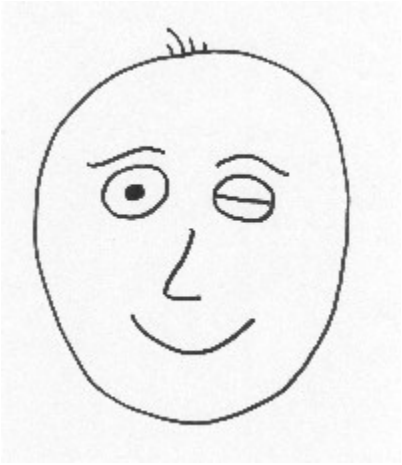
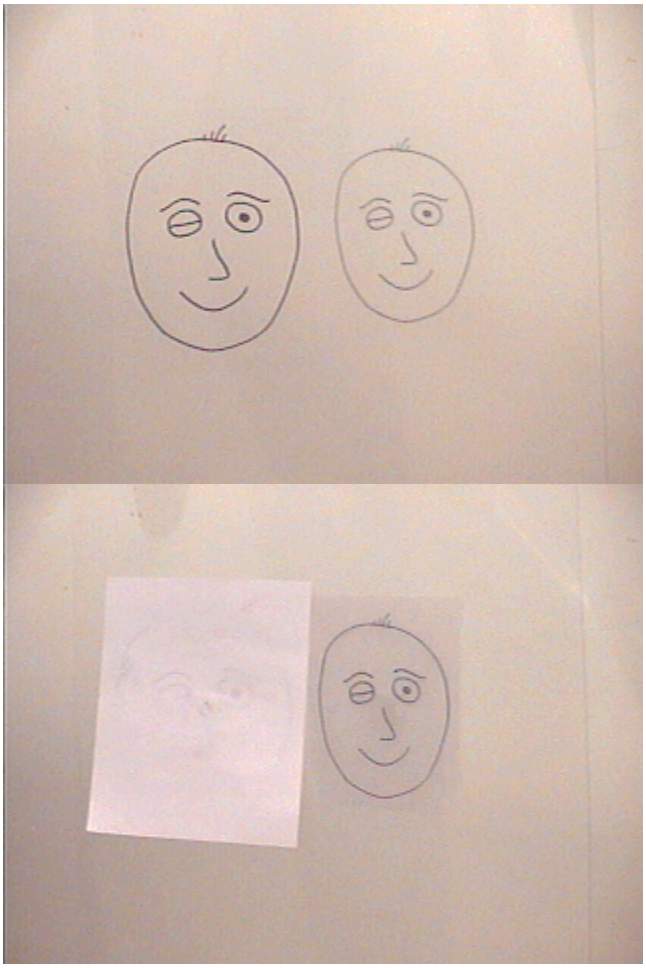
Answer #97

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



- 1. **A plane mirror:** Otto will stand in front of a plane mirror, so that an observer at the mirror would see Otto's face as in the photograph above.

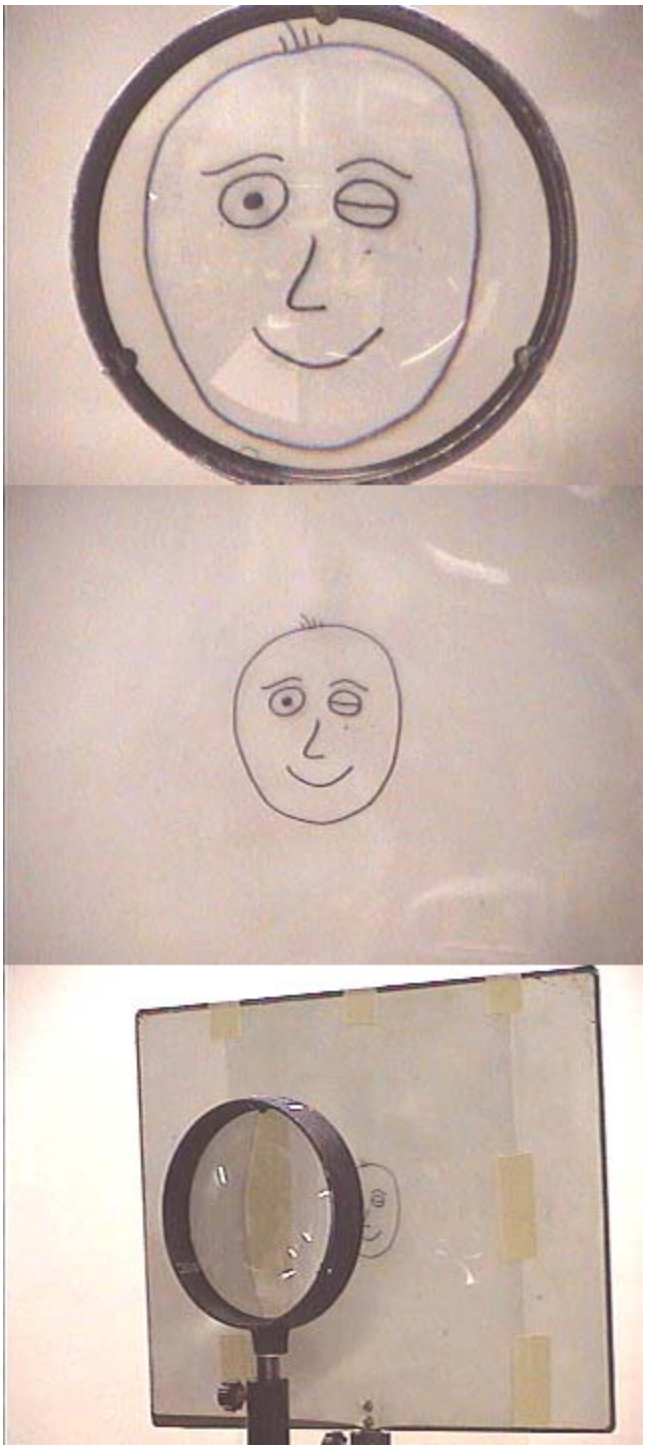
  The image will appear as (c), as seen in the photographs below.



You must view the object looking into the mirror from the same side of the mirror as the object. For our photographs, we have use a transparency of Otto, where his face appears as the original object photograph viewed by an observer standing directly in front of the mirror and looking toward Otto. The photograph at the left is taken from behind Otto, and shows both Otto and his image. Because we are viewing Otto from behind, both Otto and his image appear inverted left-to-right, but in fact are not inverted at all (See Question #18). In the photograph at the right a piece of white paper has been used as a mask to obscure the rear of the object, so that all we see is the image. You may have noticed that the image is smaller than the object. This is because the image, being virtual and behind the mirror surface (the same distance that Otto is in front of the mirror), is further from the camera than the object, and appears smaller due to the perspective. Because the image is actually the same size as the object, image (c) is a better choice than (k)!

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

  The image will appear as (g), as seen in the photographs below.

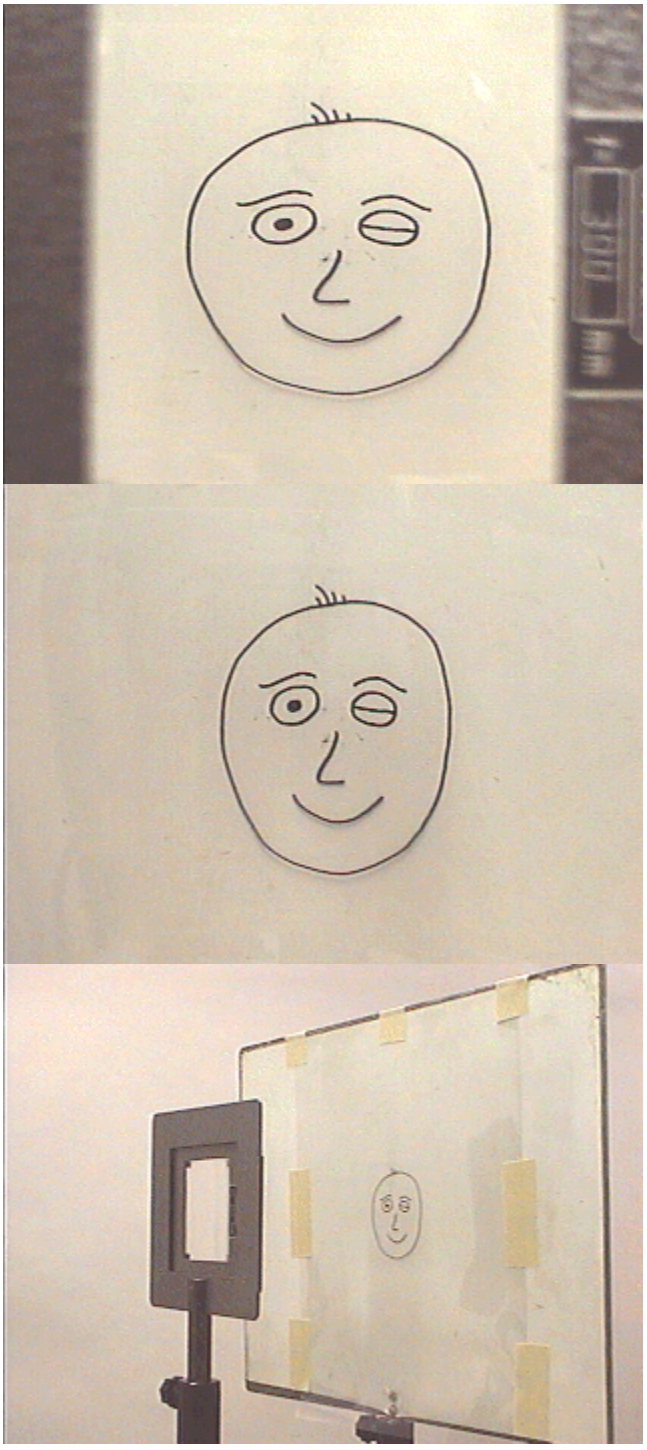


The convex lens acts like a magnifying glass, creating a virtual, erect image. The photographs at the left and center above are taken looking at Otto along the optic axis through the lens. The magnification is two if the object distance is exactly one-half the focal length of the lens. The picture at the left is taken with the lens in place; the lens has been removed for the picture in the center. The picture at the right shows the experimental setup.

- 3. **A horizontally focusing cylindrical convex lens, at a distance of f/2**: Otto will stand at a distance of one-half the focal distance of a cylindrical lens, that is oriented like a vertical 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 above.

The answer is (u), as seen in the photograph at the left below.



The photographs at the left and center below are taken looking at Otto along the optic axis through the lens. In this case the horizontally focusing cylindrical lens provides no vertical focusing. so there is no magnification in the vertical direction. On the other hand, if the object is a distance of half the focal length of the lens behind the lens, it will act

like a magnifying glass providing a magnification of two in the horizontal direction,as in the case of the spherical (normal) magnifying glass in part 2 above. The image for the horizontal direction is at a distance of the focal length of the lens behind the lens. The photograph in the center shows Otto with the lens removed. The photograph at the right shows the experimental setup.

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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.