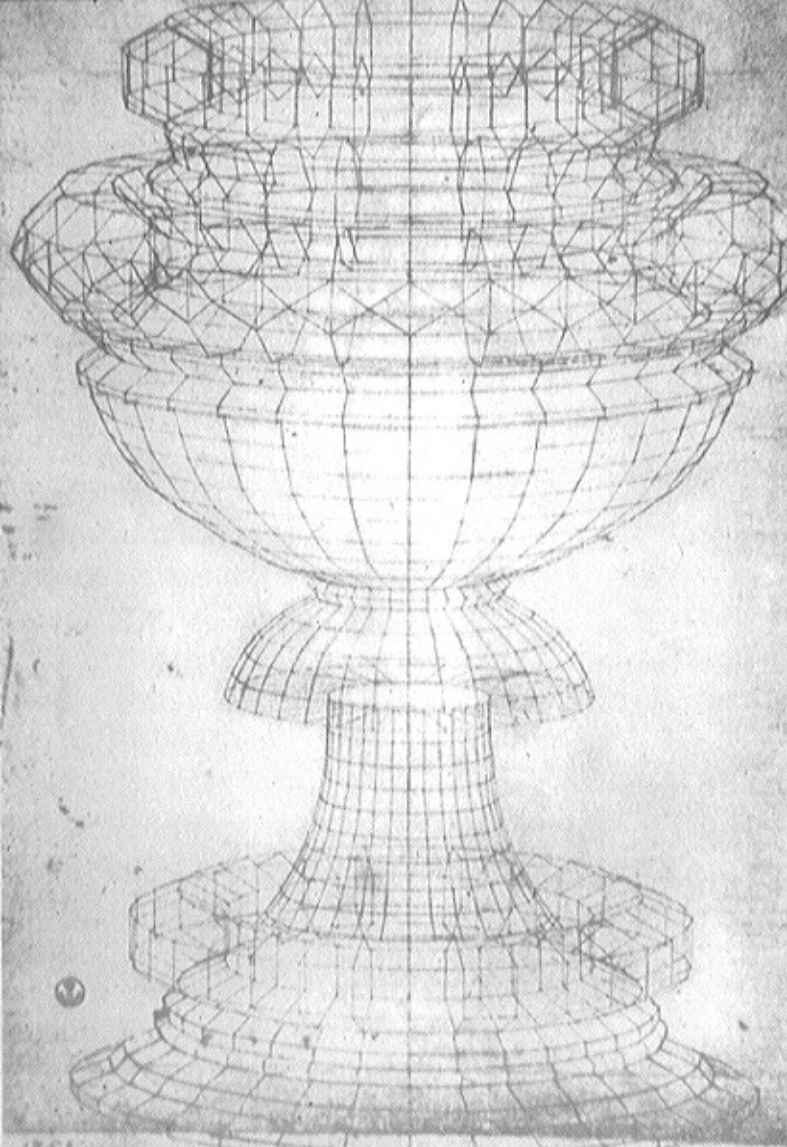
The Pre-History of Photography

Perspective, Camera Obscura, Chemistry



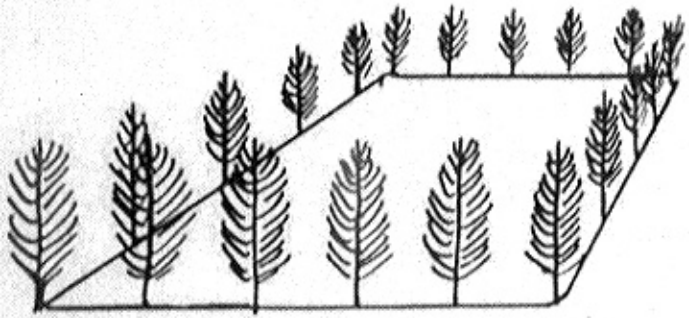


Figure 87

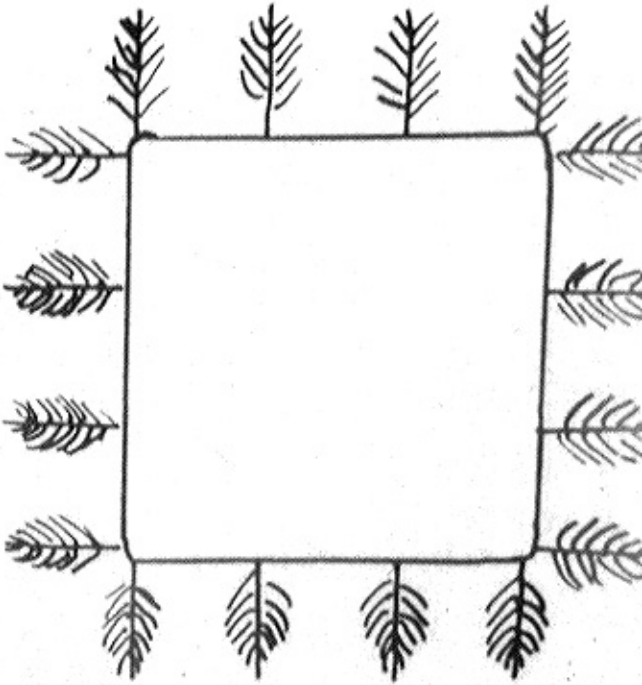


Figure 88

Except for a few white-ground pots which, perhaps, show evidence of having been drawn from models, the Greek forms give every sign of having been drawn from memory of standardized objects seen from standardized positions. The Greeks struggled with the foreshortening of the individual body—sometimes successfully enough—but their foreshortening of one body had little bearing on the foreshortening of another in immediate proximity to it. The same thing is true of their notations of the shapes of objects. In general each separate body, each separate object, was seen as a thing in itself in a private space of its own. And, unless my eyes literally deceive me, the achievement of emotional or psychological relationships is of the greatest rarity.

Today, a nomad in the Sahara does not recognize a photograph of himself the first time he sees one. He cannot put himself in a photograph and fears magic. He walks the flat and looks for himself horizontally as he would for someone coming across the desert. He *does* recognize the images in what have been called the "abstract" designs of his pottery and weaving. His innocent eye is quickly debauched by Kodachrome, but he remains hazy about the distinction between green and blue. After all, why not? Blue pigment used to be made by grinding the gemstone lapis lazuli. Even painters like Gainsborough saw trees as brown.

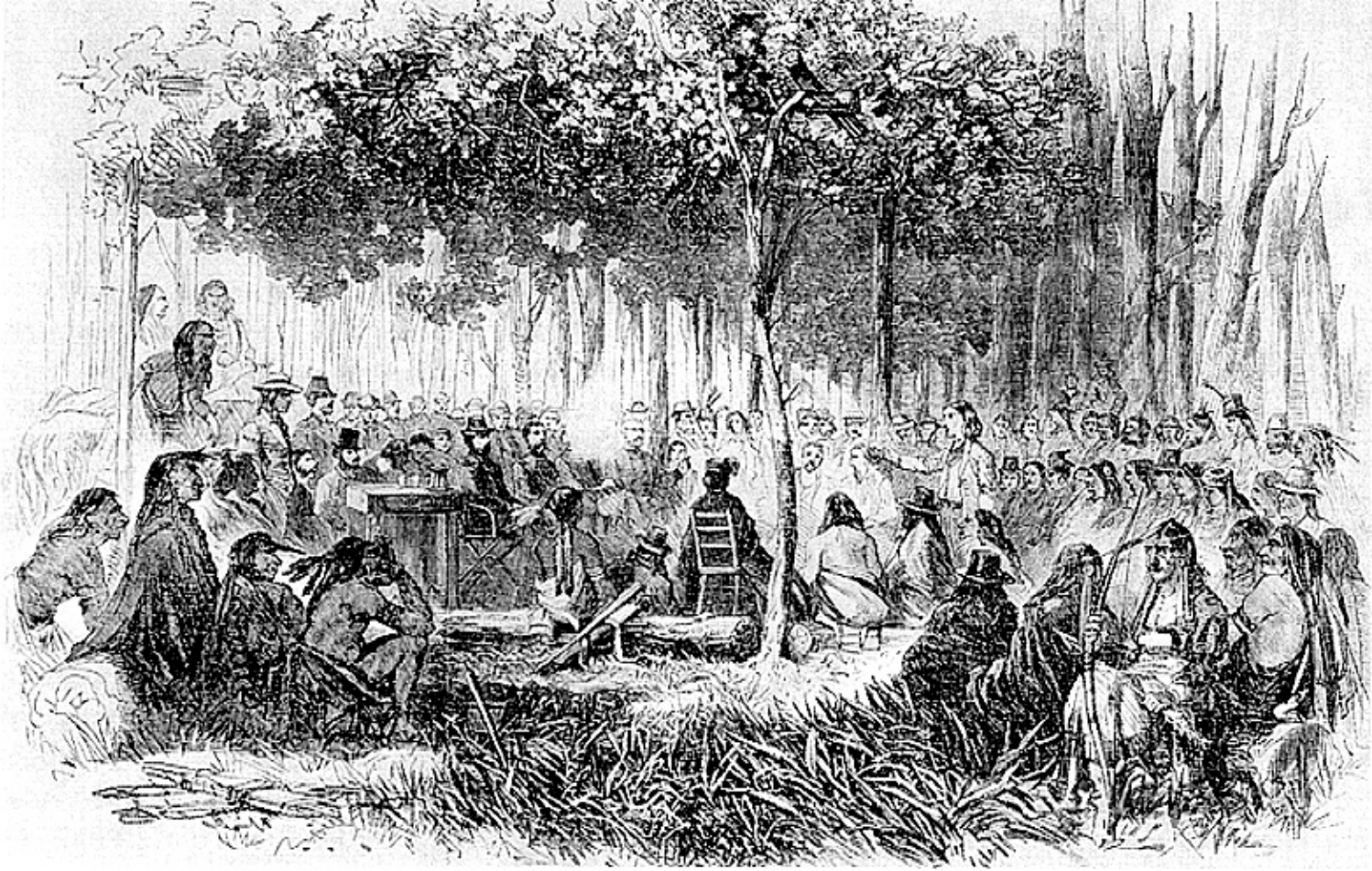
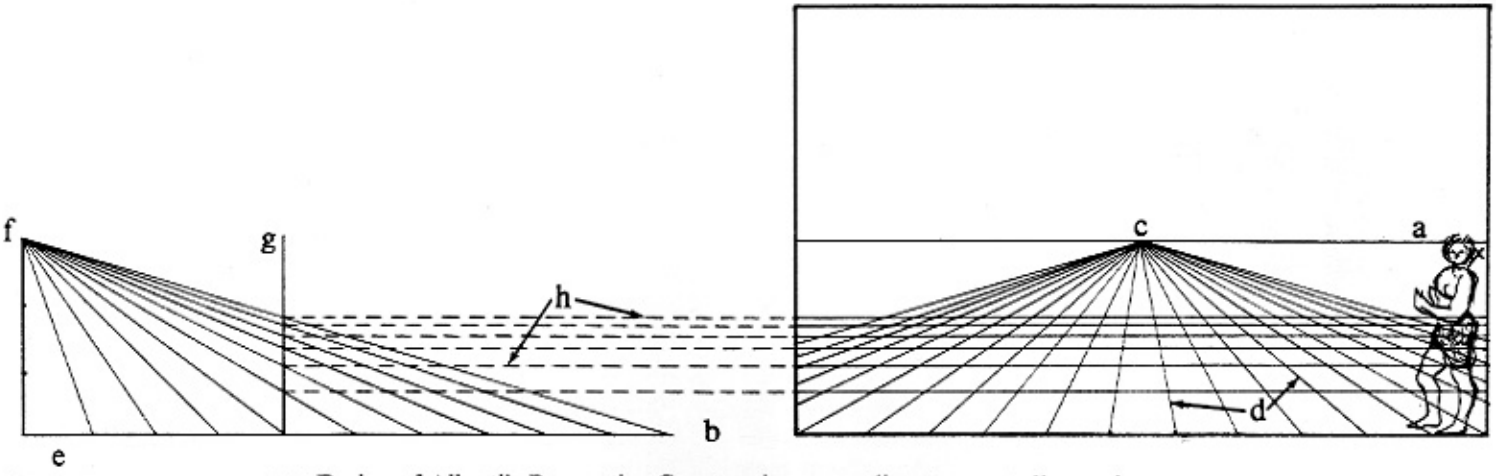
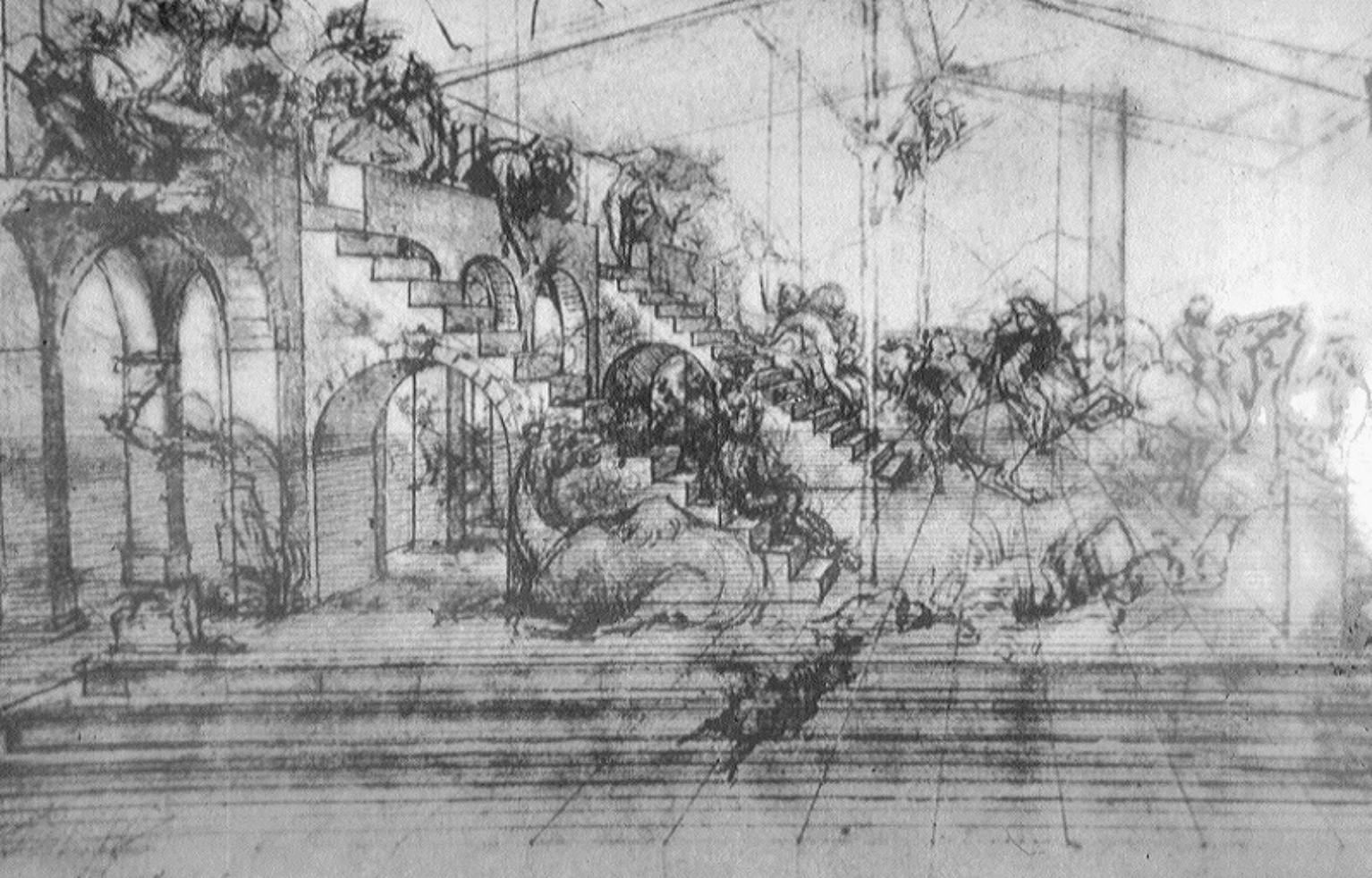


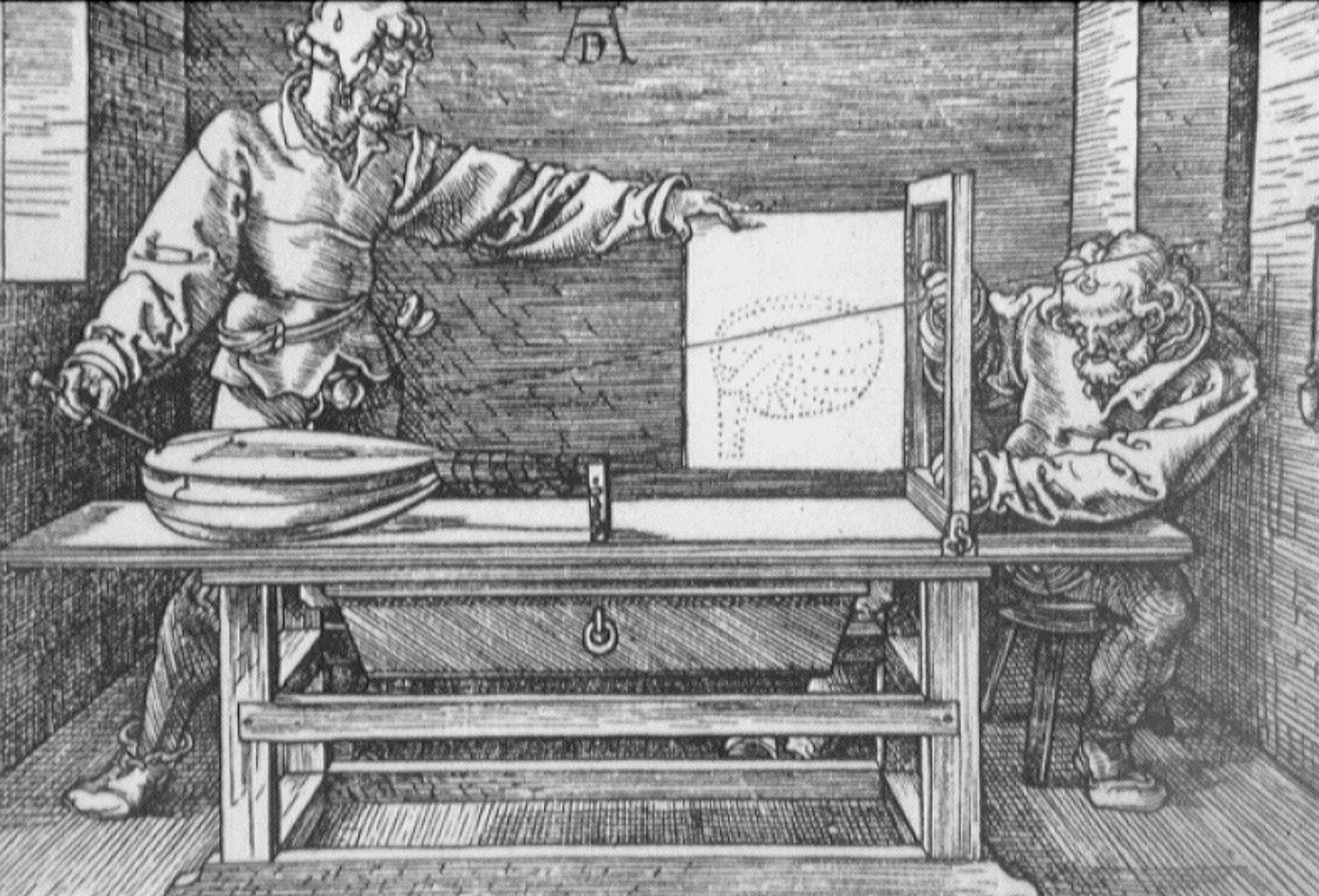
Fig. 39 John Taylor, *Treaty Signing at Medicine Creek Lodge*, 1867.
Drawing for *Leslie's Illustrated Gazette*, September–December. 1867, as seen in Douglas C. Jones, *The Treaty of Medicine Lodge*, page xx, Oklahoma University Press, 1966.

Fig. 40 Howling Wolf, *Treaty Signing at Medicine Creek Lodge*, 1875–1878.
Ledger drawing, pencil, crayon, and ink on paper, 8 × 11 in. New York State Library, Albany, New York.

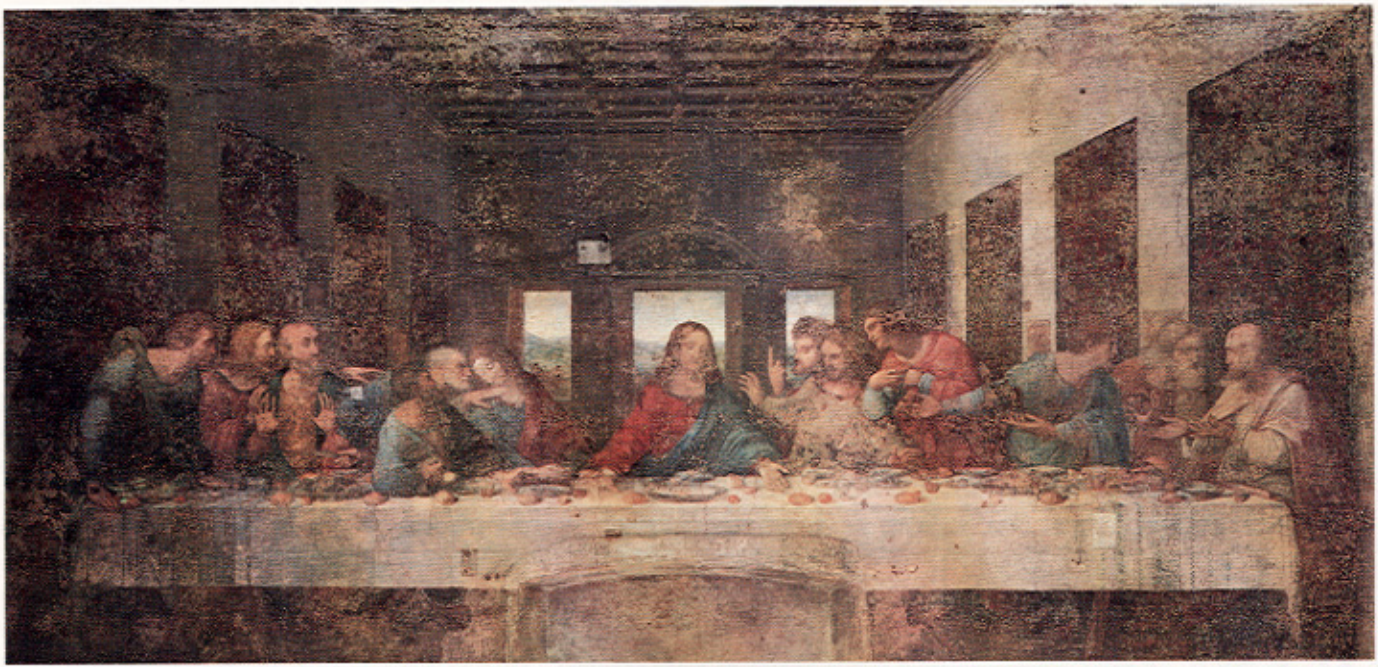


232. Design of Alberti's Perspective Construction, according to recent discoveries
a. height of human being *b*. base line *c*. vanishing point *d*. orthogonals
e. "little space" *f*. distance point *g*. vertical intersection *h*. transversals

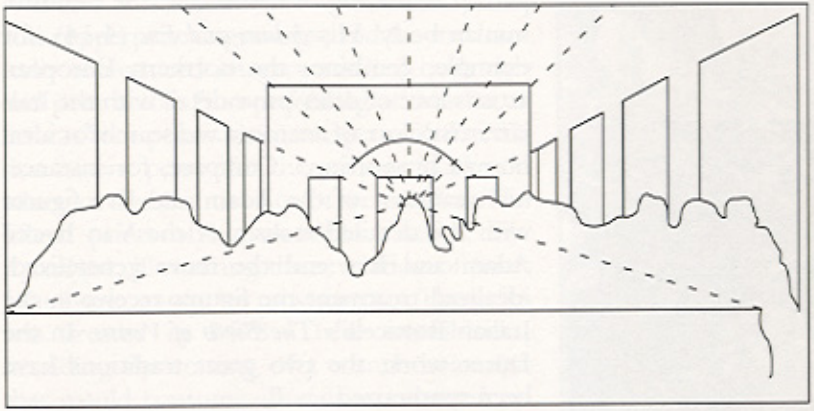




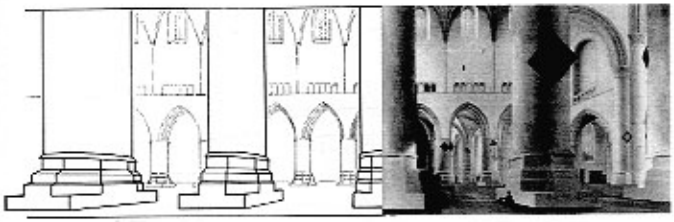

LIBERTAS
ECCLESIASTICA

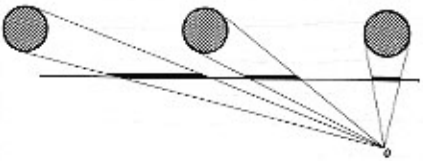


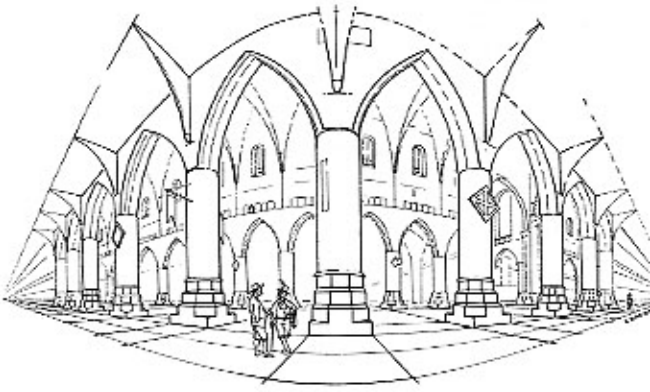
4.11 • LEONARDO DA VINCI. *The Last Supper.* *ca* 1495–1498. Oil-tempera on wall. 13′ 10″ × 29′ 7½″. Santa Maria delle Grazie, Milan.

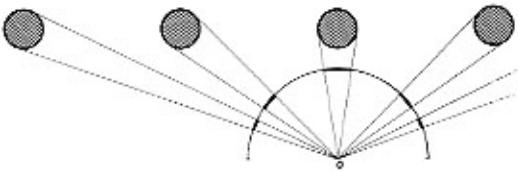


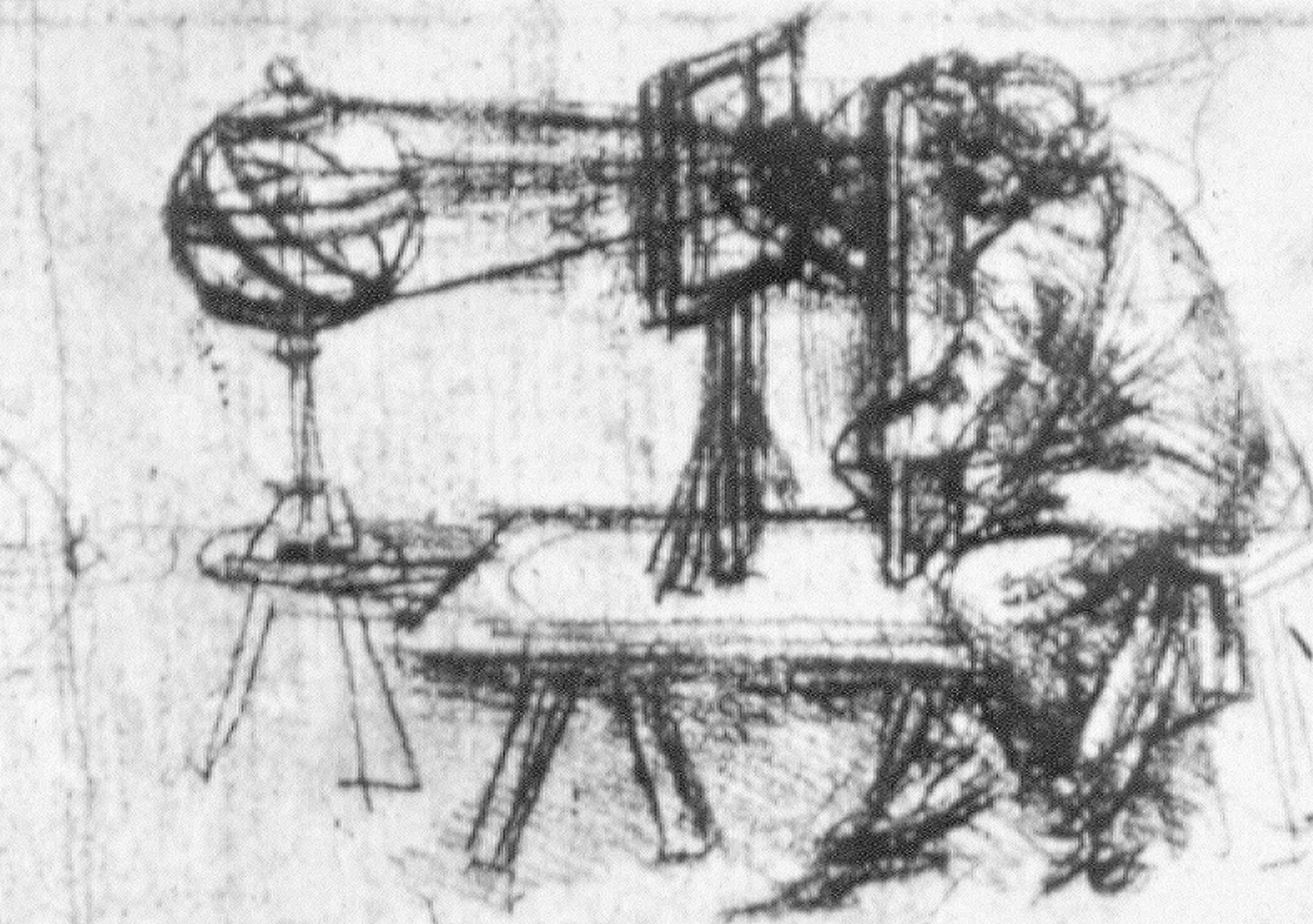
4.12 • Perspective drawing of *The Last Supper.*

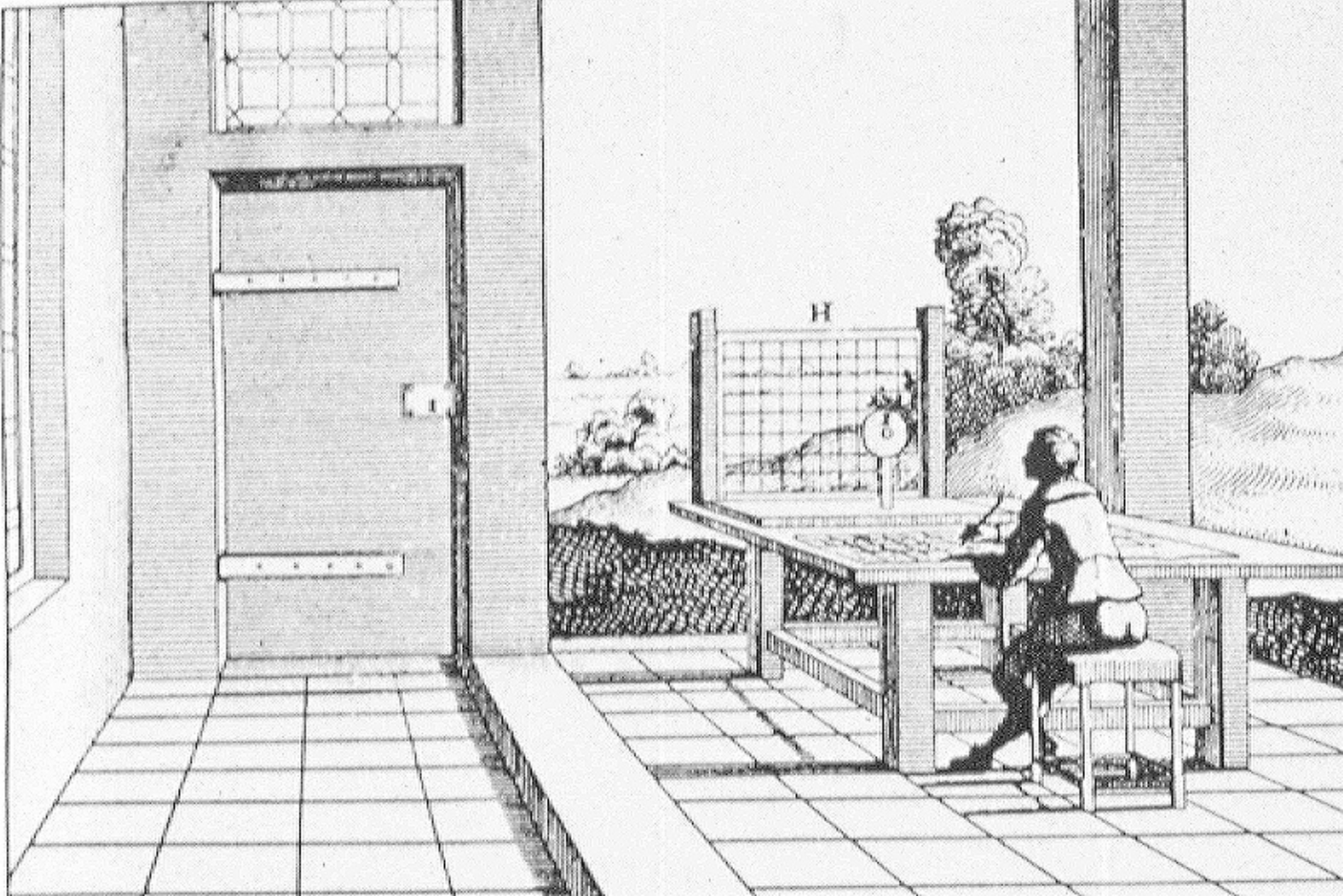








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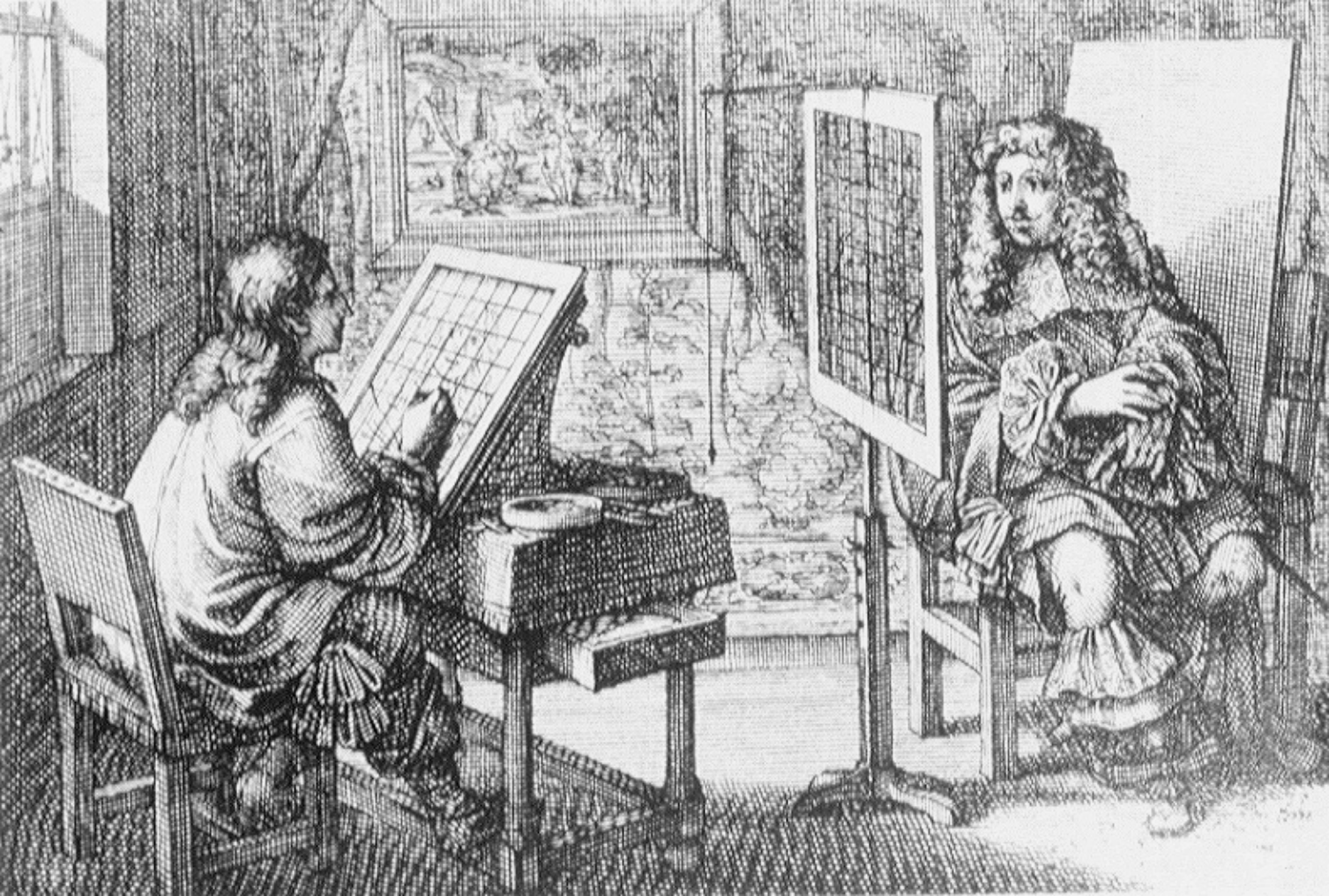
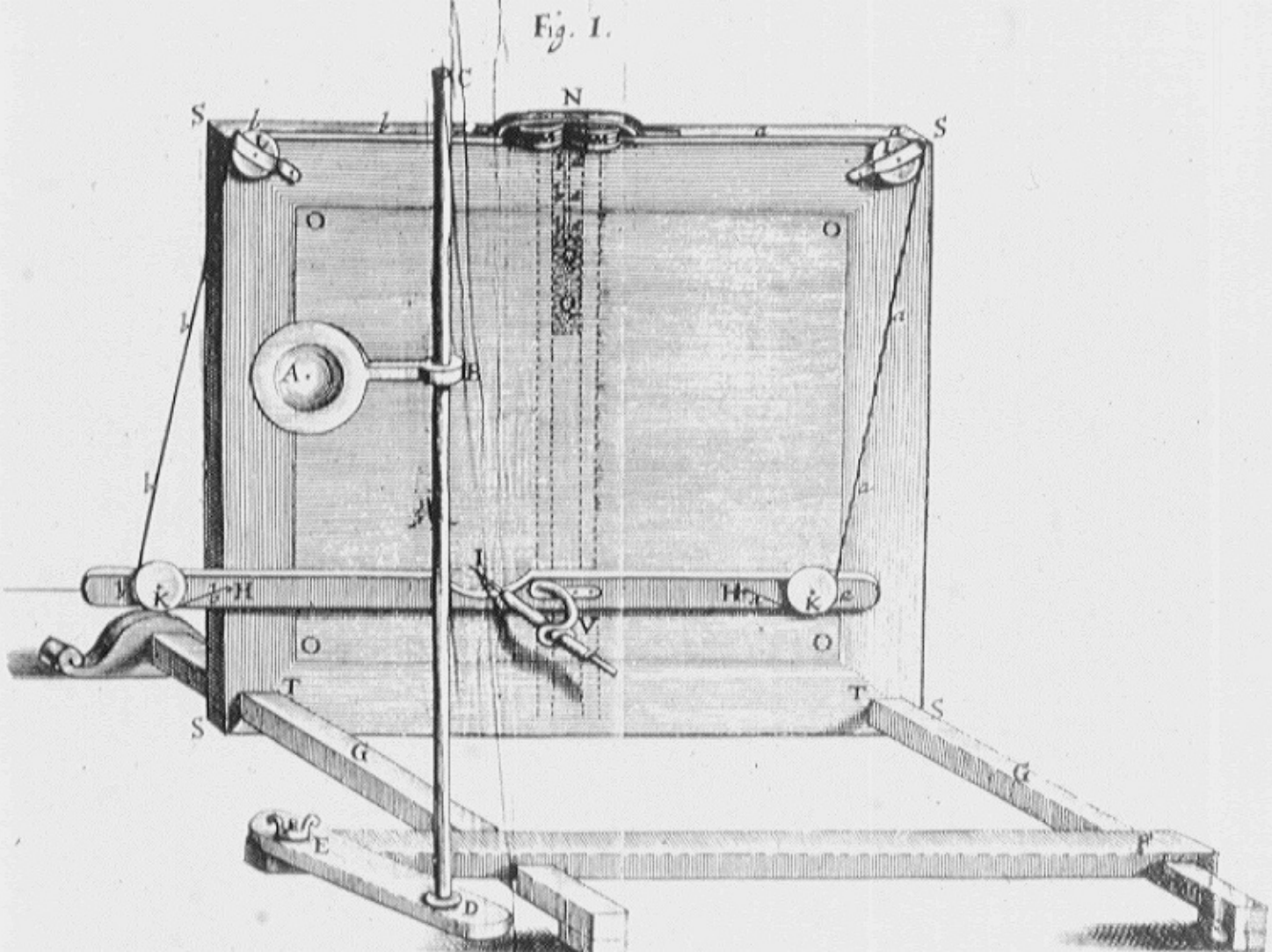
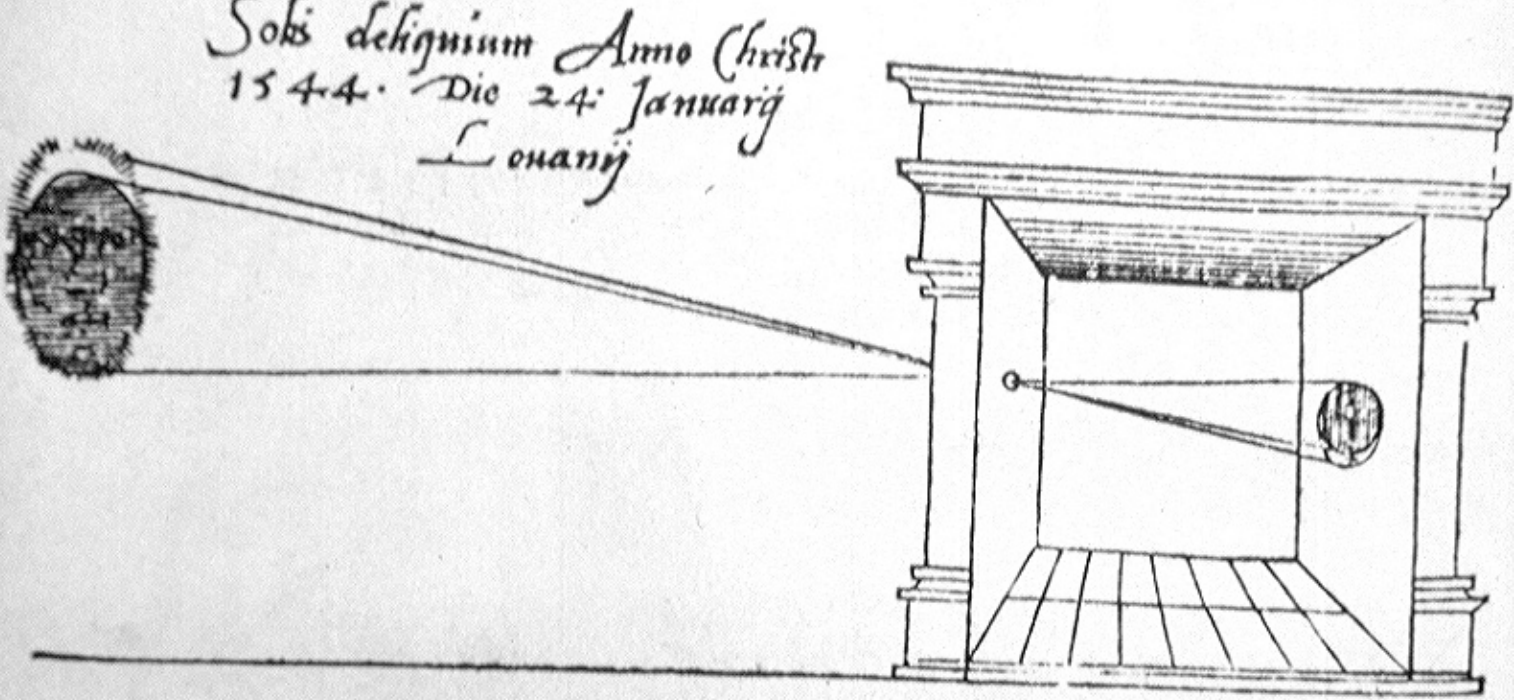


Fig. I.





Sic nos exactè Anno .1544. Louanii eclipſim Solis obſeruauimus, inuenimusq; deficere paulò plus q̃ dextantem, hoc eſt, 10. vncias ſiue digitos vt noſtri loquun-


CAMERA OBSCURA PINHOLE

3. This interest in perspective arises from observing the effects of the optical principle of pinhole imaging: i.e. the property of light such that if it passes through a very small hole the light is diffraced in such a manner that an inverted and horizontally reversed image is focused on a flat surface behind the pinhole.

a. Euclid records this phenomenon in 300 B.C.

b. Aristotle observes this optical principle

c. Arabian scholar, Alhazen, circa 1000 A.D. used it to observe solar eclipses inside a darkened tent; discusses its principles in **Optics** (translated into Latin in 1572 by Friedrich Risner)

d. Roger Bacon in his **Opus Majus** (c.1260) described the pinhole effect

e. 1521 a pupil of Leonardo da Vinci gives an account of this camera obscura (darkened room with a view).

f. Leonardo da Vinci writes in his notebooks circa 1490:

"When the images of illuminated objects pass through a small round hole into a very dark room, if you receive them on a piece of white paper placed vertically in the room at some distance from the aperture, you will see on the paper all those objects in their natural shapes and colors."

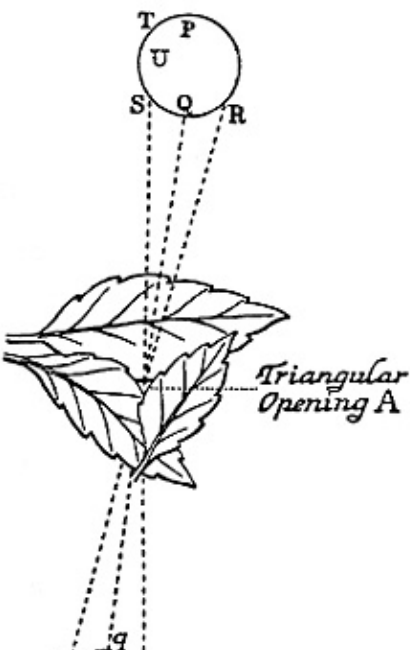
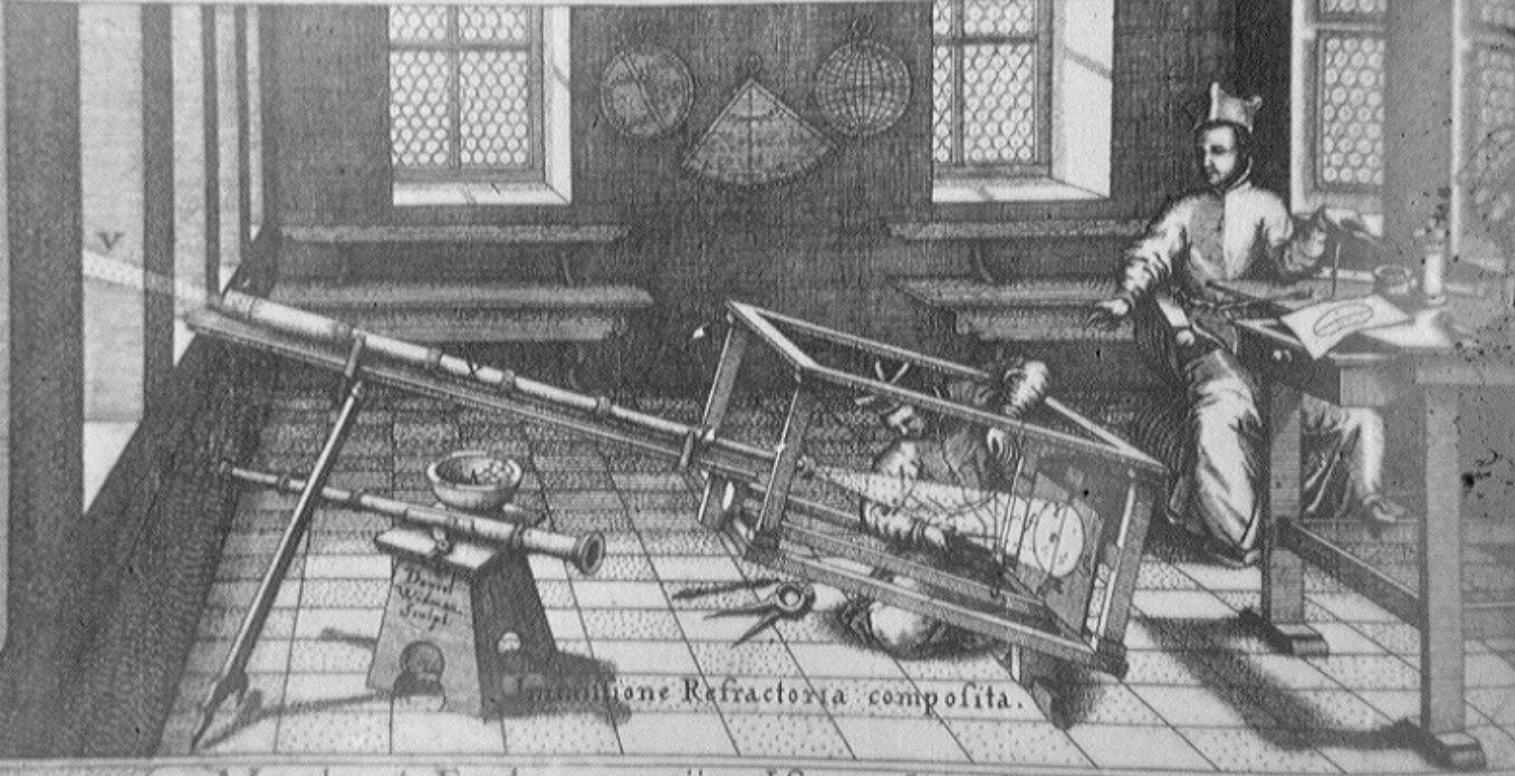


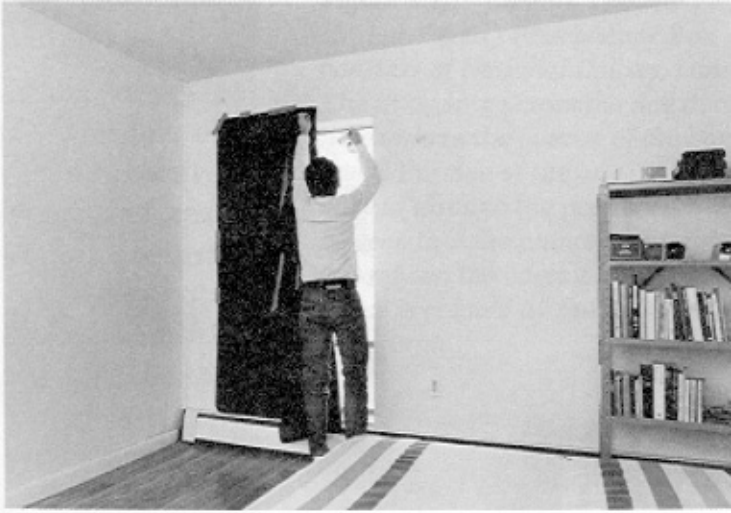
Figure 1.2 Sun's Image Projected through Chinks in Leaves. *The upper circle represents the sun and the lower circle its image on the ground; even though the pinhole is triangular, the image is round. Drawing by Sir William Bragg,* The Universe of Light, *1933.*



Maculæ et Faculæ ex uariis obſeruandi modis ſtabiliuntur

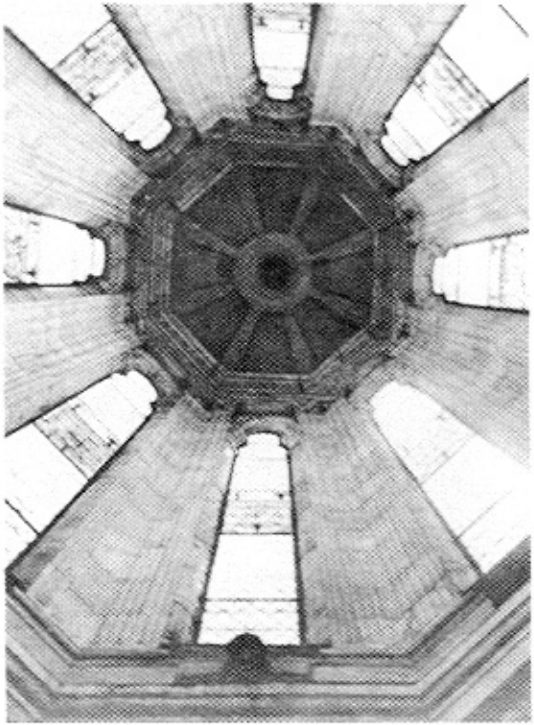
Western art bought the Greek canon and tooled away at one aspect of the visible world for hundreds of years before this particular phantom of reality was caught more economically on sensitized paper. The result, called photography (recognizing that light can write), could have been accepted as *The* image of the world only by eyes long accustomed to "realistic" painting since Giotto.

2.2a

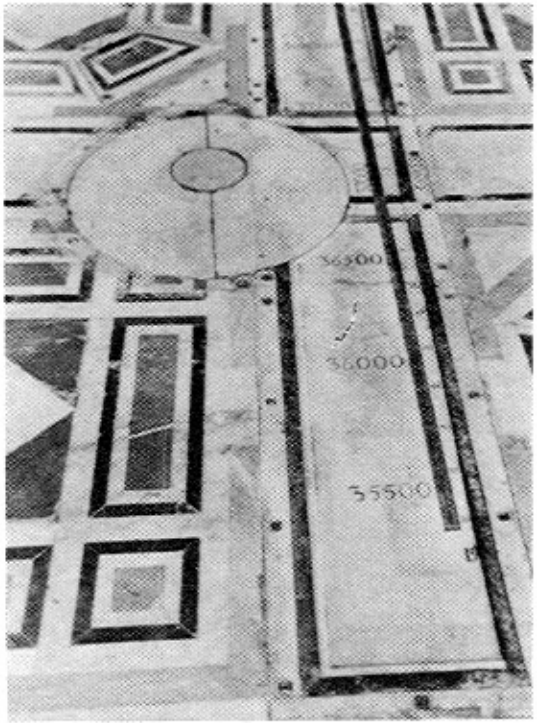


2.2b

By the latter part of the fifteenth century, some cathedrals in Italy had a large aperture placed in the arched ceiling for telling time. In 1475, at the age of seventy-eight, the Renaissance mathematician and astronomer Paolo Toscanelli placed a bronze ring with an aperture (Figure 1.9a) at the juncture of Filippo Brunelleschi's dome and lantern in the Cathedral of Florence—still in use today. A solar image is projected through this hole on sunny days, visible on the cathedral's floor. At noon, as the sun traverses the sky, this solar image bisects a "noon-mark," a meridian line placed north-south on the floor (Figure 1.9b). This pinhole is also used architecturally to see if the building has shifted.



1.9a



1.9b

Figure 1.9a View Upward into the Lantern, *Cathedral of Florence. The bronze ring with pinhole is the rounded shape at bottom of photograph in front of window. Lens photograph by Pinky Bass, from the collection at Pinhole Resource.*

Figure 1.9b Detail of Noon-mark on the Floor, *Cathedral of Florence. Lens photograph by Pinky Bass, from the collection at Pinhole Resource.*

Improvements to the Camera Obscura

1550 -- Girolamo Cardano, Milanese phyisian, suggests use of bi-convex lens to replace pinhole to increase sharpness.

1558 -- Giovanni Battista della Porta in *Natural Magic* suggests lens to increase brillance of the image.

1568 -- Daniele Barbaro, professor at Padua University suggests apertures of varying sizes to increase depth-of-field; he calcullates the optimum aperture for specific focal length lenses.

1573 -- Ignatio Danti uses concave mirror to re-invert the camera's upside down image.

1620 -- Johann Kepler scales down camera to a portable tent size device.

1636 -- Scioptric (ox-eye) ball lens (lens in a ball and socket) used for panoramic sketching.

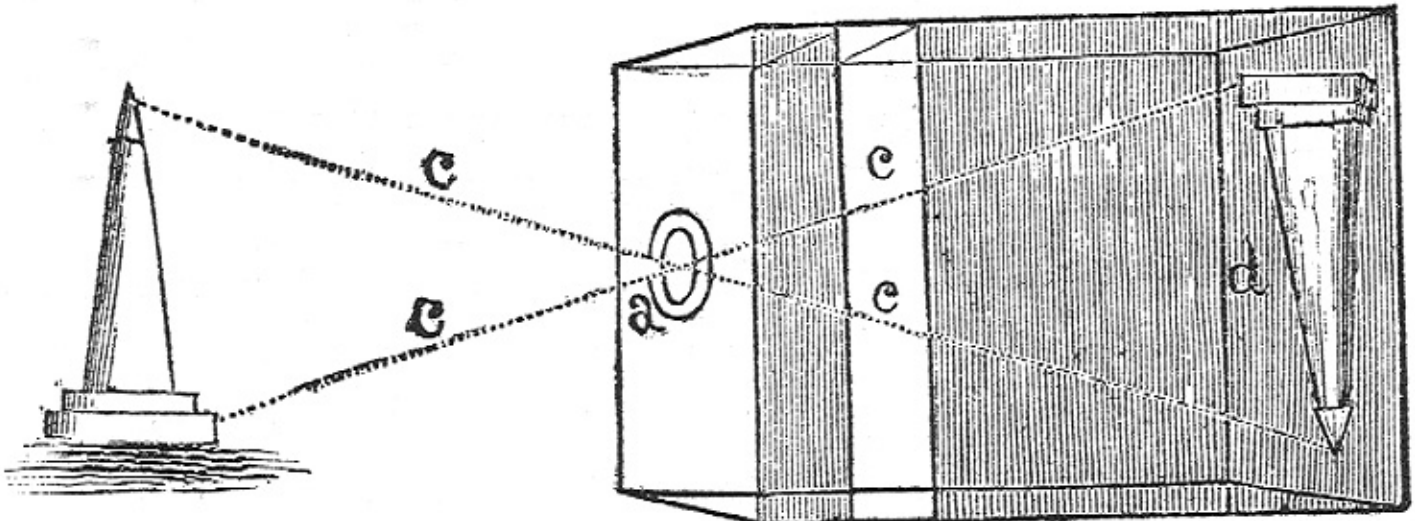
1657 -- Kaspar Schott, mathematician, introduces adjustable focus (box-within-box array).

Improvements con't

1676 -- Johann Christoph Sturn design first reflex viewing camera, mirror at 45 deg. angle projects image onto oiled paper (crude groundglass) upon which tracing for sketching is placed.

1685 -- Johann Zahn, a monk from Wurzberg, improves on Sturn's design, making it smaller: 9 x 9 x 24" long; it was painted black inside and had a hood over the reflex viewing area.

Thus, by 1685, the camera is perfected.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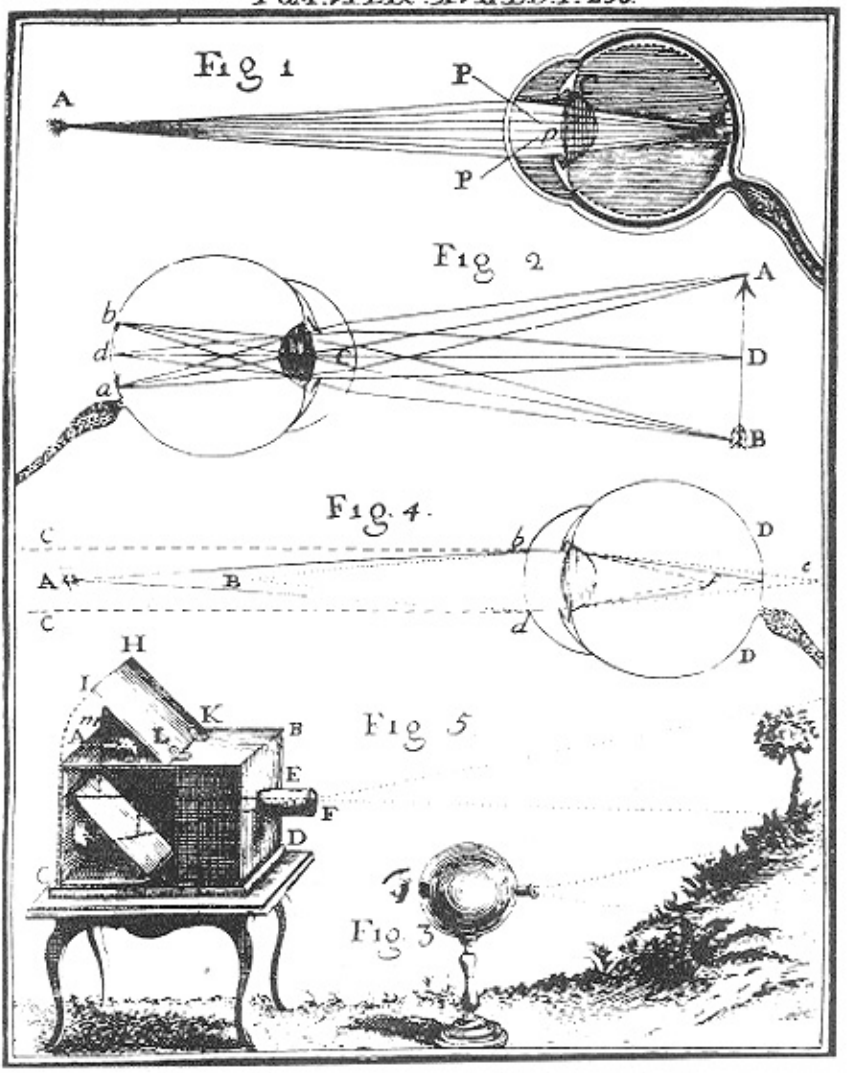
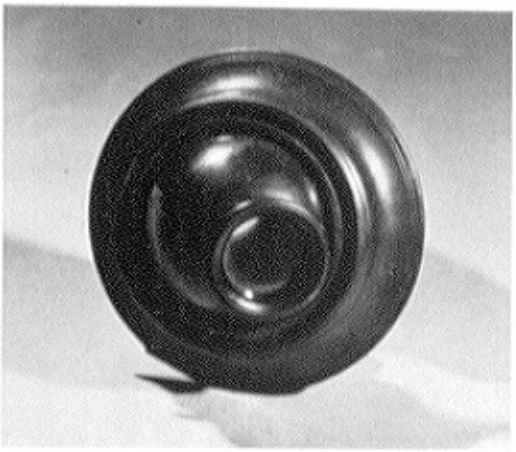


Comparison of eye and camera obscura. Early eighteenth century.

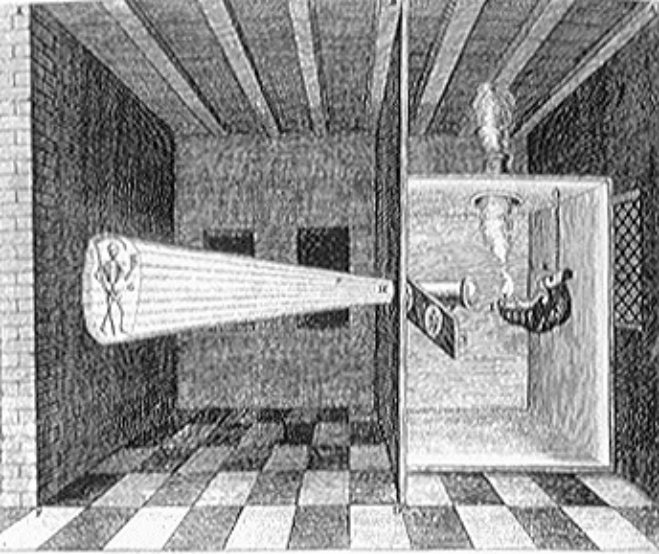

IOANNES BAPTISTA PORTA NEAPOLITANVS ANNO ÆTATIS SVÆ LXIIII

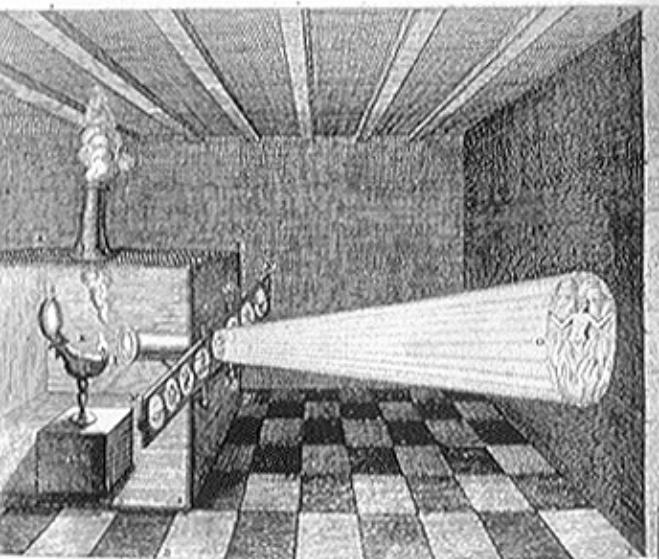
"When you make the experiment, you should choose such glasses as do best, and you should cover the lens leaving only a little circle in the middle [aperture], which should be clear and open, and you will see everything with a still more lifelike effect. When you see, therefore, on the paper the outline of things, you can draw upon the paper with a pencil the entire perspective, and the shading and coloring as in nature; holding the paper firmly until you have finishing drawing."

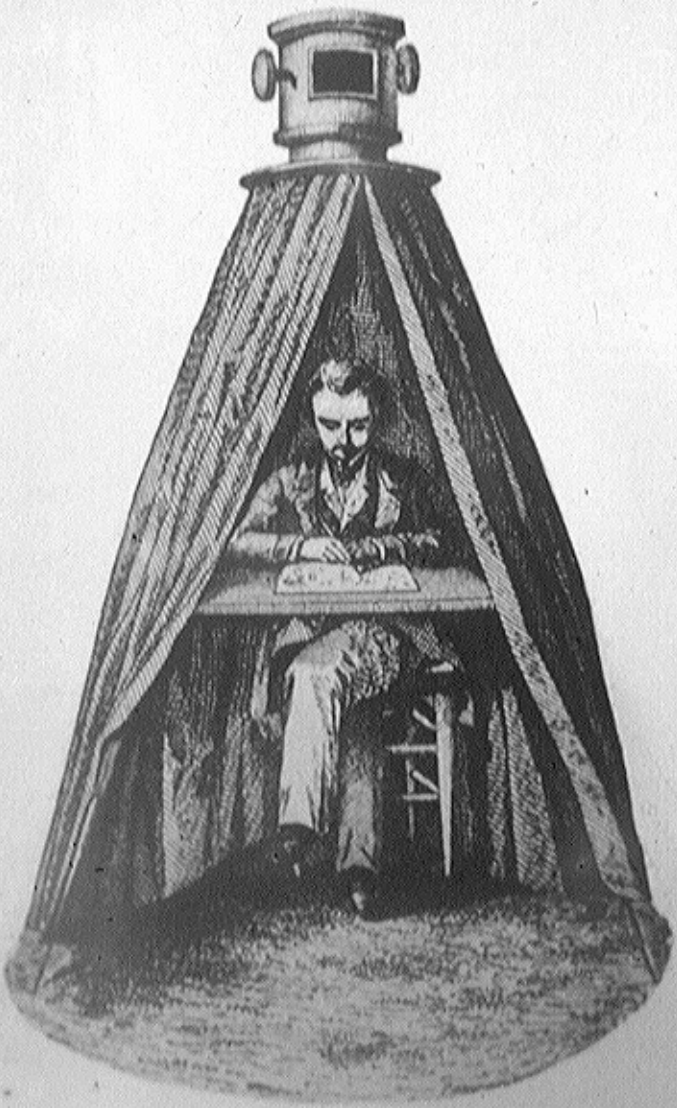


2 Scioptric ball or 'ox-eye', c. 1650

3 ATHANASIUS KIRCHER. Large portable camera obscura, 1646







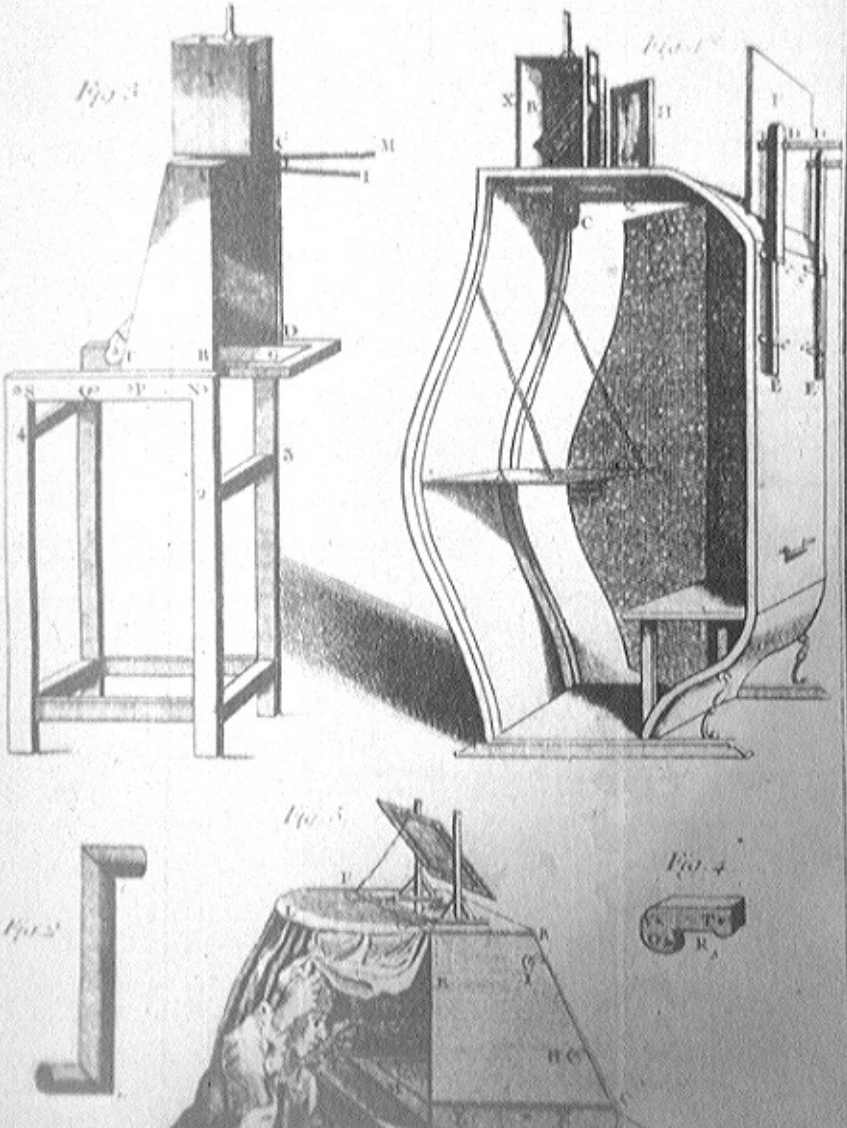


Fig. 3
Fig. 1
Fig. 2
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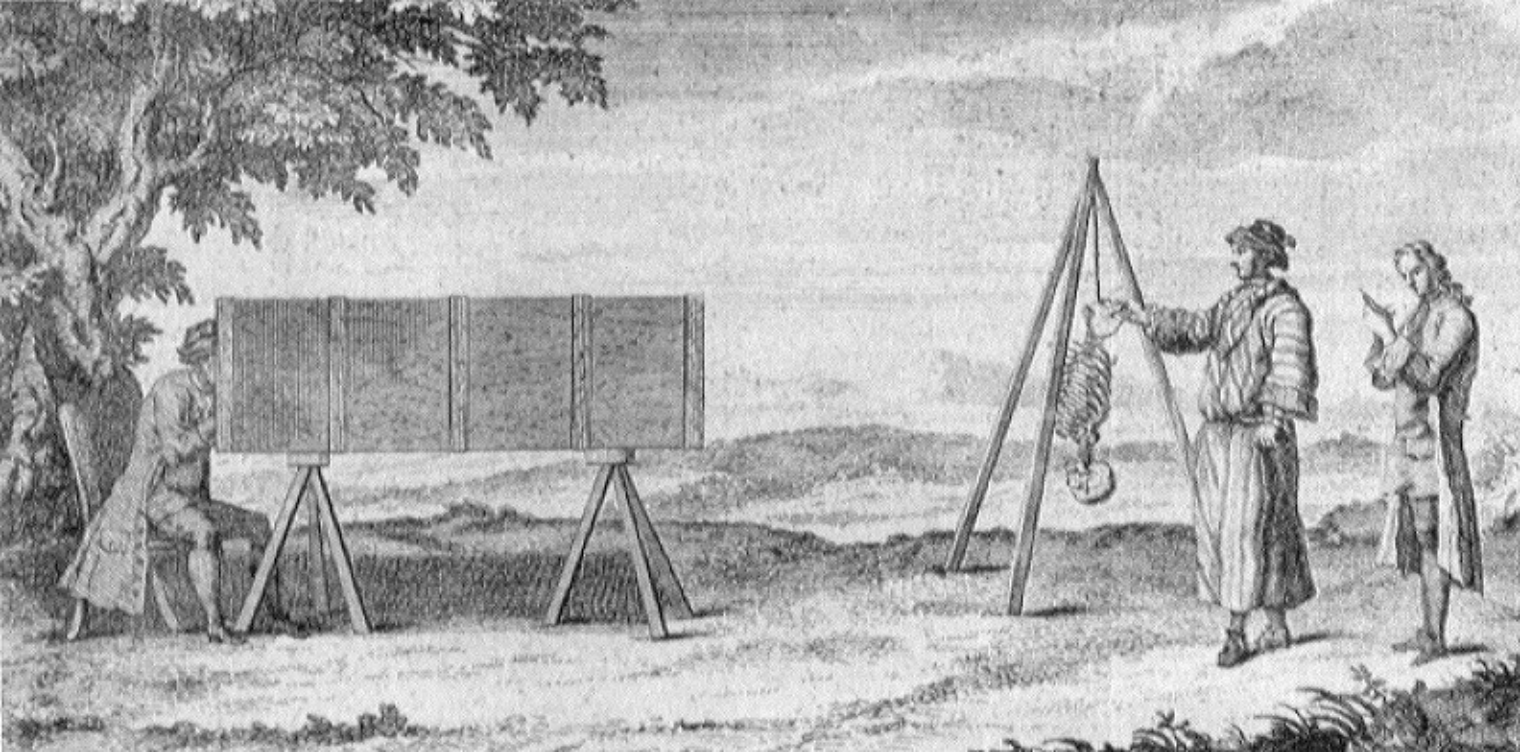

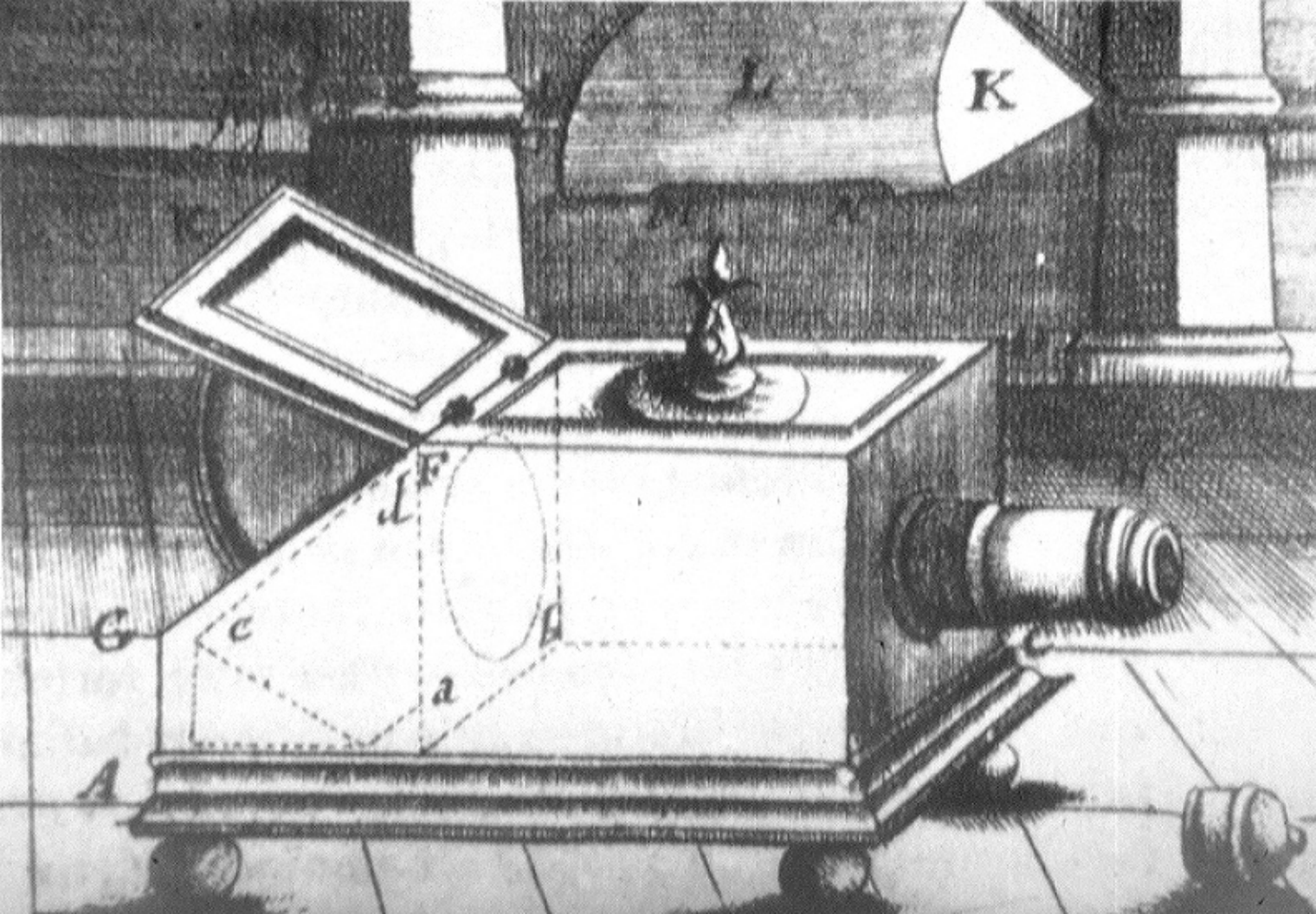
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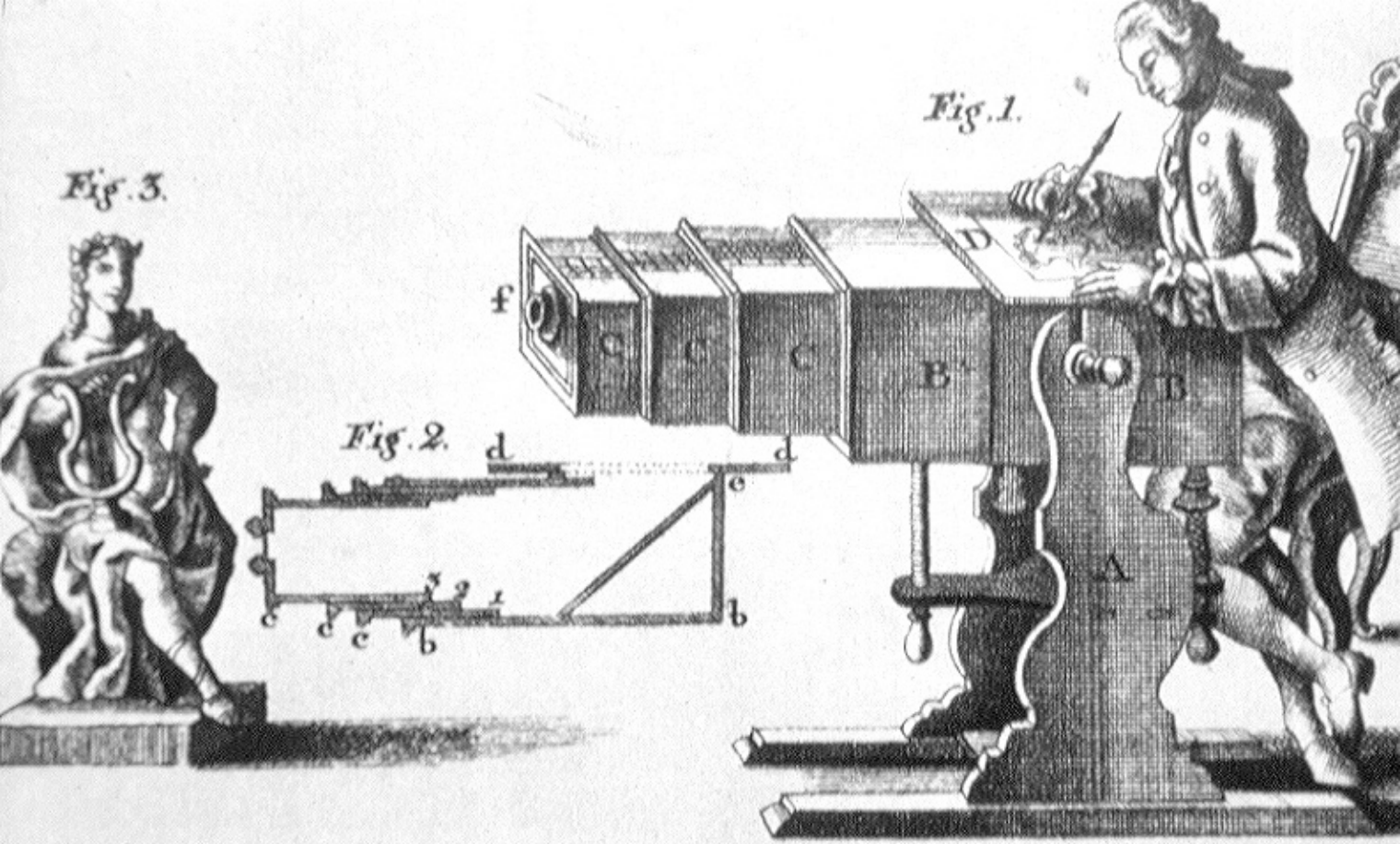
Fig. 1.
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Techniques of the Observer

ON VISION AND MODERNITY IN THE NINETEENTH CENTURY

Jonathan Crary

I will argue, however, that the camera obscura and the photographic camera, as assemblages, practices, and social objects, belong to two fundamentally different organizations of representation and the observer, as well as of the observer's relation to the visible.

For the camera obscura was not simply an inert and neutral piece of equipment or a set of technical premises to be tinkered with and improved over the years; rather, it was embedded in a much larger and denser organization of knowledge and of the observing subject. Historically speaking, we must recognize how for nearly two hundred years, from the late 1500s to the end of the 1700s, the structural and optical principles of the camera obscura coalesced into a dominant paradigm through which was described the status and possibilities of an observer. I emphasize that this paradigm was dominant though obviously not exclusive. During the seventeenth and eighteenth centuries the camera obscura was without question the most widely used model for explaining human vision, and for representing the relation of a perceiver and the position of a knowing subject to an external world.

Perhaps the most famous image of the camera obscura is in Locke's *Essay Concerning Human Understanding* (1690):

> External and internal sensations are the only passages that I can find of knowledge to the understanding. These alone, as far as I can discover, are the windows by which light is let into this *dark room*. For, methinks, the understanding is not much unlike a closet wholly shut from light, with only some little opening left . . . to let in external visible resemblances, or some idea of things without; would the pictures coming into such a dark room but stay there and lie so orderly as to be found upon occasion it would very much resemble the understanding of a man.

The formal operation of a camera obscura as an abstract diagram may remain constant, but the function of the device or metaphor within an actual social or discursive field has fluctuated decisively. The fate of the camera obscura paradigm in the nineteenth century is a case in point.[2] In the texts of Marx, Bergson, Freud, and others the very apparatus that a century earlier was the site of truth becomes a model for procedures and forces that conceal, invert, and mystify truth.[3]

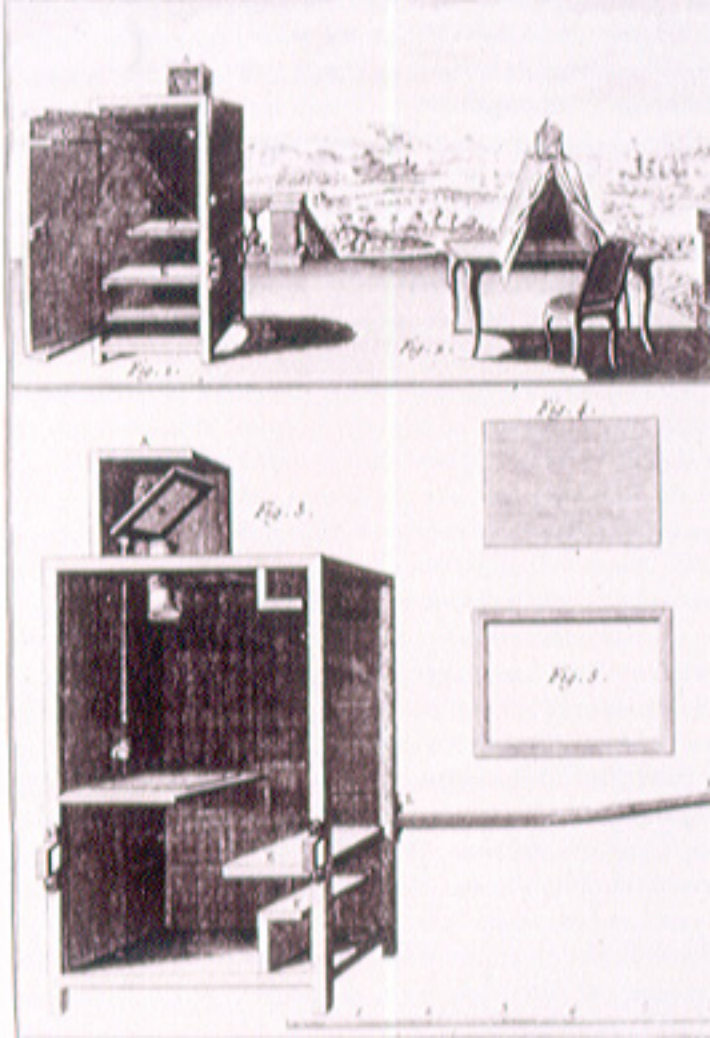
Fig. 1.
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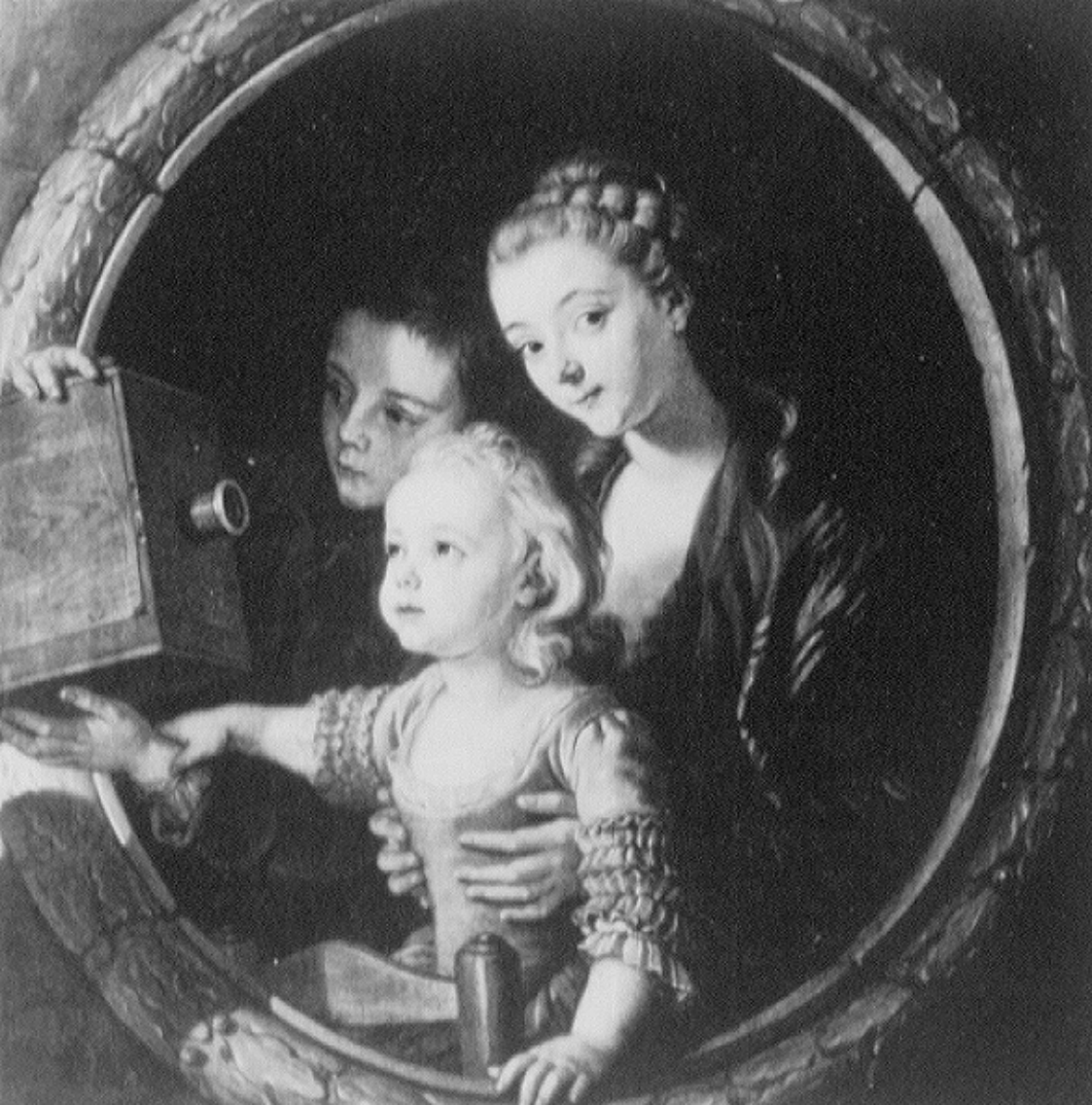
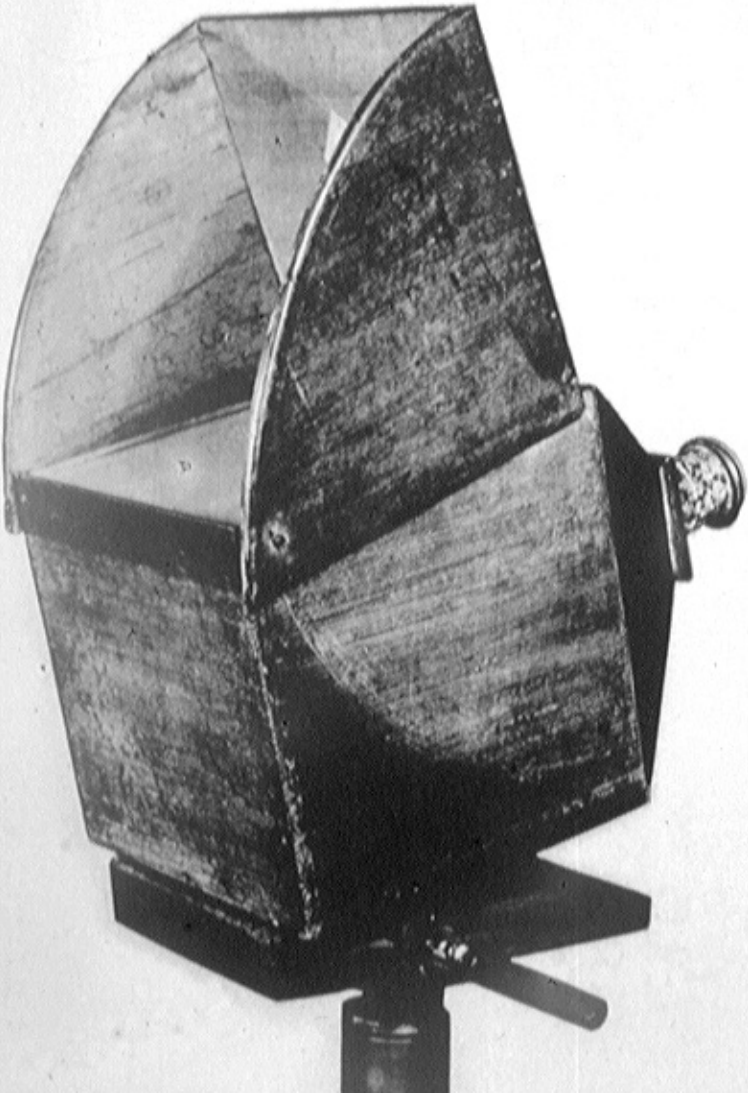
Fig. 5.

". . . to make the same use of the camera obscura, which naturalists and astronomers make of the microscope and telescope. For all these instruments equally contributed to make known and represent Nature ... The best modern painters among the Italians have availed themselves greatly of this contrivance (camera obscura); nor is it possible that they should have otherwise represented things so much to the life. . . . Let the young painter, therefore, begin as early as possible to study these divine (camera obscura) pictures, and study them all the days of his life, for he never will be able sufficiently to contemplate them."

". . . too exact an imitation [of the projected image] would be a distortion; because the way in which we see natural objects in the camera obscura is different from the way in which we see them naturally."

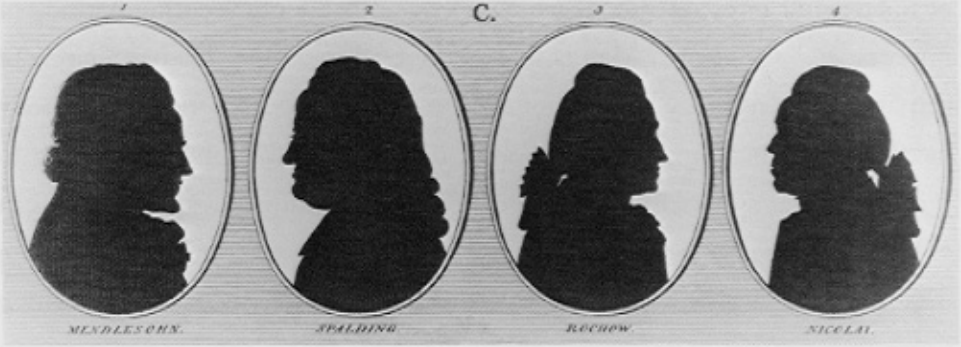

JOACHIMUS FRANCISCUS BEICH





Drawing Aides

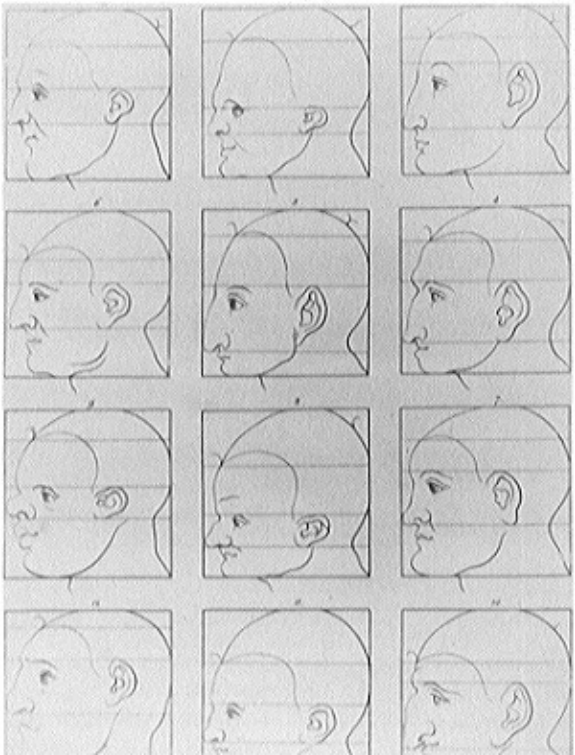
1) Camera obscura (pinhole & lens)
2) Intersectors (mechanical aides)
3) Profile machines (physiognotrace)
4) Convex mirrors (often black)
5) Camera lucida

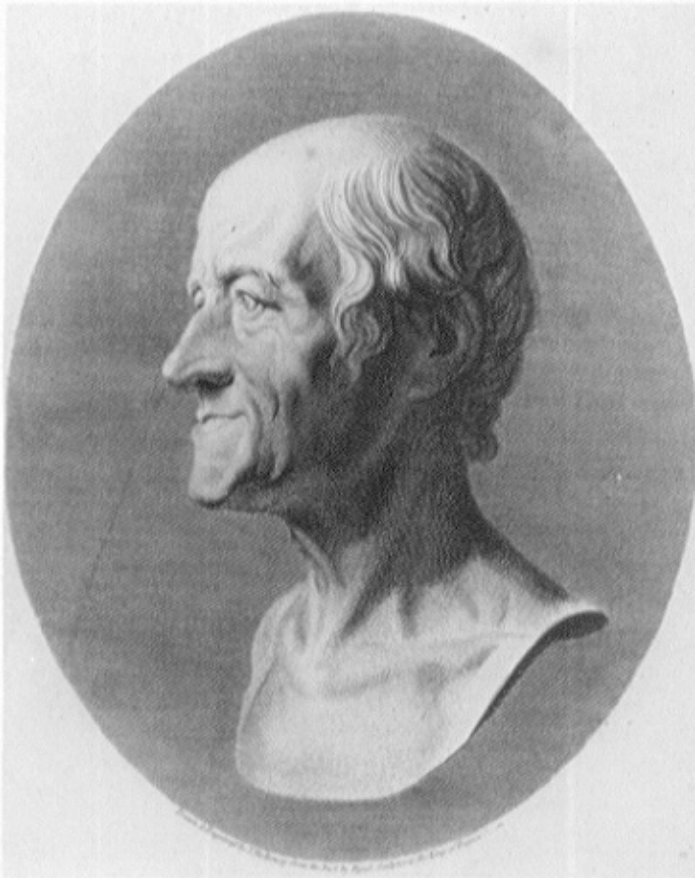


56. Johann Caspar Lavater, *Silhouettes of Mendelssohn, Spalding, Rochow, and Nicolai,* from *Essays on Physiognomy,* 1792, II, part I, p. 187. Engraving by Thomas Holloway et al. (Photo: Courtesy National Library of Medicine, Bethesda, Md.)

13. Alexander Cozens, *Simple Beauty*, from *Principles of Beauty*, 1778, pl. 1. Engraving. (Photo: Courtesy National Library of Medicine, Bethesda, Md.)

14. Johann Caspar Lavater, *Calculating Facial Disproportion*, from *Essays on Physiognomy*, 1792, III, part II, pl. facing p. 275. Engraving by Thomas Holloway et al. (Photo: Courtesy National Library of Medicine, Bethesda, Md.)





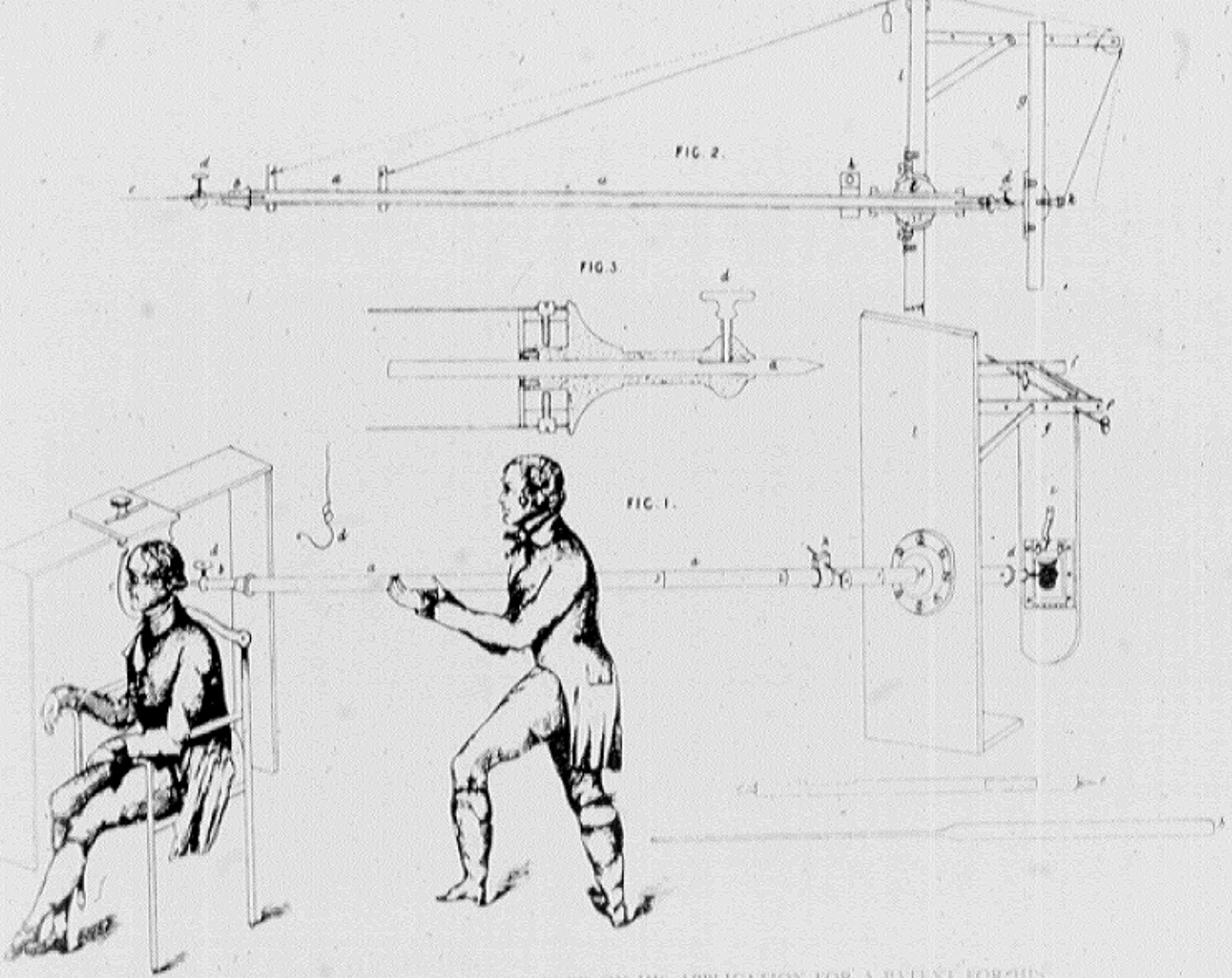


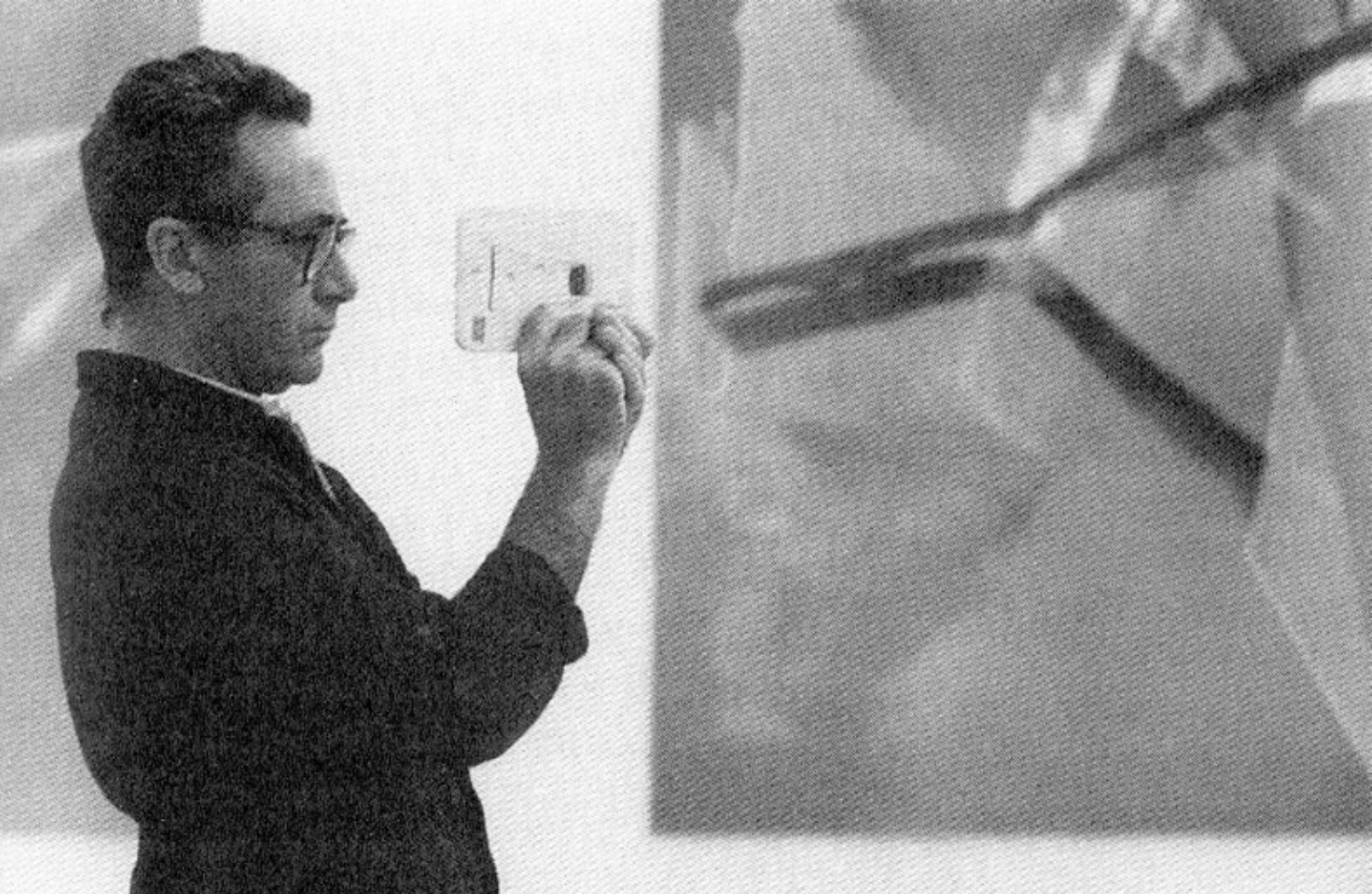
DIAGRAM SUPPLIED BY C. SCHMALCALDER ON HIS APPLICATION FOR A PATENT FOR HIS PROFILE MACHINE, 1866

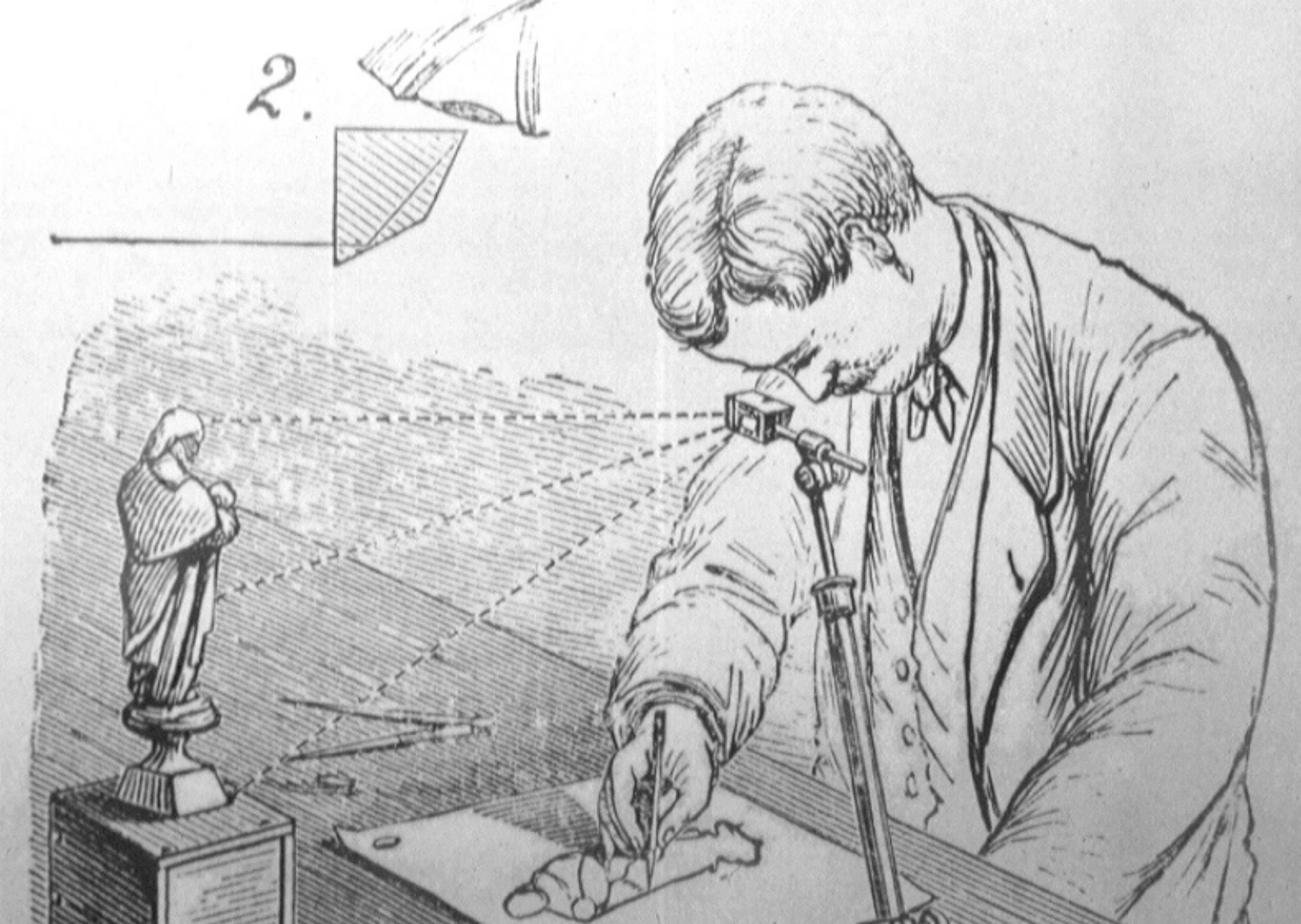
Nature's beauty is unorganized, haphazard, prodigal of detail, without finality. The eye embraces, for example, a landscape; with a wide or narrow angle of vision, as the case may be, but with no fixed limits beyond which it cannot wander. The scene involves beauty of lines and forms and color, but they are unrelated to one another. They happen here and there and there is no completeness. Moreover, there will be a far greater quantity of detail than the eye can receive. There is, in fact, from the point of view of the observer, a waste of beauty.

Gilpin says that the convex mirror allows him to grasp the landscape in a single glance, like a painting, and that the organ of sight does not need to focus, as it must with a telescope.

Elizabeth Bennet's hopes for her planned trip to the Lakes in *Pride and Prejudice*:

> Oh! What hours of transport we shall spend! And when we *do* return, it shall not be like other travelers, without being able to give one accurate idea of anything. We *will* know where we have gone—we *will* recollect what we have seen. Lakes, mountains, and rivers, shall not be jumbled together in our imaginations; nor, when we attempt to describe any particular scene, will we begin quarreling about its relative situation. Let *our* first effusions be less insupportable than those of the generality of travelers.




2.

J.F.W. Herschel delin. Camera Lucida. Feb. 7. 1838 (Cape Town & Table Bay from place above the Platte Klip. Table Mountain)

Imagining Photography

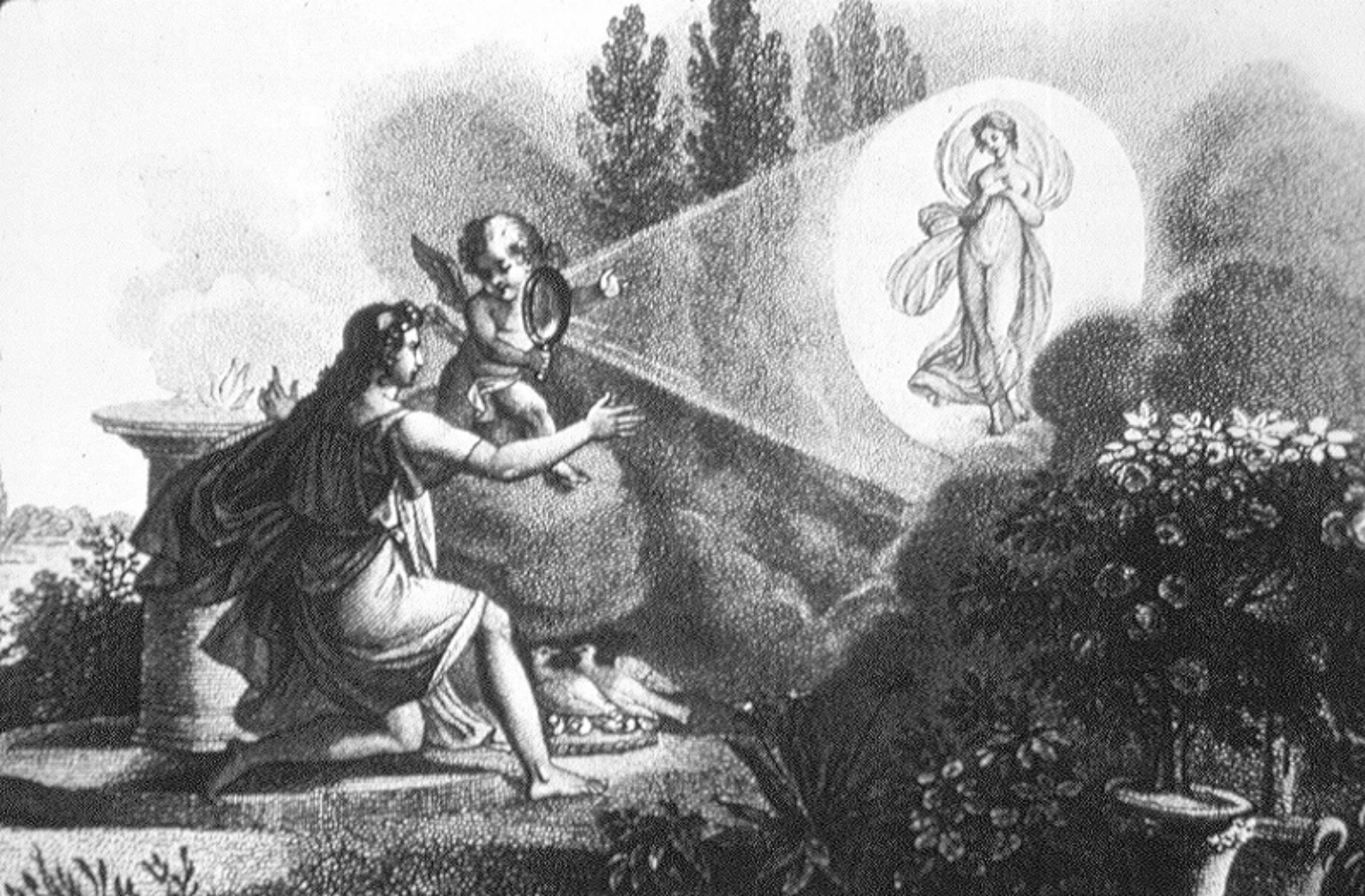
Texts that anticipate photography are:

Plato's *Republic* (360 B.C.E.)

Tiphaigne de la Roche's *Giphantie* (1760)

William Cowper's poem *The Task* (1785)

". . . there are many ways in which the feat might be quicly and easily accomplished, none quicker than that of turning a mirror round and round--you would soon enough make the sun and heavens, and the earth and yourself, and other animals and plants, and furiniture and all othr things of which we were just now speaking, in the mirror."



"To arrest the fleeting images that fill/ The mirror of the mind, and hold them fast,/ And force them sit, till he has pencilled off/ A faithful likeness of the forms he views."

Chemical History of Photography

Why wasn't photography invented earlier when the camera was ready by 1685? Lack of chemical knowledge of photo-sensitive chemicals.

Albertus Magnus mentions silver nitrate ($AgN0_3$) turns skin black but thinks heat does this.

Glauber's *Opera Chymica*(1658) mentions staining hardwoods with silver nitrate to fake the look of ebony.

Angela Sala (1614) and Whilhelm Homberg (1694) mention blackening items with silver nitrate, but thinks heat is what causes the reaction.

Chemical History con't

First to discover that LIGHT not heat causes the silver nitrate to turn dark was Johann Heinrich Schulze, professor of anatomy at University of Altdorf in 1725.

First recorded application of silver nitrate to paper is in communication to the Royal Academy of Sciences in 1737 by Jean Hellot who used it as "secret ink." But he attributes this to heat causing the ink to magically appear and turn dark.

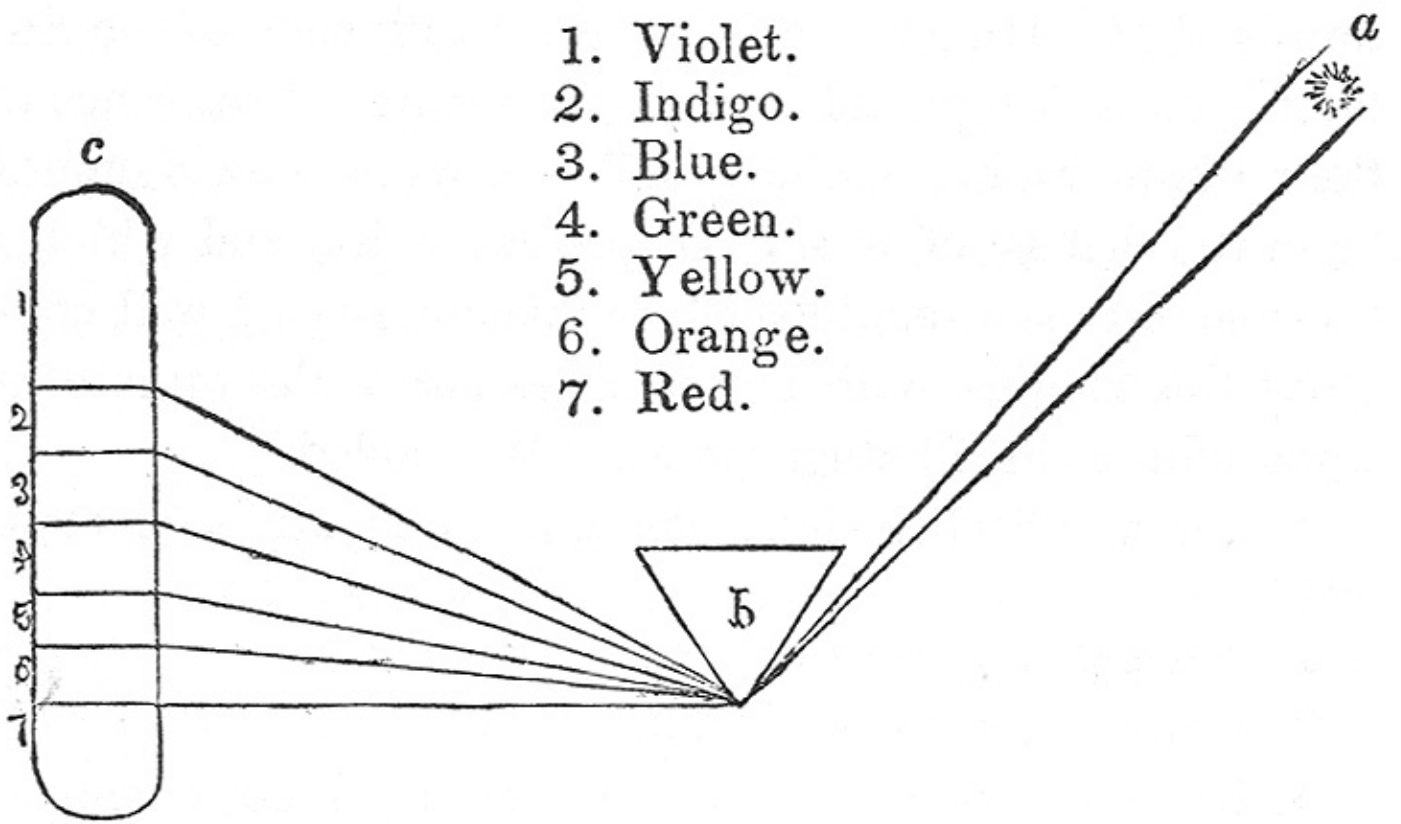
Chemical History con't

First to discover that silver chloride (Agcl) was light sensitive was Giacomo Battista Beccaria, professor of physics at University of Turin.

Jean Senebier, chief librarian of Geneva, observes that different colored light darkens silver chloride is varying rates:

- violet light: 15 seconds
- green light: 37 seconds
- red light: 20 minutes

reason for the obvious individuality of colors. To explain the seven colors of the spectrum Robinet does not hesitate to propose "seven ages or periods in the life of the igneous animalculae . . . These animals, in passing through the prism, will each be obliged to suffer refraction according to its strength and age and thus each will bear its own color."


1. Violet.
2. Indigo.
3. Blue.
4. Green.
5. Yellow.
6. Orange.
7. Red.
a
b
c
1
2
3
4
5
6
7

Chemical History con't

Carl Wilhelm Scheele, a Swedish chemist, does more studies of silver chloride and in his *Treatise on Chemistry* (1777) confirms that light in the agent that turns the chemical dark (due to silver precipitating out); discovers violet end of spectrum is more "actinic" (more able to turn the silver halide dark) than the red end. He also notes that AgCl was soluble in ammonia, so this could be used as a fixing agent (but no one ever makes the connection, so fixing the image was not easily discovered.

Chemical History con't

Dr. William Lewis, of Kingston-on-Thames, repeats and confirms Schulze's experiments and writes about it in his *Philosophical Commerce of the Arts* (1763).

After Dr. Lewis's death, his assistant, Alexander Chisholm, and all Lewis's notebooks are bought by Josiah Wedgwood in 1782.

Wedgwood and his son, Thomas, begin to with Chisholm's help, to attempt to fix an image from a camera.

During this time, Dr. Joseph Black, a member of the Wedgwood Circle, was giving lectures in Edinburgh on photo chemistry. This meant Scotland would become another focus of photographic activity later.

Chemical History con't

In 1800 Sir William Herschel, an astronomer, posits rays beyond the visible spectrum, infra-red.

This leads J.W. Ritter, a chemist in Jena to posit existence of the ultra-violet rays. Find these rays turn silver nitrate dark, but not infra-red rays.

These experiments are confiremed by Dr. William Hyde Wollaston.

So by 1802 chemical knowledge is sufficient for the Josiah Wedgwood's son, Thomas, to start his own experiments with photo-sensitive silver halides.

Thomas Wedgwood & Sir Humphrey Davy
First Experiments in Photography

1) Josiah Wedgwood was already using camera obscura to aid in making drawing of stately English homes to be copied onto to some 1200 china plates and sold to Catherine the Great of Russian for 3000 pounds. He wanted to perfect a photographic process so to speed up production of illustrated plate.
2) Josiah had created his famous circle of eminent scientists in the Birmingham area called "The Lunar Society." He drew on these men for technical info.
3) Tom Wedgwood studies chemistry at Edinburgh University where Dr. Black lectures; he writes a paper title "Experiments and Observations on the Production of Light from Different Bodies by Heat and Attrition" (1792) and presents it to the Royal Academy.

grandfather, Erasmus Darwin, assailed slavery in his poems, and his maternal grandfather, Josiah Wedgwood, was a major backer of Thomas Clarkson, the pioneering antislavery activist. The Wedgwood pottery works manufactured the famous cameo depicting a chained slave, with the motto "Am I Not a Man and a Brother?" which became the badge of the British abolitionists.

Tom Wedgwood & Davy

Tom Wedgwood meets Humphrey Davy while on wintering at Pensance in 1797 - 98. They start to collaborate on photo experiments. By 1802 they are working in Davy's lab at the Royal Institution, London. They publish an account of their experiments in "An Account of a Method of Copying Paintings upon Glass and of Making Profiles by the Agency of Light and Nitrate of Silver."

Wedgwood & Davy con't

Davy builds upon earlier experiments of Elizabeth Fulhame who wrote a book *With a View to a New Art of Dying and Painting* (1794). She suggested maps could be made using silver inscribed by the action of light.

Wedgwood and Davy failed to obtain an image from a camera using AgCl; then attempted to produce photograms of objects laid onto paper, later onto white leather moisted with $AgNO_3$. This time they got an image, but could not fix it. They tried varnish it, but no result. Had they known of Scheele's idea that ammonia made the unexposed silver halide soluble, they might have been able to fix their images. Their experiments cease when Tom dies in 1805 at age 34.

White paper, or white leather, moistened with solution of nitrate of silver, undergoes no change when kept in a dark place; but on being exposed to the day light, it speedily changes colour, and, after passing through different shades of grey and brown, becomes at length nearly black. . . .

The condensation of these facts enables us readily to understand the method by which the outlines and shades of painting on glass may be copied, or profiles of figures procured, by the agency of light. . . . When the shadow of any figure is thrown upon the prepared surface, the part concealed by it remains white, and the other parts speedily become dark. . . .

The images formed by means of a camera obscura have been found too faint to produce, in any moderate time, an effect upon the nitrate of silver. To copy these images was the first object of Mr. Wedgwood in his researches on the subject, and for this purpose he first used the nitrate of silver, which was mentioned to him by a friend, as a substance very sensible to the influence of light; but all his numerous experiments as to their primary end proved unsuccessful.[9]

Having, about forty years ago, made several experiments with my lamented friend, Mr. Thomas Wedgwood, to obtain and fix the shadows of objects by exposing the figures painted on glass, to fall upon a flat surface of shamoy leather wetted with nitrate of silver, and fixed in a case made for a stuffed bird, we obtained a temporary image or copy of the figure on the surface of the leather, which, however, was soon obscured by the effects of light. It would be serviceable to men of research if failing experiments were more often published, because the repetition of them would be thus prevented. The new method of depicting by a camera, promises to be valuable for obtaining exact representations of fixed and still objects, although at present they seem only to possess the correct elements for a finished drawing.


Peacock
Specimen of Cyanotype