads of a tapestry—break up into dots like globules of halation swimming on ground glass. By throwing near-by objects out of focus, as it were, Vermeer suggested depth with a device more subtle than the standard practice of making them markedly lighter or darker than what is behind.

Vermeer was blamed for drawing near objects too big and far objects too small. Most painters before the age of photography were in the habit of evening out sizes as modified by distance in order to approximate the correction that we unconsciously make by the convergence of our eyes, a compensation which may be what Constable meant by the popular errors of the schools. Though the dime that I hold at arm’s length covers the moon, I know it is really smaller because the crossing of my eyes tells me it is so vastly closer. Yet if I look with one eye or take a photograph or make a correct perspective outline of the moon and the dime I have no difference of convergence to tell me which is bigger. Now if Vermeer were painting from an image seen in the camera obscura, his eyes would not converge more for a near object than for a far one and he would tend to paint near objects bigger and far objects smaller than if he were painting direct from nature.

A memory of his practice might be preserved in a chance reference made by G. J. s’Gravensande, who was born thirteen years after Vermeer’s death: “Several Dutch painters are said to have studied and imitated, in their paintings, the effect of the camera obscura and its manner of showing nature, which has led some people to think that the camera could help them to understand light or chiaroscuro. The effect of the camera is striking, but false.”\(^5\) May it not be that the “falsity” of Vermeer’s perspective helped to keep him in obscurity until after the 1860’s, when the ubiquitousness of photography had conditioned men’s eyes to another way of looking at the world? At any rate it is certain that to a modern eye, accustomed to seeing the world through photographs, Vermeer’s near objects no longer look exaggeratedly big.

The eye of any age is so subtly yet inexorably a part of the mind of that age that one is tempted to wonder if photography could have been invented at any time before the 1830’s in spite of the fact that the elements had been on hand for centuries. Certainly the photograph would have seemed a distraction of vicious curiosity to the mediaeval scrutiny of everything for possible symbolism and moral value. And the mannerist world, though it showed its liking for architectural perspective by assembling the camera obscura with lens, would have rejected most photographs of the human figure for being so far from its canon of proportion. But in the 1830’s Balzac wanted to examine and record his surroundings down to the last item, and Ingres won applause with his painting of clean-edged light and shade.

The desire for exact and unlimited detail and smooth chiaroscuro was probably the incentive that started Fox Talbot on the search that discovered the negative-positive process of photography. In 1833, when Talbot was sketching a landscape with a camera lucida, he found that his “faithless pencil had only left traces on the paper melancholy to behold.” Now since the camera lucida is a drawing machine that makes the most complicated perspective as simple as tracing, Talbot, who could not have been dissatisfied with the exactness of his outlines, probably wanted more accurate values of light and shade. Daguerre, the other inventor of photography, was then making himself famous in Paris by the mastery of light and shade that he showed in painting stage scenery.

\(^5\) Quoted in C. A. Jombert, Méthode pour apprendre le dessin (Paris, 1755), p. 139.
A Studio, by Jan Vermeer. In the Czernin collection, Vienna
on thin cloth to be transformed by lights from behind.

The spread of photography made "photographic" art cease to pay. In 1842, only three years after the announcement of the discovery, over twelve hundred daguerreotype views in a Paris gallery were reporting the appearance of foreign places with more accurate detail than the best-trained hand could draw. In the course of a couple of generations photography not only took away the bread and butter from the main bulk of draftsmen—the news reporters and specimen gatherers for mankind—who had for over three centuries informed the learned and the illiterate about the look of the world, but it also squeezed out the engravers who copied those drawings on copper and wood for printing. Why should a man spend years learning to do what a child can accomplish better by clicking a box camera?

So long as illustrations were produced by a team of draftsmen and engravers, consistency could be achieved only when both groups of artists had been taught to draw alike. As factual draftsmanship ceased to provide a livelihood for most artists, the art schools ceased to train so intensively by literal copying. While this meant that some art students never learned to draw at all, it also meant that all were not pressed so tightly as formerly into a uniform mold. Without such a loosening up of the curriculum in art schools modern art could not so
readily have developed its unprecedented diversity of styles. Thus it is that photography, by taking on the drudgery of pictorial reporting, gave expressiveness a freer hand in art than it had had since the Middle Ages. The very invention that was born of a desire for the most detailed realism not only discredited that realism by too quick and easy a satisfaction, but in time stimulated art with undreamed-of revelations of form and action.

Photography has fascinated and influenced some of the greatest artists since 1839. Degas and Thomas Eakins, to name only two, both gave their serious thought to taking photographs as works of art. By getting someone else to release the shutter, both men often photographed themselves, not from vanity, but from convenience, since every artist can count on himself as his most available sitter. When Degas was fifty he wrote a curious letter in which he criticized, in greater detail than he used in writing about his paintings, a photograph where he had recently grouped several ladies in bustles around him in a parody of Ingres's Apotheosis of Homer. It is odd that while his photographs, like Eakins's, show the same characteristics of vision as his paintings, they do not show the "photographic" innovations that he painted and drew. For Degas would seem to have used certain peculiarities of photography for imaginative effect in his painting, such as his trick, in which he far outdoes Vermeer, of making near objects loom immense. When he blows up the clean, abstract shape of a near-by double-bass head or a milliner's hat until it balances a mass of figures in the middle ground he composes in depth as he does in surface extension, by counterpoising spots.

Degas's eye ferreted and foraged among too wide a diversity of pictures for us to discover the germs of some of his inventions. Though it is tempting, for instance, to think that the figures that have walked half off some of his canvases might have been suggested to him by photographs of street scenes or careless family snapshots, he did most of his painting before the photograph became cheap and easy enough for casual snapping. He is more likely to have got his idea for his sliced figures from the Japanese pillar prints that advertised reigning
geishas in posters shaped like upright strips so they could be pasted on wooden posts in teahouses. Since any figure tall enough to catch the eye from a distance was wider than the slender wooden pillars, the Japanese, like any true artists, made a virtue of necessity by designing figures that looked right only when sliced off at the sides.

There is, however, another matter in which Degas seems to have had a more easily demonstrable connection with photography. His drawing of horses in action was the first complete break with tradition as represented either by the English eighteenth-century rocking-horse gallop or by the monumental baroque horse careering above a stump. How is it that Degas succeeded in accurately catching that elusive horse action—the thoroughbred’s high-strung, jumpy instability—when the specialists like Leonardo, Stubbs, Marshall, and Géricault had not come anywhere near as close? Degas did not benefit by Muybridge’s pioneer photographic analysis of horse action, for he was already painting his characteristic horse action in the late 60’s and early 70’s, before Muybridge had begun to photograph horses in 1872 and long before his results first reached France late in 1878.

A possible answer is suggested in an article pointed out to me by Mrs. Beaumont Newhall, “The Human Wheel,” which Oliver Wendell Holmes wrote for the Atlantic Monthly in 1863, when articulated wooden legs were being devised for the wounded of the Civil War. Holmes said of the mechanism of walking: “We thought we could add something to what is known about it from a new source, accessible only within the last few years, namely the instantaneous photograph. We have selected [for reproduction] a number of instantaneous stereoscope views of the streets and public places of Paris and New York, each of them showing numerous walking figures, among which some may be found in every stage of the complex act. No artist would have dared to draw a walking figure in attitudes like some of these.”

The wet plate then available was too slow for what we today would call instantaneous photography, but old stereoscope views nevertheless show cab horses stopped suddenly enough to give an extraordinarily quick eye, like Degas’s, an inkling of what to look for on the race track. This may well be the answer, for the attitudes of Degas’s horses, while truer than those of any painter before him, are not the catalepetic, nightmare suspensions that were first revealed to the world through Muybridge’s photographs of the gallop. Degas would certainly not have thought it beneath him to study horse action in stereoscope views since he
About 1884 Thomas Eakins, one of Muybridge’s co-workers whose collaboration has only lately received attention, took time off from his painting to make photographs of action by a slightly different method. He used one camera to make a rapid series of exposures on one plate (see p. 23). Where Muybridge separated the stages of action like playing cards dealt out for solitaire, Eakins stacked one on top of the other to satisfy his mathematical passion for relations. It was a step towards that series of pictures rapidly replacing each other on one spot which is the movie. Eakins never bothered to publish his photographs, perhaps because in 1882 and 1883 his correspondent, Etienne Jules Marey, had already published the same sort of photographs in *La Nature*. This publication of what amounts to pictures of Bergson’s idea of time rolling up on itself did not attract special attention at the moment, but when Marcel Duchamp translated the same idea into oil painting in 1912, his *Nude Descending the Stairs* (see p. 24), like the first

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night of Hugo's *Hernani*, called up one of those storms of protest that mark the outburst of an intellectual revolt. An idea that has passed without comment in photography strikes indignation thirty years later in painting, for in art as in morals we judge separate categories of things by separate standards. Once I picked up a little urn of pink and gray marble, but dropped it instantly when it squashed. It was not marble, but rubber, and rubberiness, while not in itself distasteful, becomes repulsive where solidity has been expected. We dislike seeing a man paint what we accept from a camera.

Instantaneous photography, that microscope of time, which began by opening our eyes to things at home and in the street, nowadays reports the unseen—even the unseeable. And so it is also with the microscope of space that first confirmed what a sharp eye might guess and now reveals what few eyes can believe. Greek lenses, with their low magnification, and even the early compound microscope that was developed in Holland about 1600 showed things that do not look so very different from things big enough to feel in the hand. Yet the Dutch advance in exploring the world of littleness was startling enough to make it no accident that Leeuwenhoek should have been discovering tiny forms of life with his microscope in Delft during the very years when Gerard Douw in Leiden was painting with strokes so minute that he had to make his own brushes and always sat still at his easel until all dust had settled before he put on his eyeglasses and opened his paintbox. While the first microscopes seemed to lead toward the most prosy stock-taking of facts, the larger magnifications which culminate in the electron microscope peer into a world of angles and ovals that hardly resemble any natural shapes that we can see unaided (see p. 25). Not only has the world revealed by the senses become a shell encasing God knows what, but the physicist has had to abandon his old ideas of matter and to adventure among electrons and protons.

"The physicist used to borrow the raw material of his world from the familiar world, but he does no longer. The external world of physics has thus become a world of shadows. In removing our illusion we have removed the substance, for indeed we have seen that substance is one of the greatest of our illusions. The frank realisation that physical science is concerned with a world of shadows is an assertion of freedom for autonomous development."

These words were spoken by A. S. Eddington in 1927, in the ripe heyday of abstract art; they might have been written, changing "science" to "art," by Klee or Picasso or Kandinsky. Logic and sensibility are aboard the same train even though they ride in separate cars and disconcert each other when they meet. While they thought they were traveling toward something "minutely accurate, mechanically imitative," the train has whirled away through the night somewhere north of illusion and west of dream.