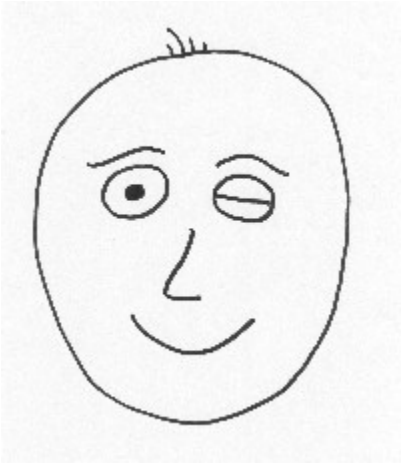
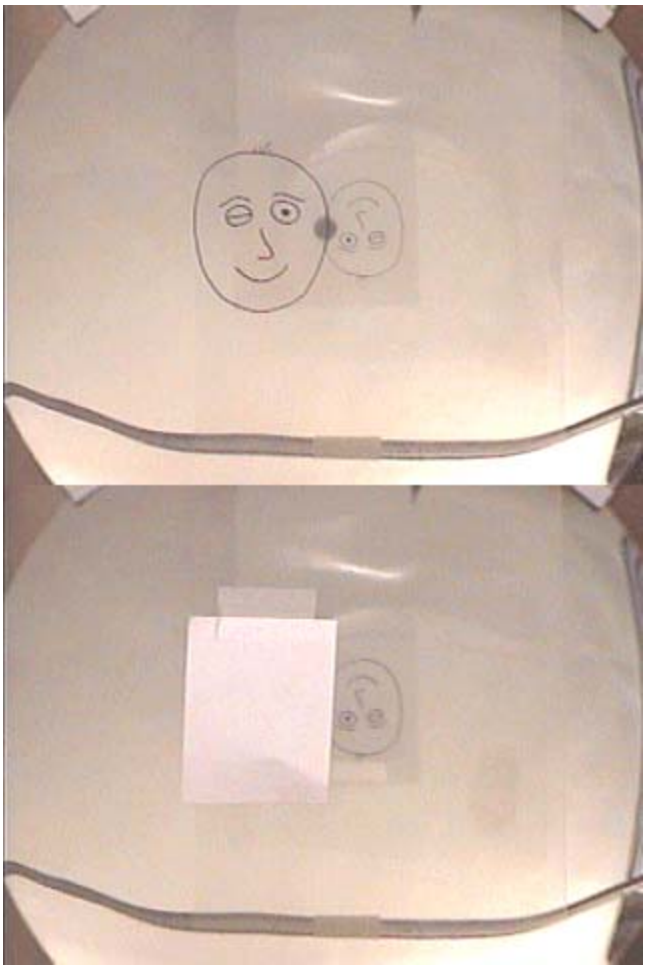
Answer #114

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



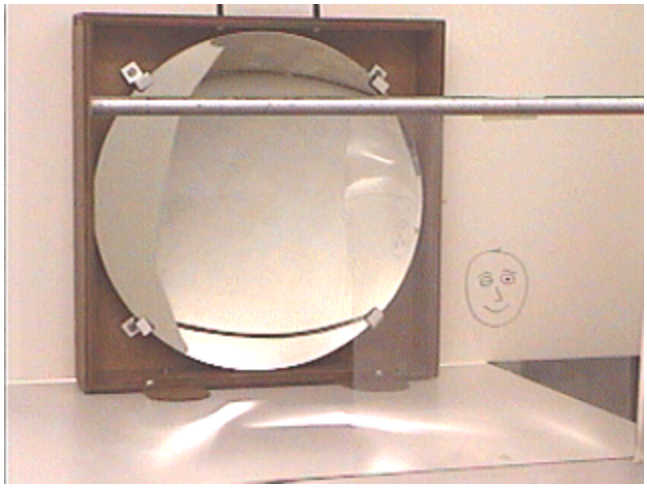
- 1. **A parabolic concave mirror**: Otto will stand at a distance of four times the focal length in front of a spherically symmetric concave mirror, so that an observer at the mirror would see Otto's face as in the photograph above.

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



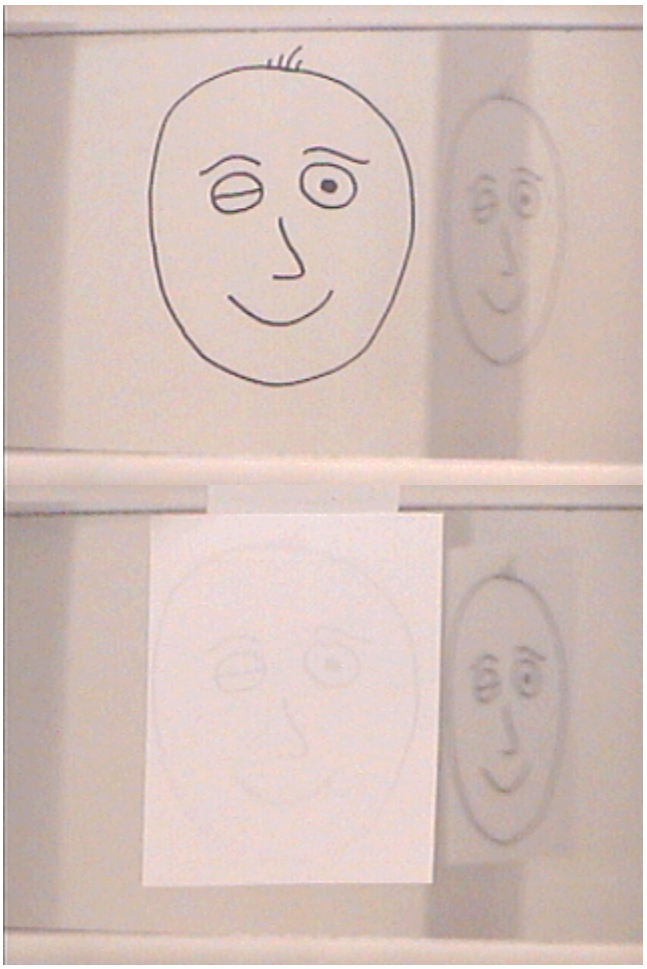
You must view the image from behind Otto, so in the picture Otto appears horizontally inverted from how he looks when you are facing him. In the photograph at the right a paper mask obscures the back of the object so that the image can be readily identified. The image is real, is located at a distance of 1.3 times the focal length in front of the mirror and has a magnification of (-3/4) (inverted and slightly smaller).

The photograph below shows more of the optical setup. In the photograph the transparency of Otto can be seen in front of the large parabolic concave mirror, but the image cannot be seen. The curved dark bar is a distorted image of the rod that supports the transparency.



- 2. **A horizontally focusing cylindrical convex mirror**: Otto will stand at a distance equal to the focal length in front of a cylindrically symmetric convex mirror, so that an observer at the mirror would see Otto's face as in the photograph above.

  The image will appear as image (o), as seen in the photograph below.

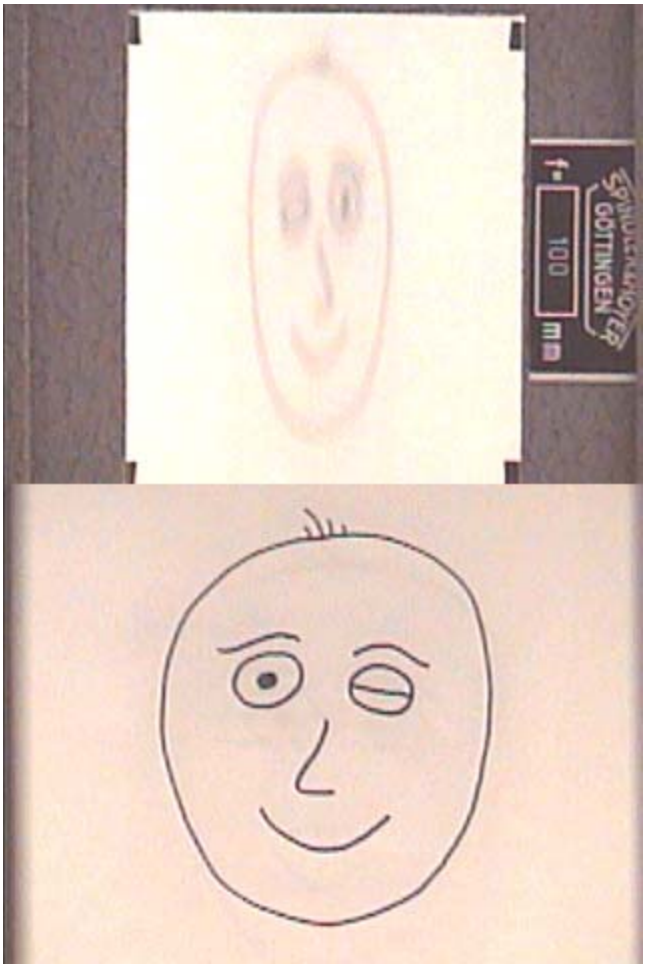


You must view the image from behind Otto, so in the picture Otto appears horizontally inverted from how he looks when you are facing him. In the photograph at the right a

paper mask obscures the back of the object so that the image can be readily identified. The image is virtual, is located at a distance of f/2 behind the mirror, and has a magnification of 1/2, in the horizontal direction only. In the photograph Otto is slightly smaller in the vertical direction due to perspective, because he is further from the camera.

- 3. **A horizontally focusing cylindrical convex lens**: Otto will stand at a distance equal to four times the focal length from a horizontally focusing cylindrical convex lens, 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 image will appear as image (o), as seen in the photograph at the left below. The photograph at the right shows Otto with the lens removed for comparison.



You must view the image looking through the lens toward Otto. The image will be real, inverted in the horizontal direction, located at a position 1.33 times the focal distance from the lens (on the opposite side from Otto) and have a magnification of about 1/3 in the horizontal direction. The image appears larger than calculated because it is closer to the camera; the camera focused automatically on the lens, so the image is also somewhat out of focus.

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Question of the Week

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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.