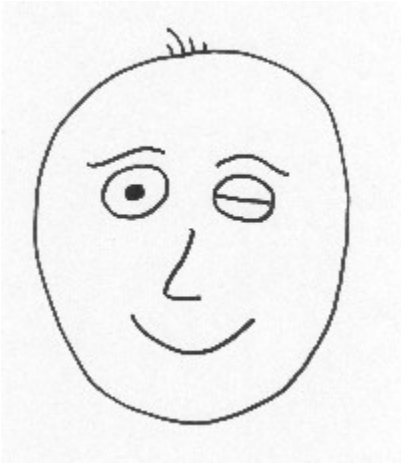
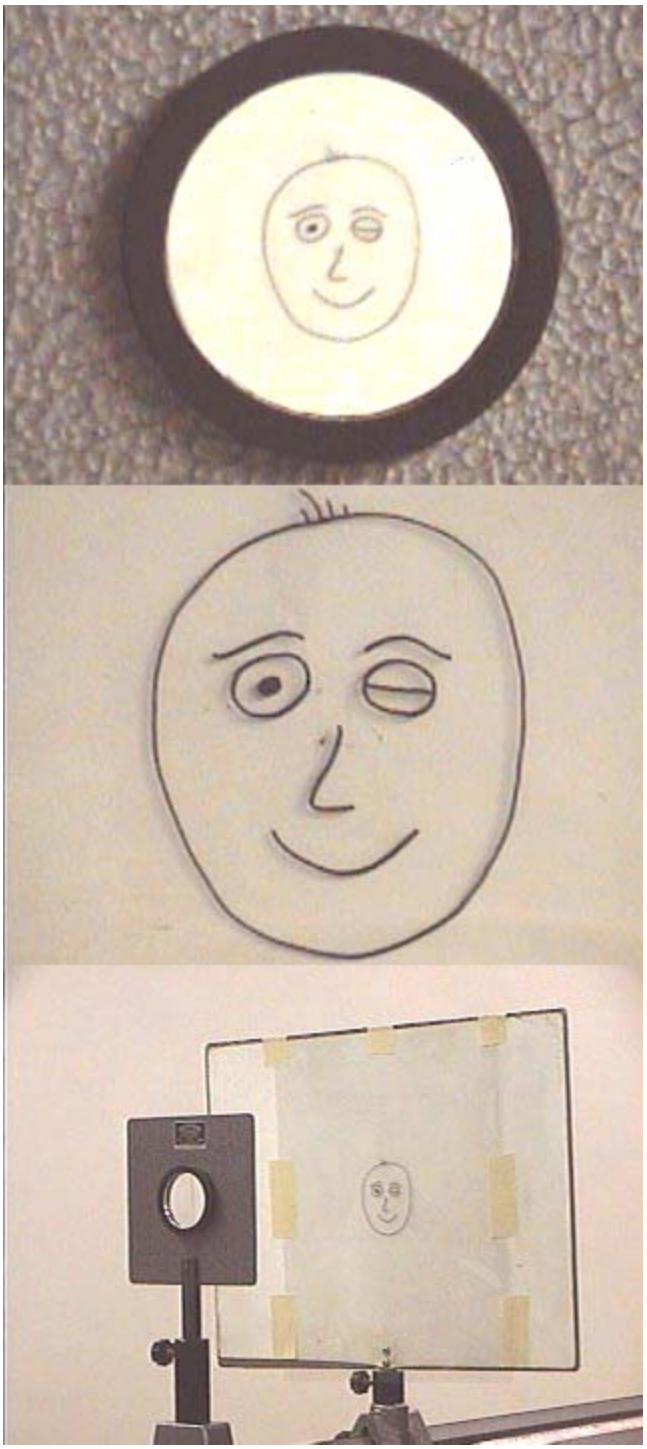
Answer #99

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



- 1. **A spherical concave lens:** Otto will stand at a distance of one focal length from a spherical concave lens, so that an observer *at the lens* would see Otto's face as in the photograph above.

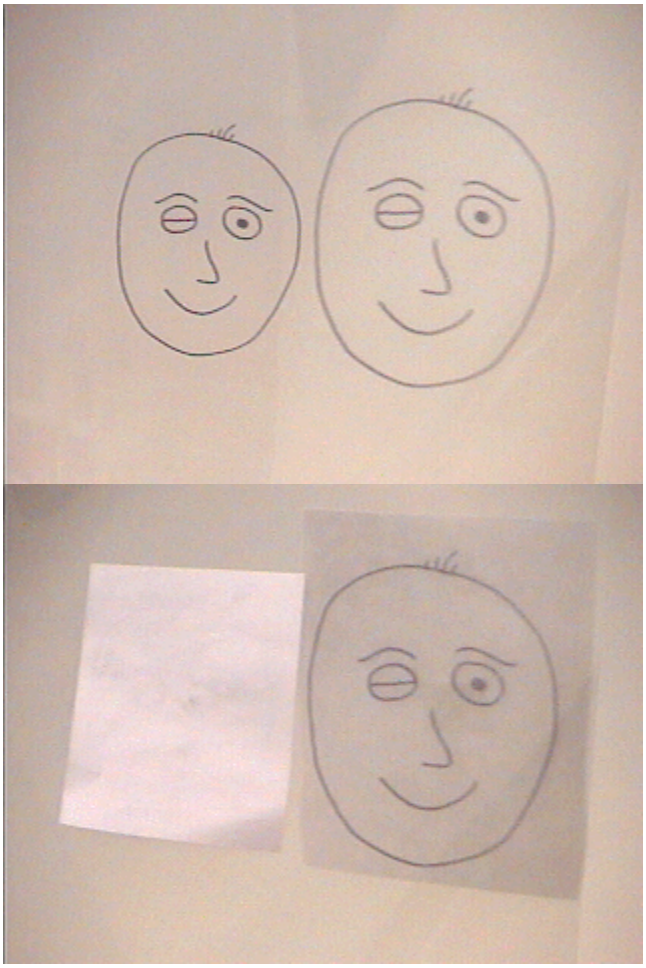
  The image will appear as image (i), as seen in the photograph at the left below.



You must view the image looking through the lens toward Otto. A photograph of Otto with the lens removed is shown in the center; note that you are viewing Otto straight on, so his left-right orientation is the same as the original Otto. The experimental setup used to photograph Otto is shown in the photograph at the right. This is a virtual image located at a distance of one-half of the focal length of the lens *behind* the lens, with a magnification M=1/2.

- 2. **A spherical concave mirror, at a distance of f/2:** Otto will stand at a distance of half the focal length of the mirror in front of the mirror, so that an observer *at the mirror* would see Otto's face as in the photograph at the top of this page.

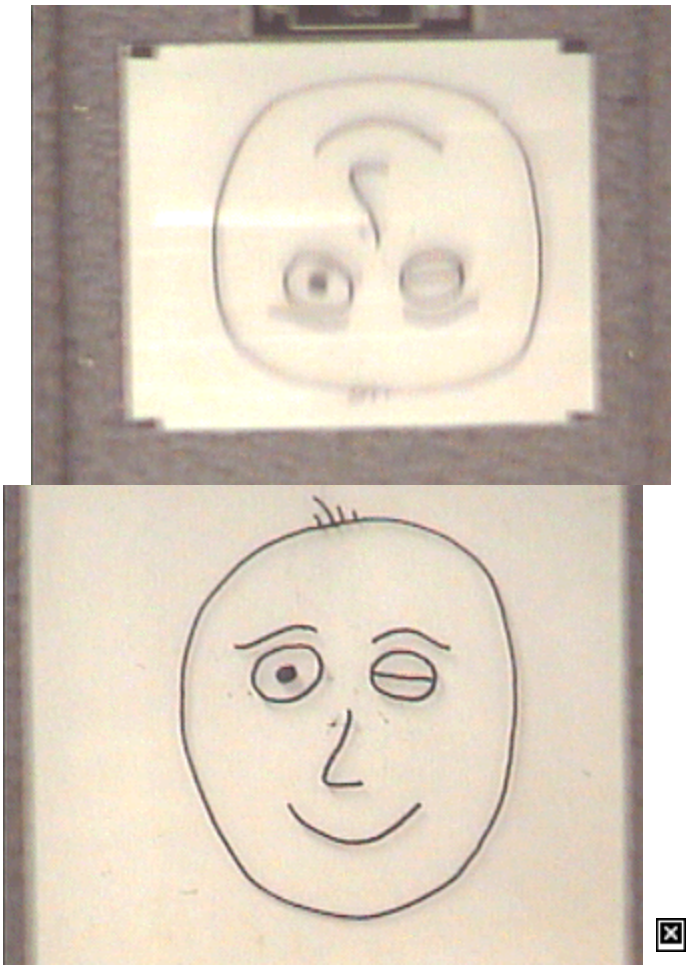
  The image will appear as image (e), as seen in the photograph at the left below.



  You must view the image looking from behind Otto into the mirror; in the photograph you can see both Otto (from behind) and his image. The image is larger than Otto, and oriented the same way, so the image is not inverted in either up/down or left/right direction. The photograph at the right has a paper mask over the back of Otto, so only the image is visible. The image will be located at a distance equal to the focal distance of the mirror *behind* the mirror, and have a magnification M=+2. The image does not look that big in the photograph because it is further away from the camera than is the object. More information on this mirror is given at the web page for demonstration L3-14.

- 3. **A vertically focussing cylindrical convex lens, at a distance of 2f:** Otto will stand at a distance of twice the focal distance from a vertically focussing cylindrical lens, that is oriented like a horizontal log in front of Otto. He again faces the lens so that an observer at the lens would see Otto's face as in the photograph at the top of this page.

  The image will appear as image (b), as seen in the photograph at the left below.



You must view the image by looking from a distance through the lens toward Otto, but the vertical image is actually at a distance of twice the focal length of the lens on the opposite side of the lens from Otto, closer to you than either Otto or the lens. The image is inverted in the vertical direction but not in the horizontal direction. For an object distance equal to twice the focal length of a convex (focusing) lens, the image is at the same distance on the opposite side of the lens and is inverted in the vertical direction only, and the magnification in the vertical direction M=1. Otto is shown in the picture at the right with the lens removed. The photograph at the right shows the experimental setup. There is some distortion in the corners of the image causing poor Otto's head to become a tad squared.

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For questions and comments regarding the *Question of the Week* contact Dr. Richard E. Berg by e-mail or using phone number or regular mail address given on the Lecture-Demonstration Home Page.