

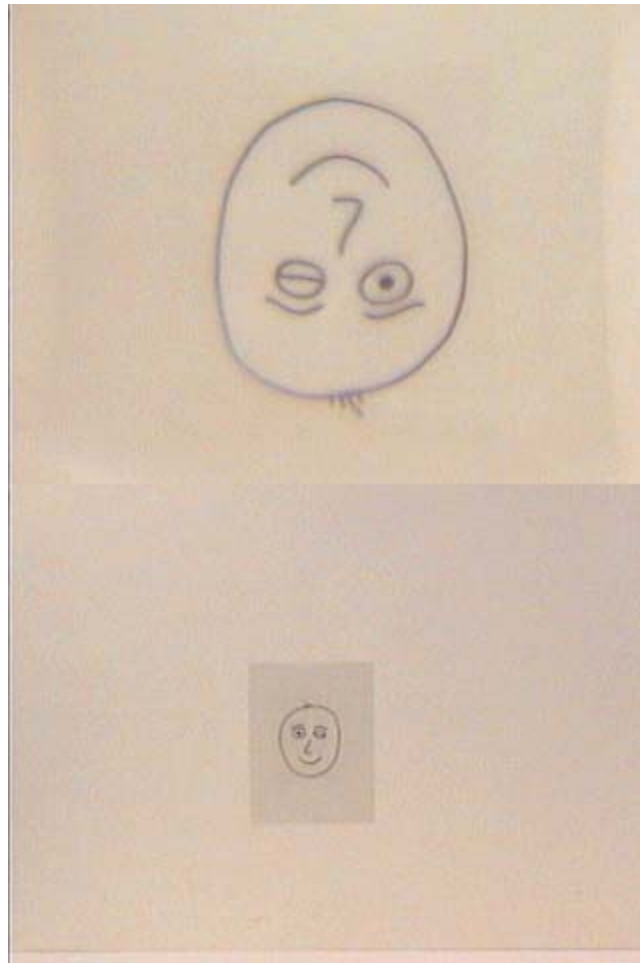
Answer #124

We will review the two problems in the order they were presented in the question. Here is Otto:



- 1. Otto stands facing the observer who is located a large distance from Otto. The observer then looks at Otto right-to-left *through* the lens system shown in the photograph below: the eye of the observer is positioned close to a 5cm focal length convex lens (at right in photograph) that is positioned 25 cm from a 20cm focal length large-diameter convex lens.

The answer is (h). This optical system is an astronomical telescope, designed to give a magnified, inverted image. Shown below are Otto as seen through the telescope (left) and directly with the TV camera.

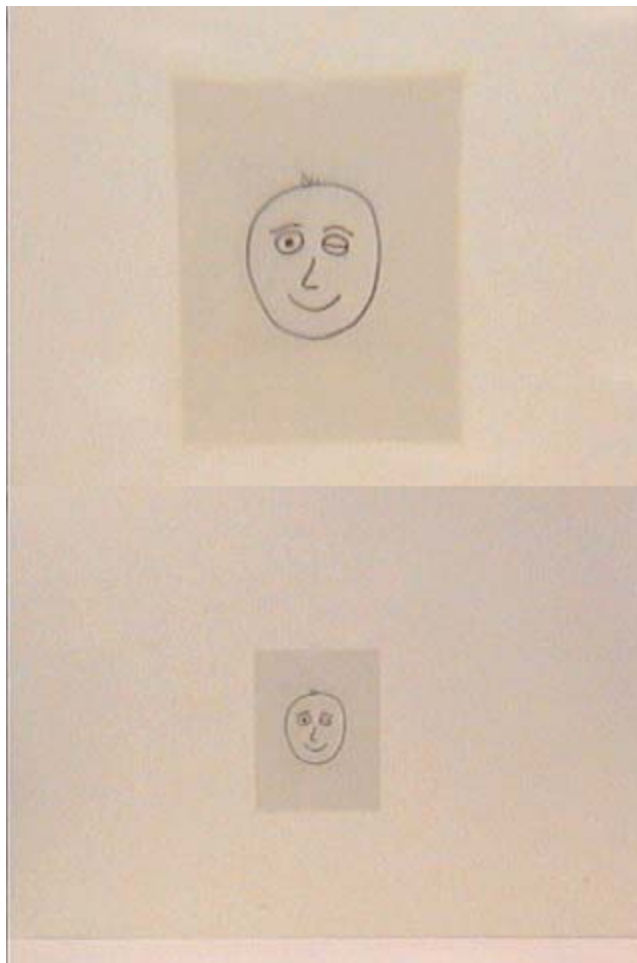


The video camera is the "eye" in this arrangement, and its lens is an integral part of the optical system. The telescope casts its image onto the CCD, which acts as the retina, and the focus of the camera is set to infinity, representing a "relaxed" eye. The magnification of the image on the retina is equal to the ratio of the focal length of the objective lens (20 cm) to the focal length of the eyepiece (5 cm); therefore in this case the magnification is about 4. The photographs below show view the optical system looking at Otto.



- 2. Otto stands facing the observer who is located a large distance from Otto. The observer then looks at Otto right-to-left *through* the lens system shown in the photograph below: the eye of the observer is positioned close to a 10cm focal length concave lens (at right in photograph) that is positioned 15 cm from a 20cm focal length larger-diameter convex lens.

The answer is (e). This optical system, a Galilean telescope, often used as "opera glasses," is designed to give a magnified, upright image. (Who wants to watch the opera upside-down?) Again, the camera lens is an integral part of the optical system, and the camera focus is set to infinity. The magnification is equal to the ratio of the focal lengths of the objective lens and the eyepiece, in this case 2. Shown below are Otto as seen through the telescope (left) and directly with the TV camera.



The photographs below show view the optical system looking at Otto.



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