Alberti's Method for Perspective Drawing

Lecture notes for MATH 121
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Early in the Italian Renaissance, many artists became interested in the mathematical problem of correctly drawing a floor tiled by squares. In 1435 the Italian theorist and architect Leone Battista Alberti recorded in a book called *On Painting* the first mathematically accurate method of solving this problem. Below is a description of Alberti's technique, adapted and modified slightly for our modern point of view.

Imagine a rectangular room whose floor is covered with a grid of square tiles, as illustrated in Figure 1. The rectangular wall $GRCB$ is open, so that a viewer standing at point P can see the entire room. In what follows we describe Alberti's method for drawing exactly what the viewer sees from this position.

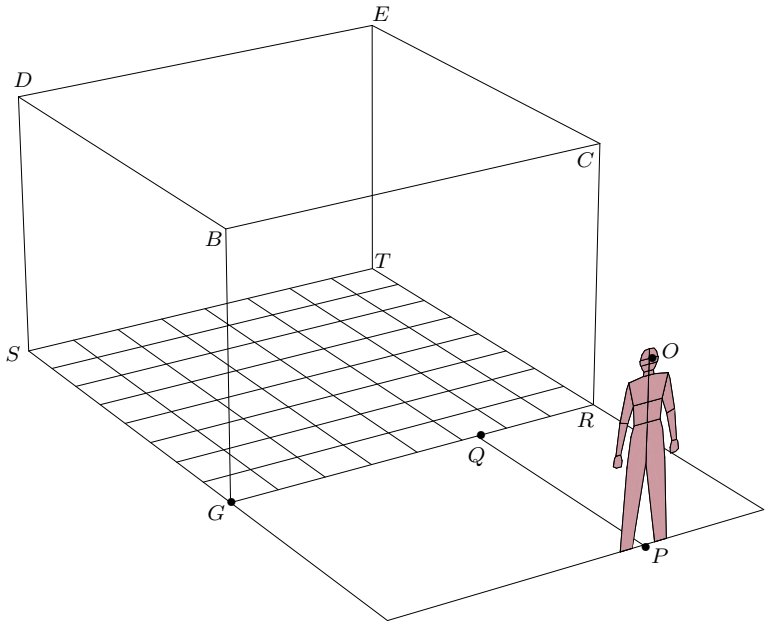


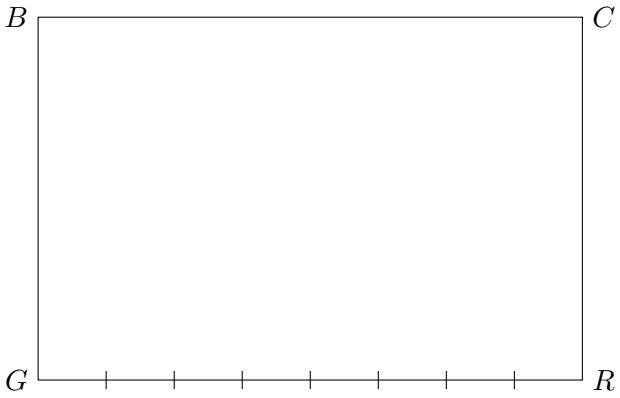
Figure 1: A viewer looking into a room

It is helpful to imagine that the wall $GRCB$ is made of glass, and that the viewer could reach over with a very long pen and trace out what he sees on the glass. (As you did for your first homework assignment.) Thus we are taking the rectangle $GRCB$ to be our **picture plane**. Alberti's method gives a mathematical procedure for drawing exactly what the viewer would trace out on the picture plane.

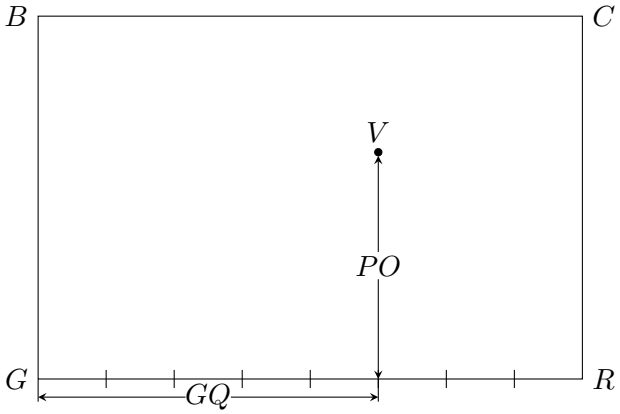
Of course the image will differ depending on where the viewer is standing. Thus Alberti's method will take into account the following distances which describe the viewer's position: The length of segment PO is the distance between the floor and the viewer's eye. The length of segment QP is the viewer's distance from the wall $GRCB$. The length of segment GQ can vary depending on how far to the right or left the viewer is situated.

We now describe Alberti's method in 10 steps. These steps are purely mechanical, and are presented without any justification. After you've had a little practice in carrying out the steps we will discuss in class exactly why they produce a correct perspective drawing.

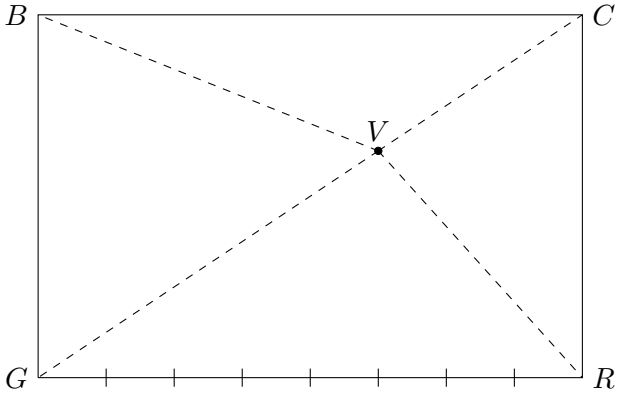
Step 1. Draw the picture plane. Draw a rectangle of the same proportions as the rectangle $GRCB$ in Figure 1. This rectangle may have any length you want, but it must have the same proportions as $GRCB$ in Figure 1. (For example, if rectangle $GRCB$ in Figure 1 is 12 by 8 feet, you could draw a 12 by 8 inch rectangle, or a 6 by 4 inch rectangle, etc.) Divide the line segment GR into equal parts, as determined by where the edges of the tiles in Figure 1 meet it. (For example, if there are eight tiles between points G and R in Figure 1, then divide the segment GR into eight equal parts.)



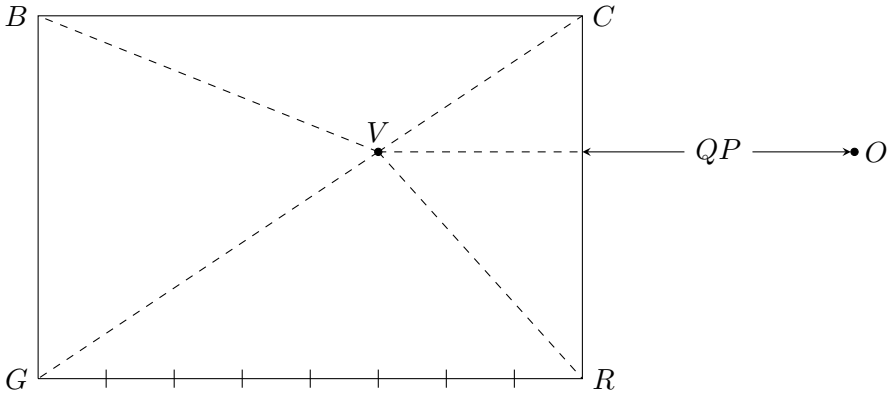
Step 2. Locate the vanishing point. Mark off a distance of GQ units to the right of Point G, and from there mark off a distance of PO up, to reach a point V. This is the vanishing point.



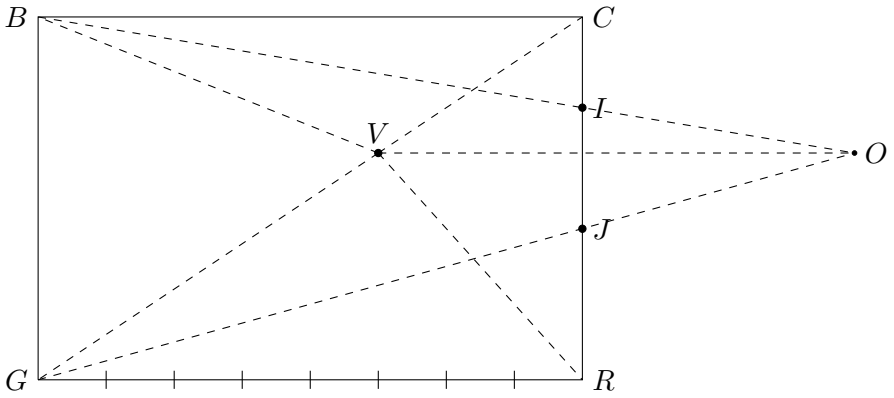
Step 3. Lightly draw lines from V to corners G, B, C and R.



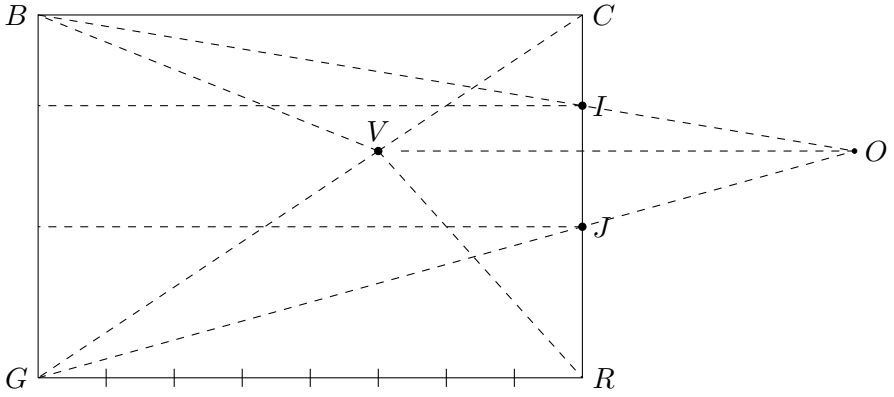
Step 4. Lightly draw a horizontal line through V that extends a distance of QP from the right of the picture plane. Label the right endpoint of this segment O.



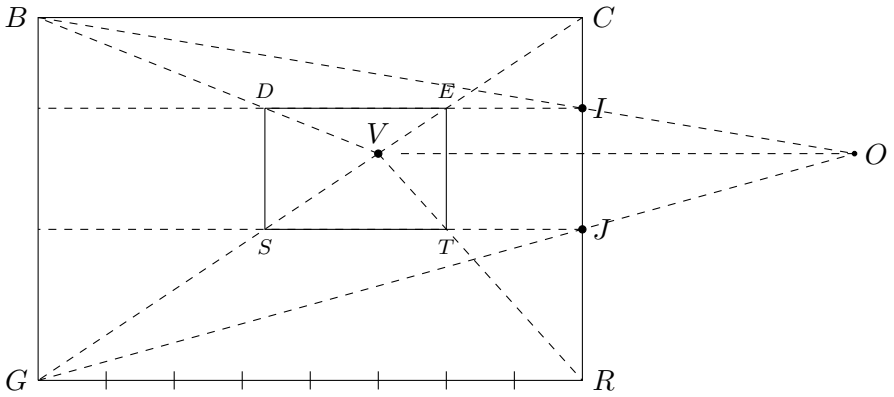
Step 5. From O, draw lines to G and B. Mark the points I and J where these two lines intersect the segment CR.



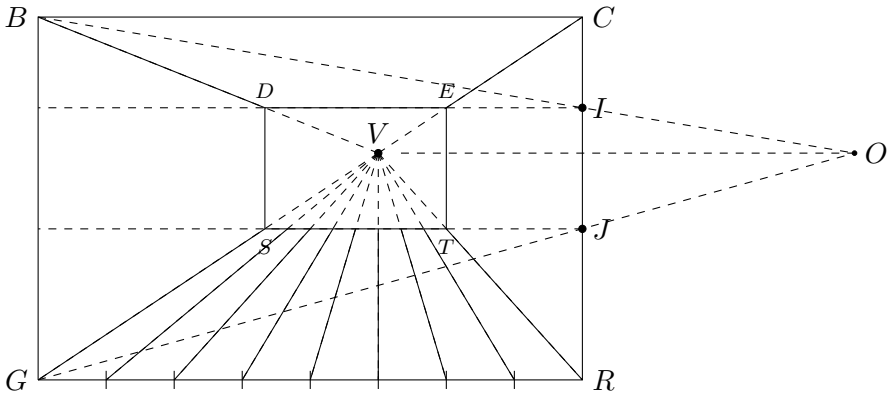
Step 6. Lightly draw horizontal lines through I and J.



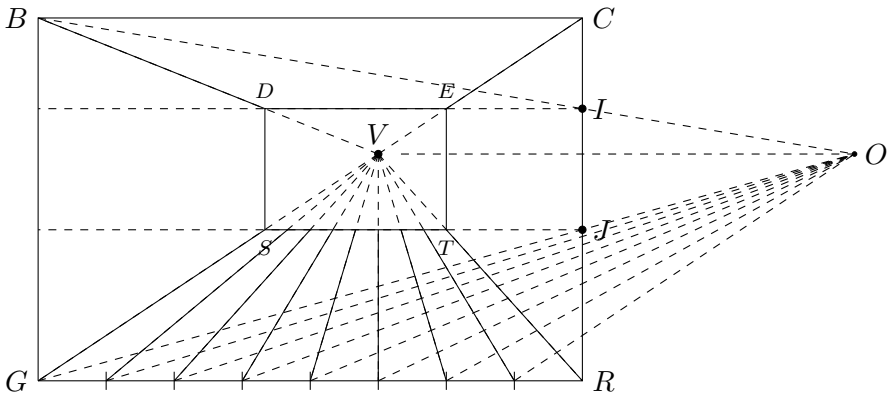
Step 7. The horizontal lines through I and J intersect segments VR, VB, VC and VR at points S, D, E and T. Draw a rectangle with corners S, D, E and T. (This rectangle is the rear wall of the room.)



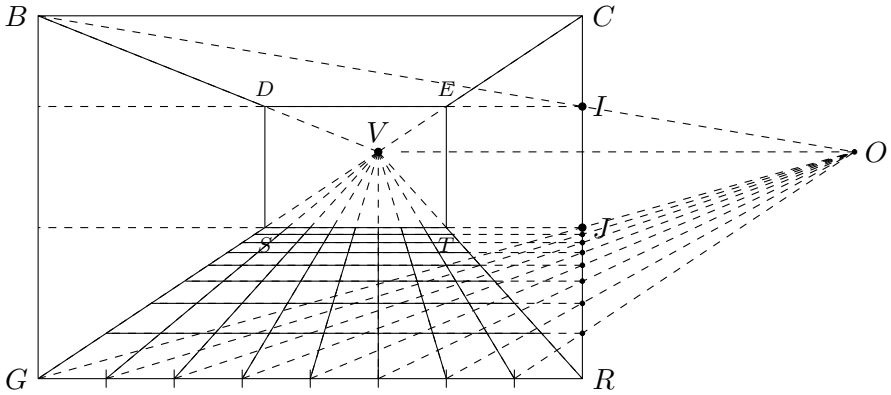
Step 8. Make solid the line segments between the inner and outer rectangles, as illustrated. Also draw draw lines radiating out from V, and extending from segment ST to each tick mark on GR.



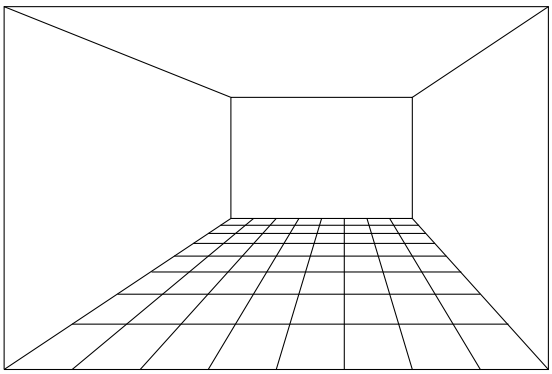
Step 9. Lightly draw lines from O to the ticks on segment GR.



Step 10. At each point where the lines just drawn through O meet the segment JR, draw a horizontal line, darkened between the right and left walls of the room.



Step 11. Erase (or ignore) all letters and lightly drawn (dashed) lines. You now have a picture in correct perspective.



Note: This method can be adapted to a room with a floor plan that is not square. The procedure is exactly the same, except in Step 8 we draw lines OS and OD (as indicated below), where SR is the length of the depth of the room in Figure 1. The figure below shows how to do a perspective drawing of a room that is 8 tiles wide by 10 tiles deep. We will discuss this in greater detail in class.