¶ **1.** During the 15th century, artists and architects developed a new technique, linear perspective, for painting real world scenes on a canvas. The idea and practice of perspective drawing or linear perspective is credited to Brunelleschi, and developed by other artists like Dürer, Leonardo da Vinci, etcetera.

¶ **2.** Brunelleschi's idea is as follows. Imagine you are standing before a scene to be painted, looking through one eye, and suppose that your picture plane or canvas is set between you and the scene. Locate a point in the scene and imagine a line ray joining that point to your viewing eye. In this way, without moving you viewing eye, you can find the point in the canvas that corresponds to a given point in the scene to be painted.
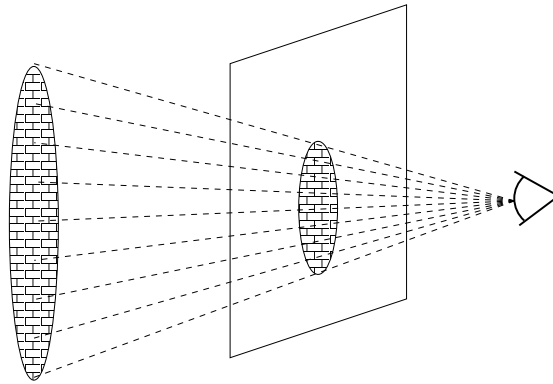
¶ **3.** Artists like Dürer constructed mechanical devices to help artists implement this method. (Dürer, A., Underweysung der Messung Mit dem Zirckel un Richtscheyt, in Linien, Nuremberg: 1525.)

¶ **4.** As said above, the principle of linear perspective is that each point on the scene correspondes to a unique point on the picture frame (canvas), so that those two point are in line with the artist's eye. From that principle, Brunelleschi deduced a set or rules for constructing perspective drawings. These rules, which are mathematical in content, are simple and powerful.

¶ 5. *The horizon appears as a line on the picture plane.* Indeed, think of the horizon as a line. The lines through you viewing eye which pass through the horizon make a plane, and this plane intersects the canvas on a line.

   This line, the vanishing line, is the line of intersection of a plane parallel to the level plane of the scene passing through your viewing eye.

¶ 6. *Straight lines in the scene appear as straight lines on the picture plane.* Indeed, lines from your viewing eye to points on a line in the scene describe a plane, which intersects the picture plane on a line.

¶ 7. *Sets of parallel lines that are at an angle with the picture plane meet at a common vanishing point.* Imagine that you are looking at points on the line that are further and further away from your viewing eye. In the limit, you will be looking in a direction that is parallel to that line. The vanishing point of that line is where the line through your viewing eye and in that direction meets the picture plane. Now imagine holding a book so that one end of its spine is on your viewing eye and the other end is on the vanishing point of that line. If you now open the book so that one of its covers passes through that line, the other cover will pass thru a parallel line.

¶ 8. *Lines in the scene that are parallel to the picture plane have no vanishing point, and are therefore parallel on the picture plane.* The line that joins your viewing eye to a point on such a parallel line will limit on a line parallel to the picture plane as the point moves further and further along that line.

¶ 9. A box-like object, like a building, has three sets of parallel directions, each perpendicular to the other two. A one-point perspective drawing of such a box-like object is obtained by setting two of the parallel sets parallel to the picture plane, so that only one vanishing point is needed.

¶ 10. A two-point perspective drawing is obtained when only one parallel set is maintained parallel to the picture plane. For example, in a box-like object like a building, that is usually the vertical (up-down) direction of the building.

   The two other parallel sets, north-south and east-west, determine two vanishing points on the vanishing line. We can place one of them anywhere we like, but how do we place the other so that the picture look right?

¶ 11. Another key observation is contained in the following picture.
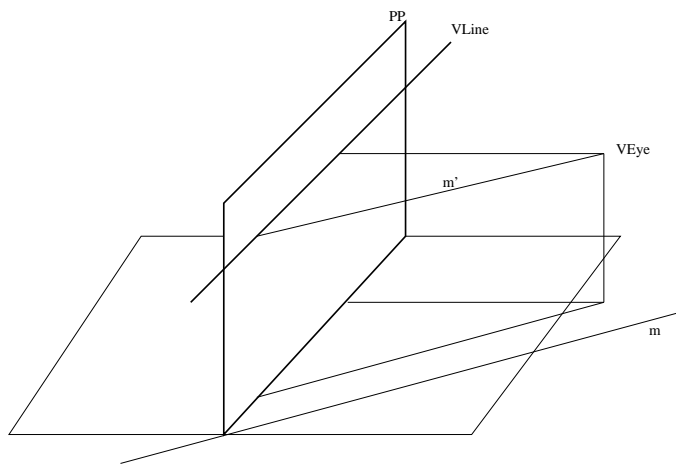
   You are standing on an infinite plane π, the viewing eye is at VE, and the Picture plane P is perpendicular to π. The vanishing line is VL. To find the vanishing point of a line m on the surface plane π find a line m' parallel to m and passing through the viewing eye. This line m' intersects the picture plane on the vanishing point of m.

¶ **12.** How to draw a square? In one-point perspective and in two-point perspective.
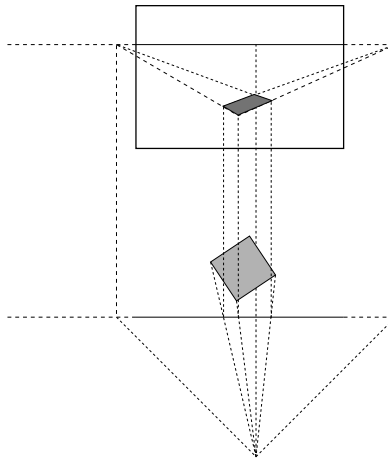
¶ **13.** How to draw a tiled floor? For example, construct a square in two-point perspective and the divide it into a chessboard-like grid

¶ **14.** How to draw a circle in perspective?

¶ **15.** Construct a window in two-point perspective with an arched top in the form of a semicircle.

¶ **16.** How to draw a row of equally space columns?

Literature

[1] Dan Pedoe, *Geometry and the Visual Arts*, Dover Publications, New York, 1983.

[2] Robert Dixon, *Mathographics*, Dover Publications, New York, 1991.