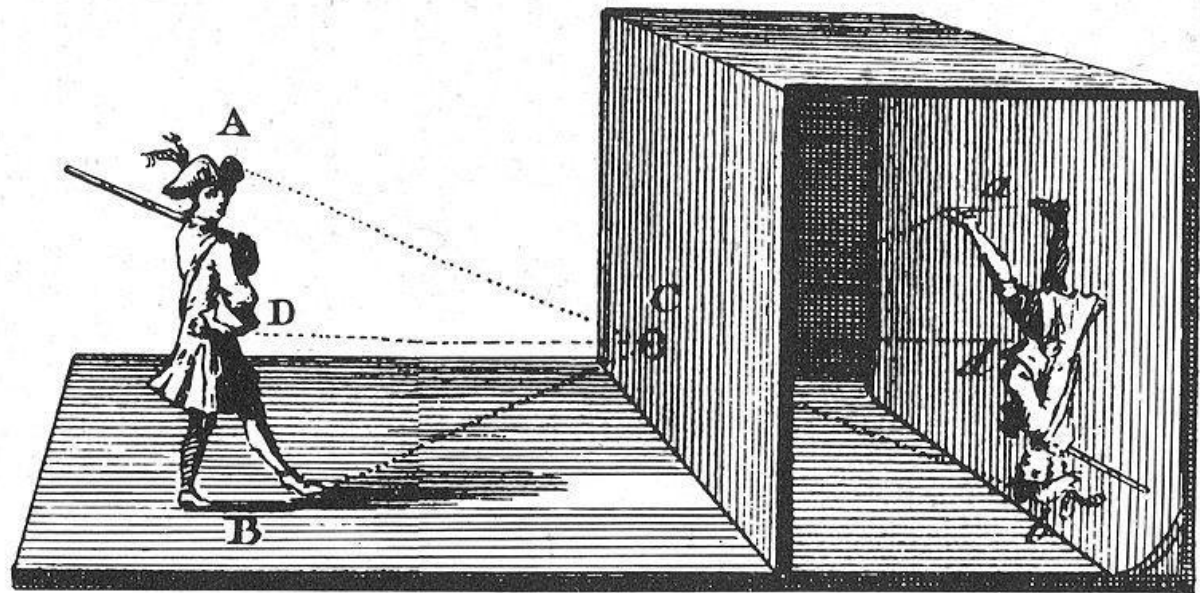


# Camera obscura



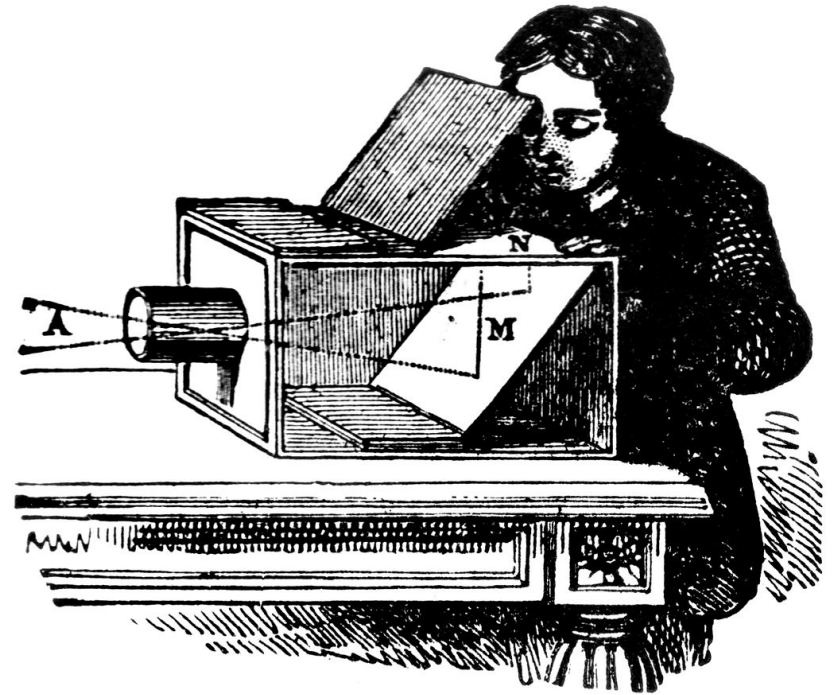
- **Camera obscura** (plural *camerae obscurae* or *camera obscuras*; from Latin, meaning "dark room": *camera* "(vaulted) chamber or room," and *obscura* "darkened, dark"), also referred to as **pinhole image**, is the natural optical phenomenon that occurs when an image of a scene at the other side of a screen (or for instance a wall) is projected through a small hole in that screen as a reversed and inverted image (left to right and upside down) on a surface opposite to the opening. The surroundings of the projected image have to be relatively dark for the image to be clear, so many historical camera obscura experiments were performed in dark rooms.





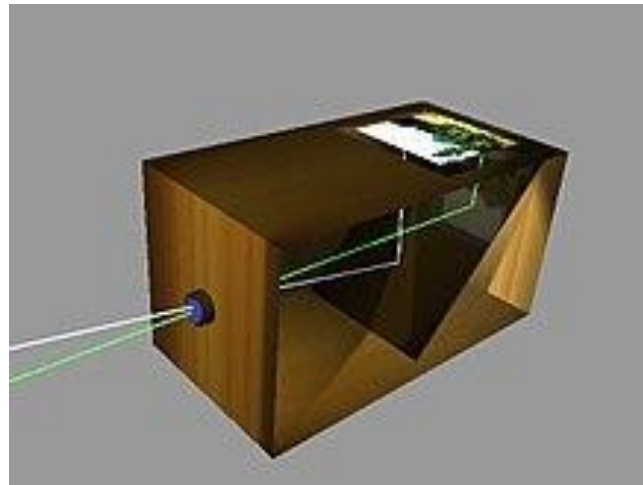
- The term "camera obscura" also refers to constructions or devices that make use of the principle within a box, tent or room. Camerae obscurae with a lens in the opening have been used since the second half of the 16th century and became popular as an aid for drawing and painting. The camera obscura box was developed further into the photographic camera in the first half of the 19th century when camera obscura boxes were used to expose light-sensitive materials to the projected image.

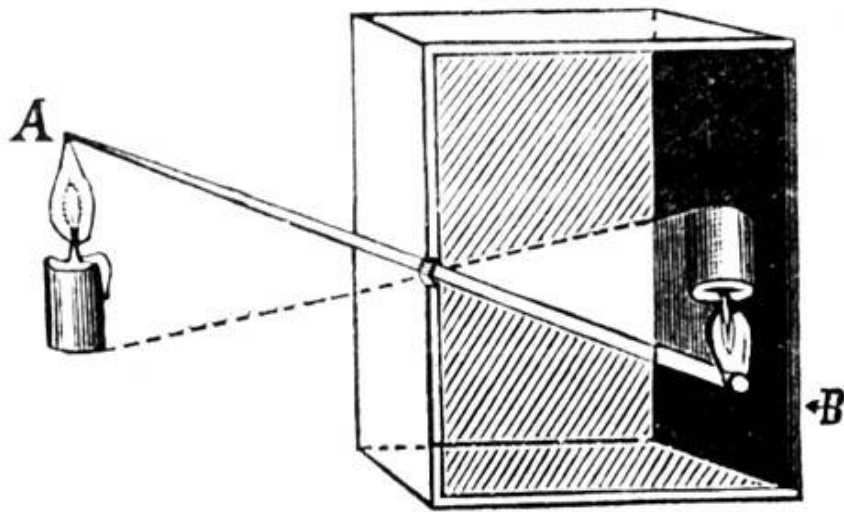
- Before the term "camera obscura" was first used in 1604, many other expressions were used including "cubiculum obscurum", "cubiculum tenebricosum", "conclave obscurum" and "locus obscurus".
- A camera obscura device without a lens but with a very small hole is sometimes referred to as a "pinhole camera", although this more often refers to simple (home-made) lens-less cameras in which photographic film or photographic paper is used.



# Technology

- A camera obscura device consists of a box, tent or room with a small hole in one side. Light from an external scene passes through the hole and strikes a surface inside, where the scene is reproduced, inverted (thus upside-down) and reversed (left to right), but with color and perspective preserved. The image can be projected onto paper, and can then be traced to produce a highly accurate representation.
- In order to produce a reasonably clear projected image, the aperture has to be about 1/100th the distance to the screen, or less.
- Many camerae obscurae use a lens rather than a pinhole (as in a pinhole camera) because it allows a larger aperture, giving a usable brightness while maintaining focus.





- As the pinhole is made smaller, the image gets sharper, but the projected image becomes dimmer. With too small a pinhole, however, the sharpness worsens, due to diffraction.
- Using mirrors, as in an 18th-century overhead version, it is possible to project a right-side-up image. Another more portable type is a box with an angled mirror projecting onto tracing paper placed on the glass top, the image being upright (but still reversed) as viewed from the back.

# Role in the modern age

- While the technical principles of the camera obscura have been known since antiquity, the broad use of the technical concept in producing images with a linear perspective in paintings, maps, theatre setups and architectural and later photographic images and movies started in the Western Renaissance and the scientific revolution. While e.g. Alhazen (Ibn al-Haytham) had already observed an optical effect and developed a state of the art theory of the refraction of light, he was less interested to produce images with it (compare Hans Belting 2005); the society he lived in was even hostile (compare Aniconism in Islam) towards personal images. Western artists and philosophers used the Arab findings in new frameworks of epistemic relevance. E.g. Leonardo da Vinci used the camera obscura as a model of the eye, René Descartes for eye and mind and John Locke started to use the camera obscura as a metaphor of human understanding per se. The modern use of the camera obscura as an epistemic machine had important side effects for science. While the use of the camera obscura has dwindled away, for those who are interested in making one it only requires a few items including: a box, tracing paper, tape, foil, a box cutter, a pencil and a blanket to keep out the light.

