How does it work?

The mechanics of the Camera Obscura are a cross between a giant pinhole camera and a periscope. At the top of the tower is a dark chamber with a mirror on top which reflects light downwards, passing through three lenses before projecting a stunning image of the city onto a large white table. Your guide turns and tilts the mirror to give a 360° tour of Edinburgh while giving a fascinating and fun commentary. Don't miss the chance to pick up a passer-by in your hand in this amazing interactive exhibit.

Technical information (PDF)

In the centre of the Obscura room is a white painted, concave wooden table. 21 feet 4 inches (6.52 metres) above it is a 10 inch diameter glass doublet lens. A metal cylinder rises another 6 feet 9 inches (2.06 metres) upwards with a singlet lens halfway and a triplet lens 5 inches in diameter at the top. The cylinder projects out of the roof of the Camera Obscura and is covered by a protective hood, open to one side. Under the hood facing out through the opening is a plain mirror protected by a pane of ordinary glass.

The light from any object passes through the glass. The mirror is set at an angle and so reflects the light downwards, through the lens and on to the white table, where an image of the object is visible when the room is darkened. The mirror tilts and rotates to change the view.

The image is not magnified but is reproduced at life size. It is also correctly orientated. In a basic pinhole Camera Obscura the image is upside down and reversed. In this Camera Obscura the mirror and lens turn the image the correct way up. The lenses of course also focus the image. The focus is very precise and the depth of field (area from near the lens to far away in sharp focus) is also very large. This is achieved by having a very small aperture, equal here to F67. The F number is simply the focal length divided by the diameter of the lens. (Focal length is the distance from table to lens. The focal length is 337.7 inches. The top lens is 5 inches in diameter. 337.7 divided by 5 is equal to an F number of 67.54)

If the aperture became smaller still, very close objects would also be sharply focused. But then this would cut out more light, and make the image too dark. With the present 5 inch lens most of the picture is in focus and the image on a reasonable day is bright enough. The large depth of field avoids the need to constantly adjust the focus.

The distances involved in the Camera Obscura are huge when compared to those in a photographic camera. This creates another problem. The lenses focus light in a curve. To overcome this, the table has a concave surface to match the curve of the focus. Nevertheless the image is still less clear at the edge than it is in the centre. This is due to the fact that any lens is weaker at the edge. With an image of this large scale the weakness is clearly visible.

The quality of the image is however excellent. This is due to the present lens system which was installed in 1947 by Barr and Stroud, the Glasgow firm of scientific instrument makers. Apparently in 1853 the image was smaller and less clear than it is today.

Make your own camera obscura. (PDF)

- I. Tape up a cardboard box to ensure that no light can penetrate
- 2. Cut away part of one end of the box and fix a screen of tracing paper across it.
- 3. Cut a 25mm hole in the box at the opposite end and cover with kitchen foil
- 4. Tape down the edges and bore a neat round hole through the foil that is no larger that the lead of a pencil.
- 5. Take the box outside shutting out as much light as possible with a thick blanket.
- 6. An upside down image of the scene outside will be seen on the screen.