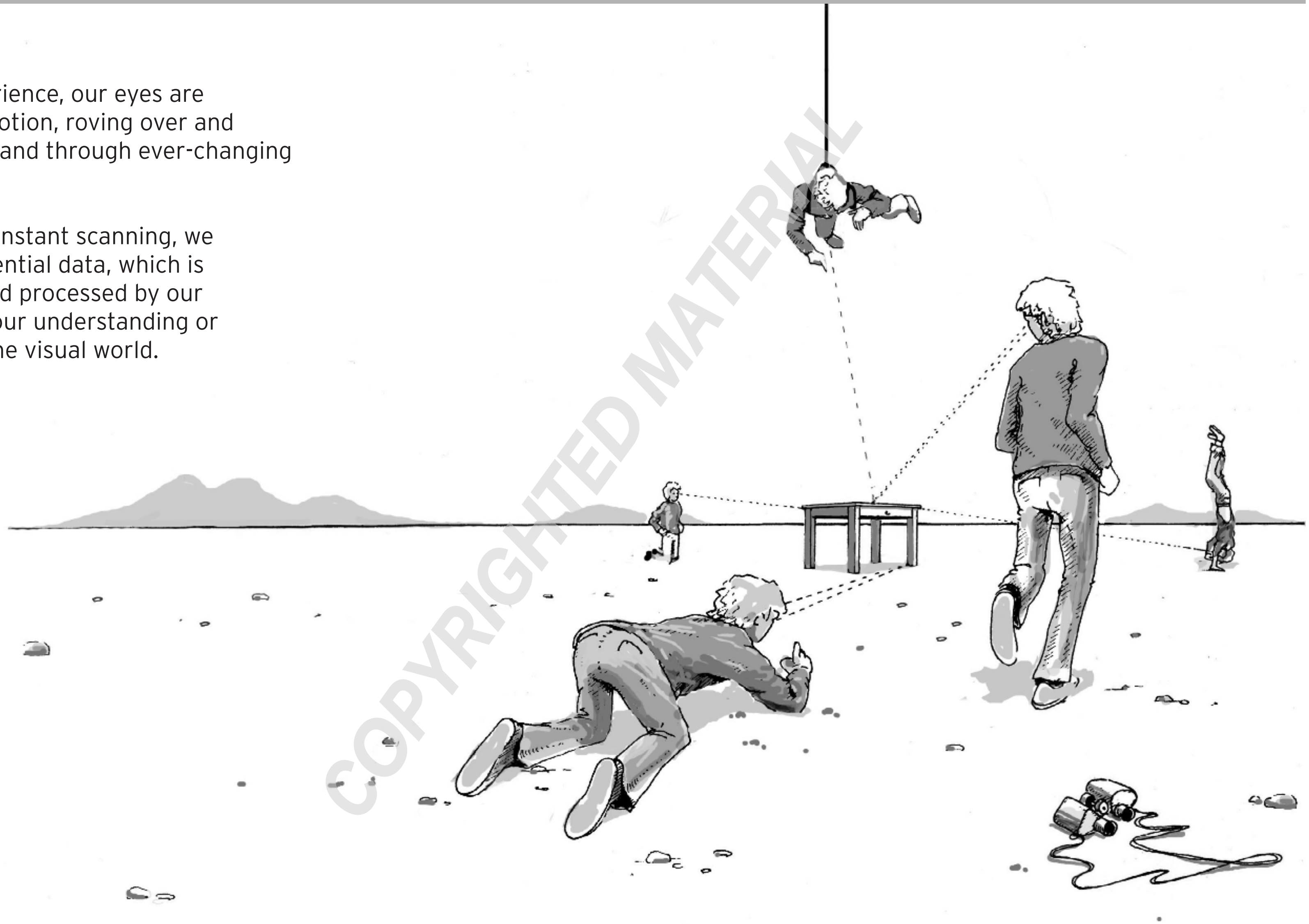
OVERVIEW

1

In normal experience, our eyes are constantly in motion, roving over and around objects and through ever-changing environments.

Through this constant scanning, we build up experiential data, which is manipulated and processed by our minds to form our understanding or perception of the visual world.

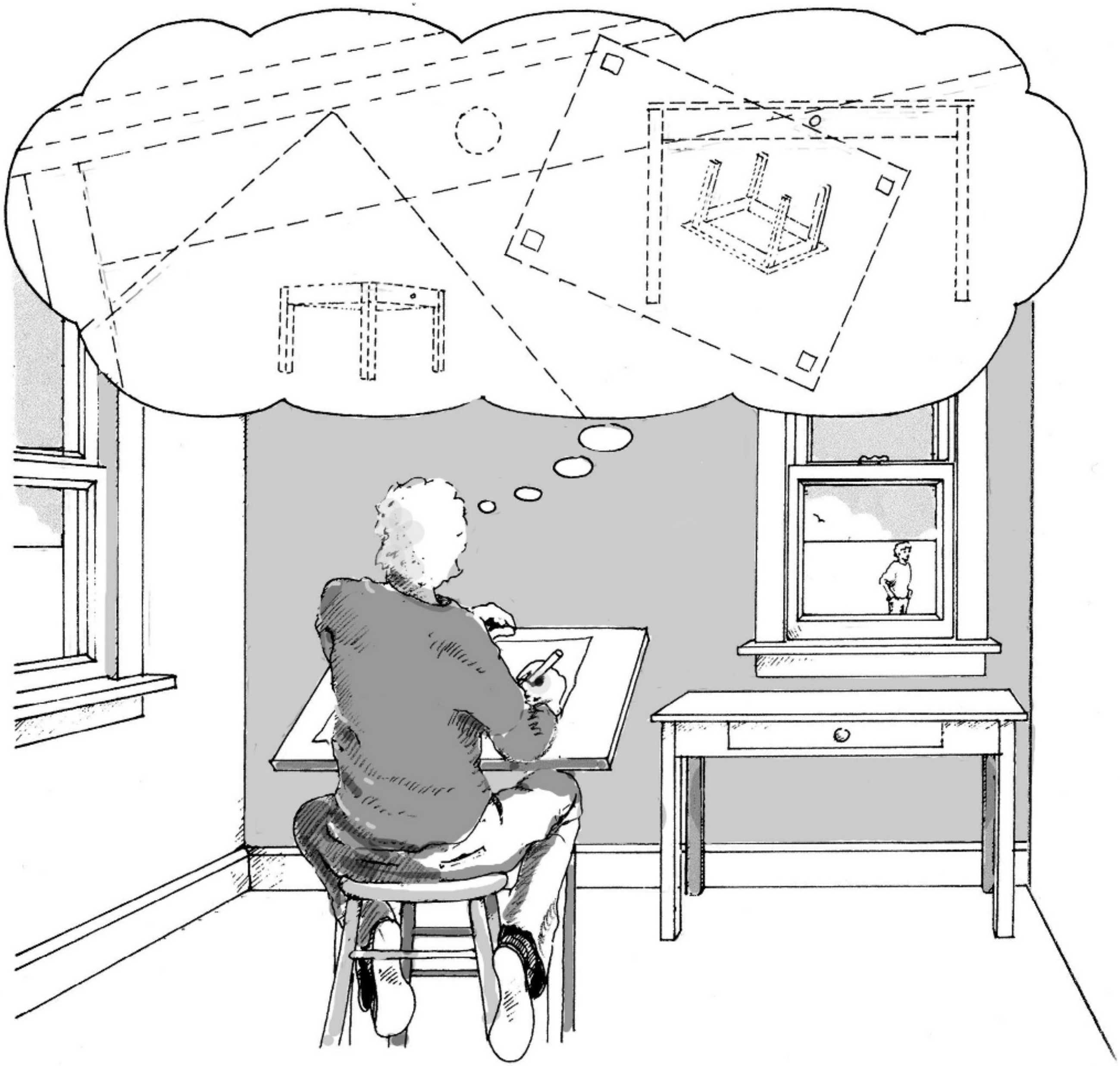


These mental images of the visual world can never be in an exact one-to-one correspondence with what is experienced. Our perceptions are holistic; they are made up of all the information we possess about the phenomena, not just the visual appearance of a particular view.

As we gaze at the object or view, we sense this perceptual information all at once—colors, associations, symbolic values, essential forms, and an infinity of meanings.

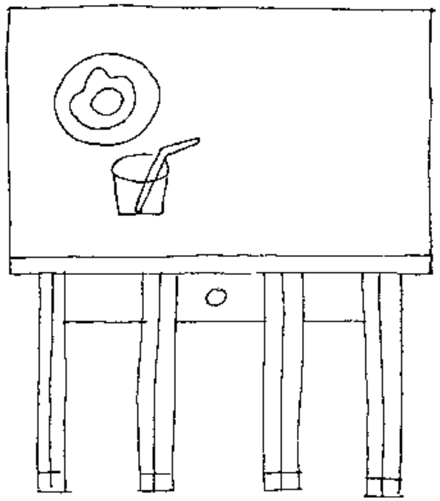
Thus, our perception of even such a simple object as a table is impossible to express completely. Any expression of our experience must be limited and partial.

Our choice of what can or will be expressed is greatly affected by the various limits we self-impose or that are imposed upon us by our culture.

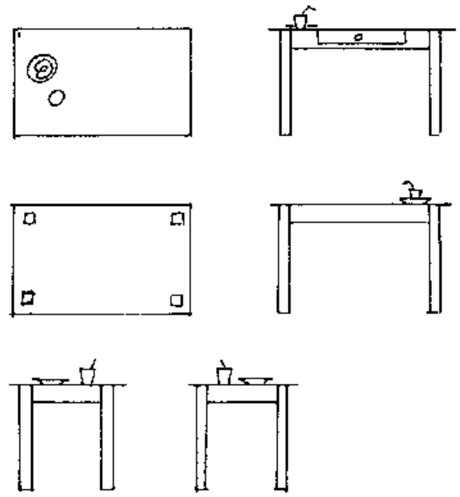


In expressing visual data, individuals and cultures as a whole make choices—some conscious, some unconscious—as to which aspects of their experience of a phenomenon can or should be expressed.

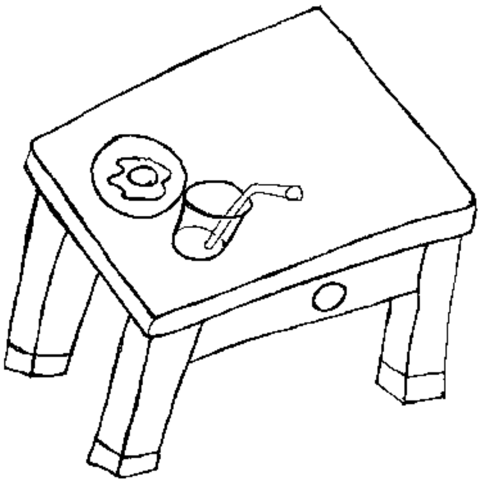
Consider the different images on the right. Each of these drawings of a table is expressing different sets of information about the table, and each is "correct."



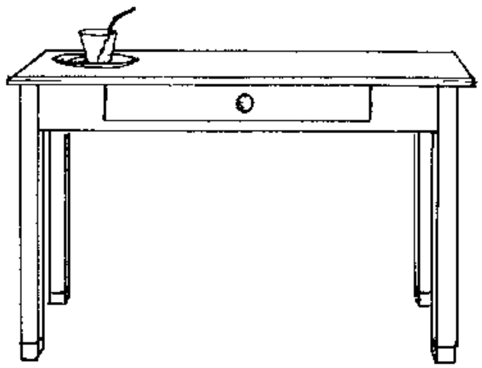
A.
Several views are presented simultaneously.



B.
Parts are separated into measured plans and elevations.



C.
Parts are arranged to express feeling, emotions, and weight.



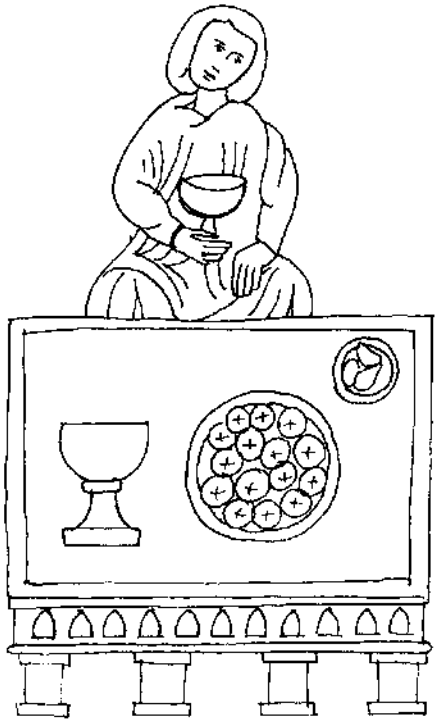
D.
A single point of view is selected to produce an optical appearance.

POINTS OF VIEW

For every advantage gained from a particular system of representation, other possibilities are lost. Thus, linear perspective is only one of many representational systems and is certainly not always the most useful or appropriate technique.

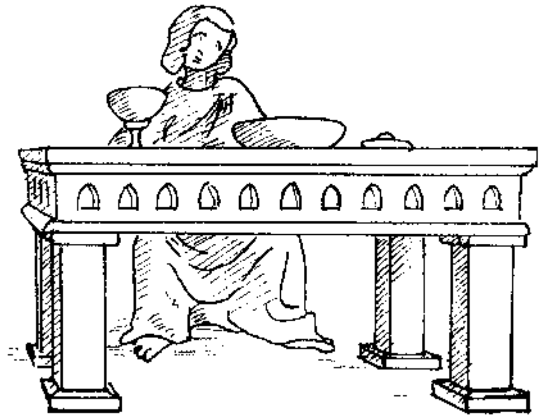
Several Points of View

This system of representation has dominated art of the Middle Ages, nonwestern cultures, primitive art, the art of children, and much of the art of the twentieth century. This system represents what is important or what is known about the subject, not just the way the subject appears optically from a single point of view.



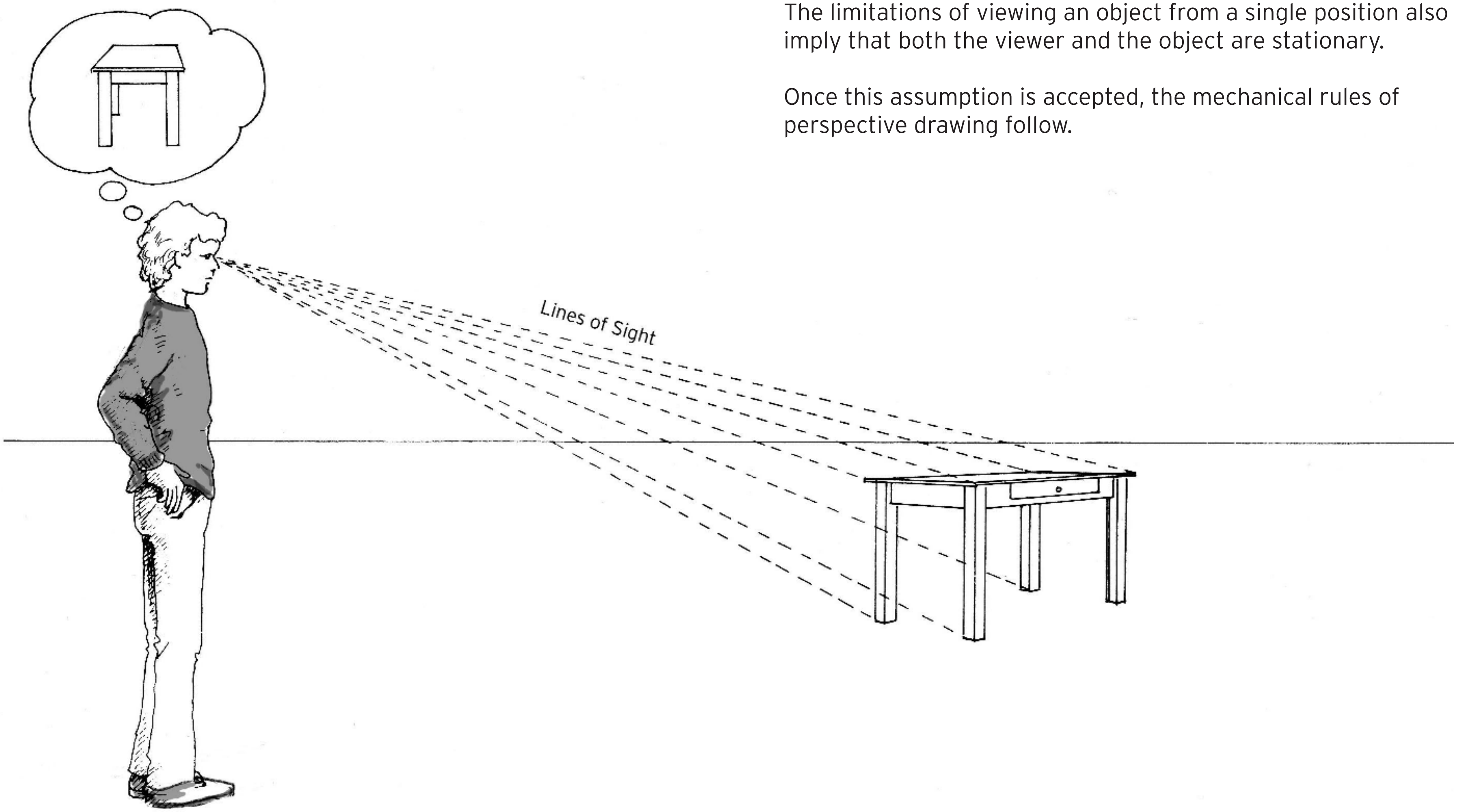
Single Point of View

This system of representation was established at the time of the European Renaissance (c. 1450). It represents the appearance of reality; that is, appearance from a single point of view, as if traced on a window. Note that this "realistic" view prevents us from seeing the apples and the second cup.



The limitations of viewing an object from a single position also imply that both the viewer and the object are stationary.

Once this assumption is accepted, the mechanical rules of perspective drawing follow.



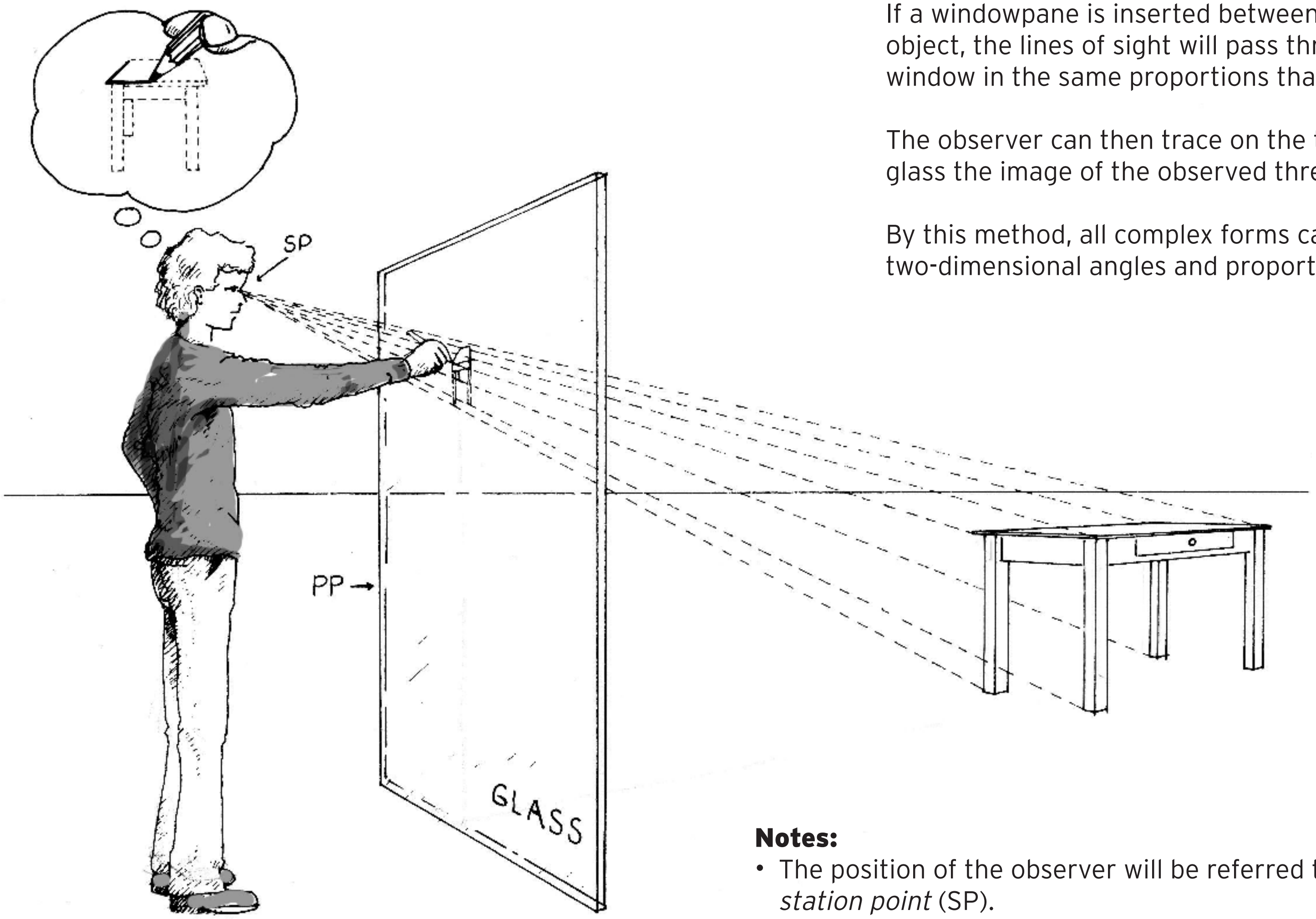
While the object reflects light (visual information) in all directions as shown here, only the light reflected in the direction of the observer conveys the visual information necessary for the viewer's image of the object.

The Picture Plane

If a windowpane is inserted between the observer and the object, the lines of sight will pass through the plane of the window in the same proportions that reach the eye.

The observer can then trace on the two-dimensional plane of glass the image of the observed three-dimensional object.

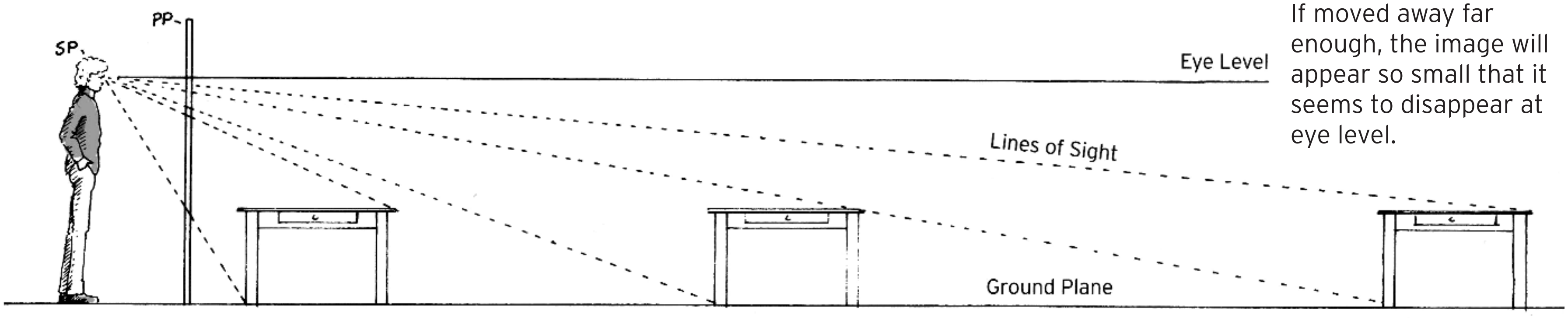
By this method, all complex forms can be reduced to simple two-dimensional angles and proportions.



Notes:

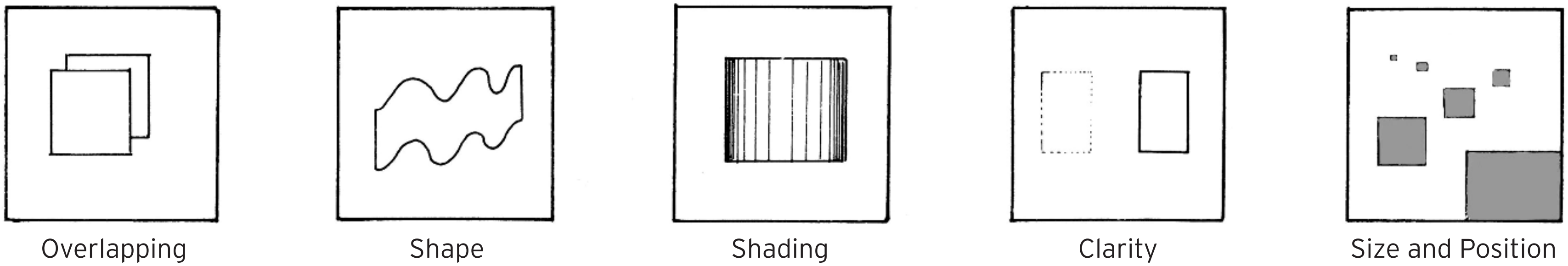
- The position of the observer will be referred to from now on as the *station point* (SP).
- This imaginary window will be referred to from now on as the *picture plane* (PP).
- For the purposes of perspective drawing, the drawing paper can be assumed to be the transparent plane of the picture plane window.

The illusion of depth in linear perspective is suggested by the relative size, position, and shape of lines on the picture plane. The most obvious of these cues is size. The further away an object, the smaller it appears. This is demonstrated here. Notice that the farther the object moves away from the observer, the narrower the lines of sight on the picture plane, and the closer those lines approach eye level.



If moved away far enough, the image will appear so small that it seems to disappear at eye level.

The following illustrations are some cues used to suggest depth on a two-dimensional surface. Seeing these forms as 3-D is not a universal experience. Some cultures refuse to interpret any 2-D image as anything by 2-D—even a photograph! Similarly, Western cultures find it impossible to see certain 2-D images as truly flat.

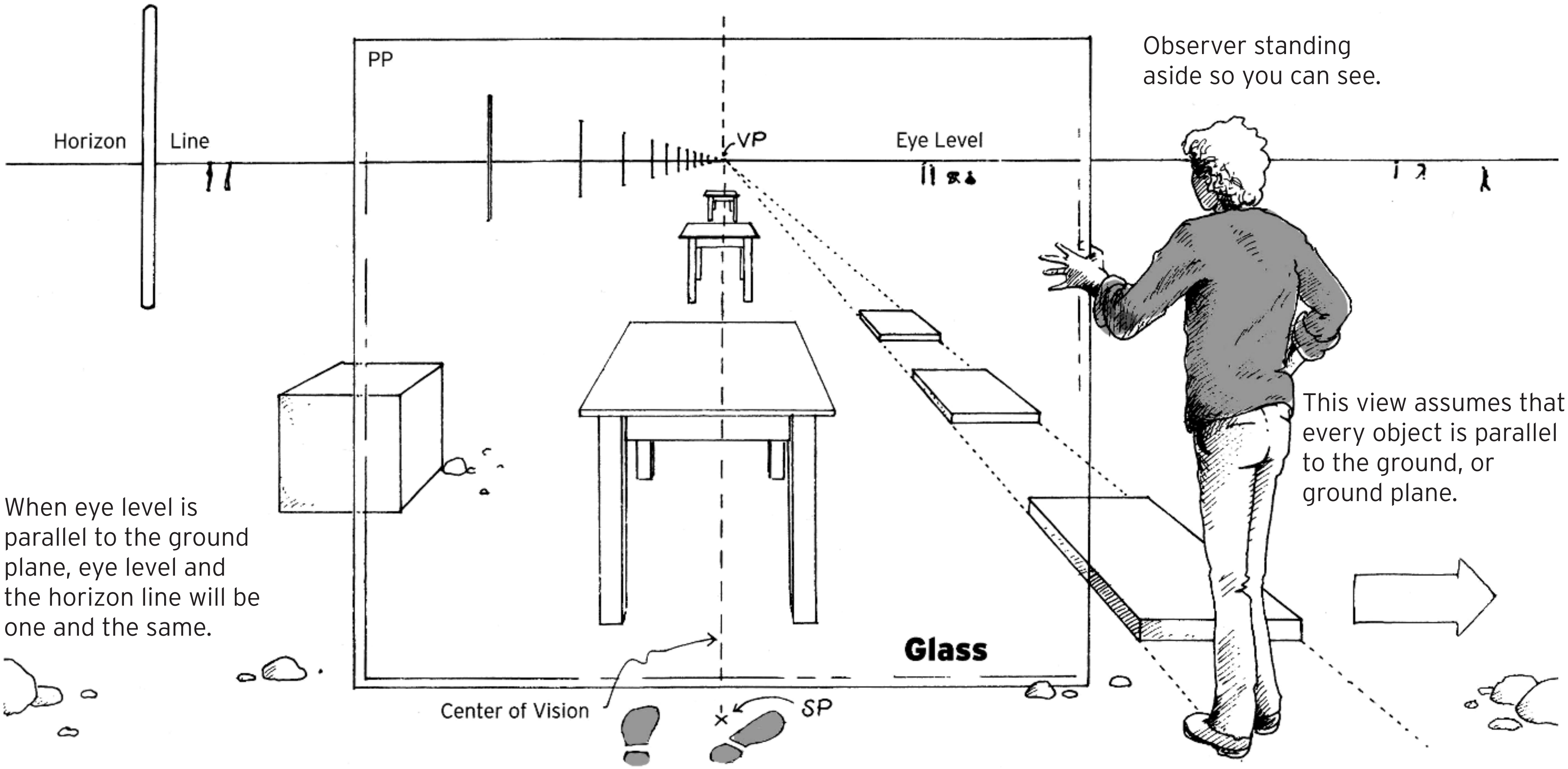


View from Behind the Station Point

In relation to the picture plane, all objects moving away from the viewer gravitate toward the viewer's eye level while getting smaller at the same time.

Note that lines parallel to each other in the scene converge toward a common point at eye level, where the distance between them becomes so small it seems to disappear.

The point at which lines converge is called the *vanishing point* (VP).



Observer standing aside so you can see.

This view assumes that every object is parallel to the ground, or ground plane.

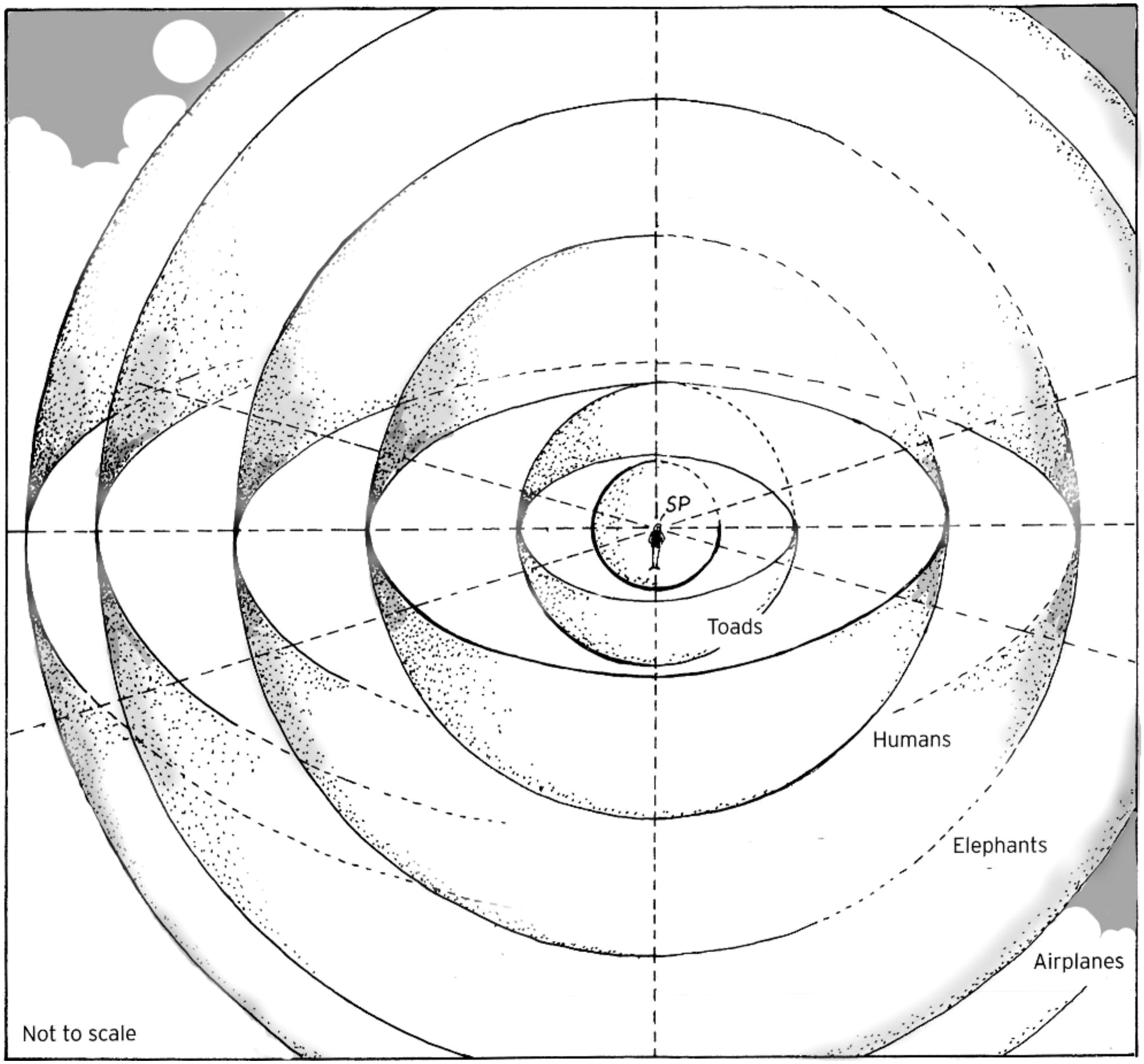
When eye level is parallel to the ground plane, eye level and the horizon line will be one and the same.

SPHERES OF DISAPPEARANCE

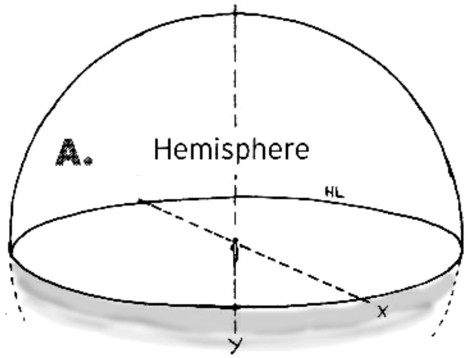
From the observer's position in space, objects can recede in any direction, not just along lines parallel to the ground. Therefore, for each observable object, there exists a *sphere of disappearance* encompassing the observer. An object receding in any direction from the observer's point of view (station point) will appear to decrease in size until it reaches the outer limits of its own sphere, vanishing completely.

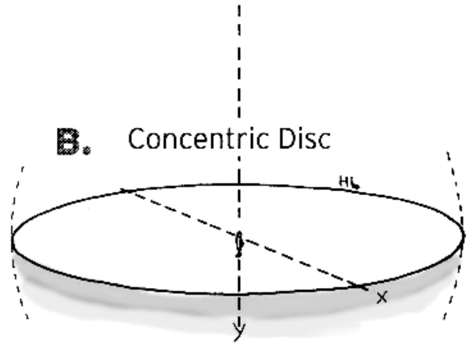
The size and brightness of the object determine the magnitude of its sphere if all other factors are equal.

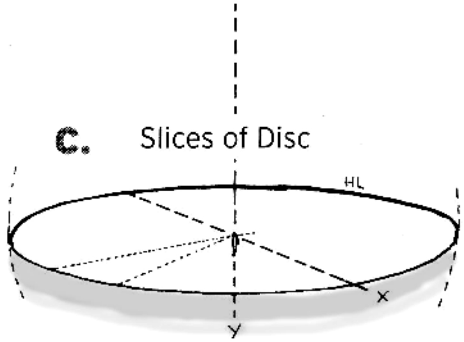
There are as many concentric spheres of disappearance as there are objects observed.



Most of the time, people observe things while their feet are firmly planted on the ground. As a result, spheres of disappearance can be reduced, for practical purposes, to the following types:

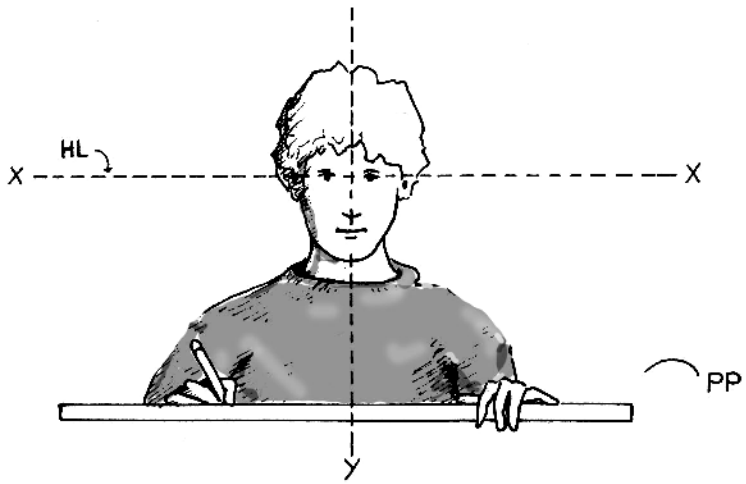




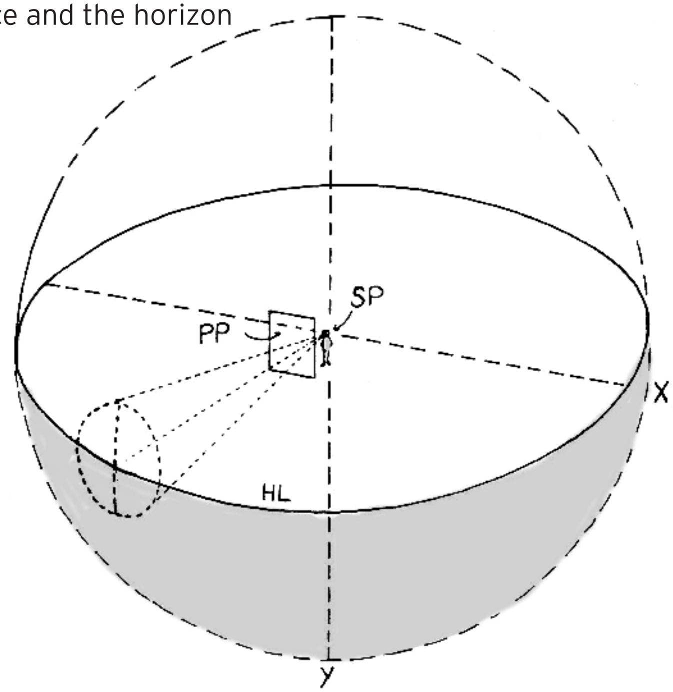


Since our normal experience is concentrated on observations on the ground plane, spheres of disappearance can be reduced to a *horizon line* (HL) surrounding a disc, analogous to the ground plane (B). Because we can look in only one direction at a time, the disc is reduced to a slice and the horizon line to a segment (C).

The physical arrangement of our bodies provides us with natural horizontal and vertical axes.



This slice of the sphere, hemisphere, and disc is actually conical in shape.



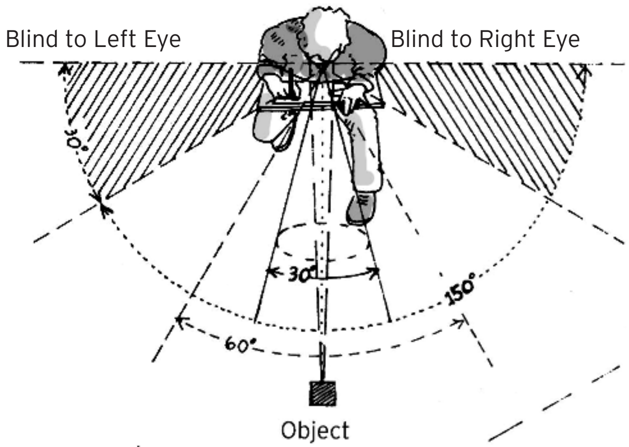
CONE OF VISION

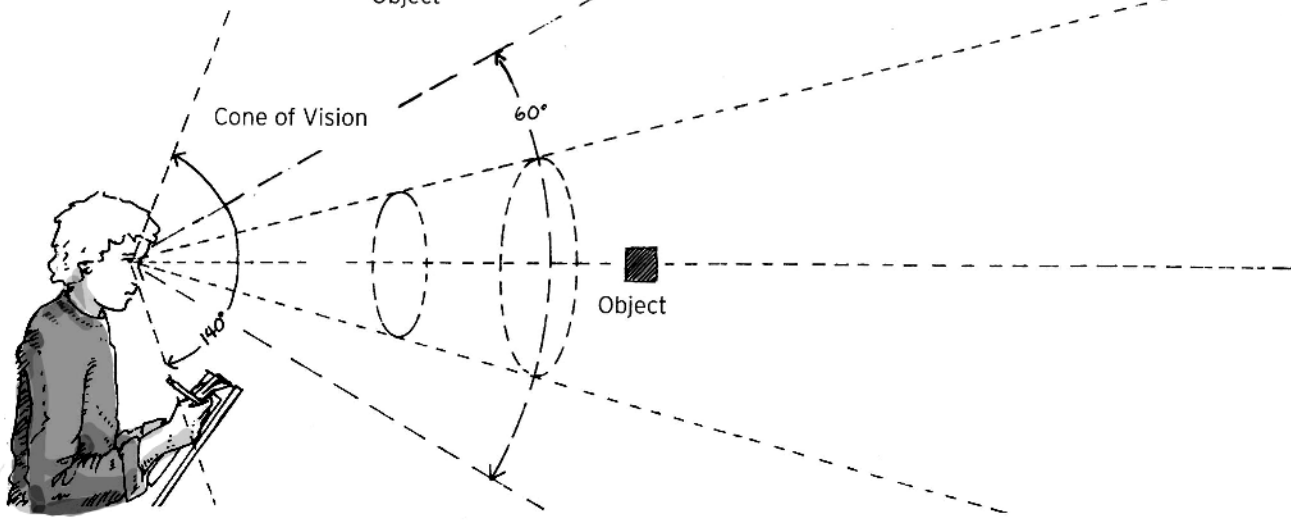
The parts of our eyes that receive light are hemispherical, each gathering light from a cone of about 150 degrees. When these two cones overlap, we gather light from almost 180 degrees.

Only in the area where the fields from both eyes overlap does binocular vision occur.

Within this broad field of vision, we actually focus clearly through cones of about 30–60 degrees. When objects are outside of these standard cones of vision, we generally consider them to be distorted, as images appear through a wide-angle lens.

Vertically, our vision is limited to about 140 degrees, our sight being cut off by eyebrows, eyelids, and cheeks.

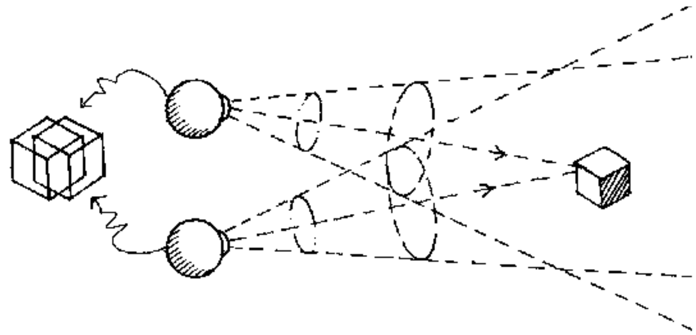




When we use both eyes, our cone of vision is a combination of two overlapping cones, one from each eye.

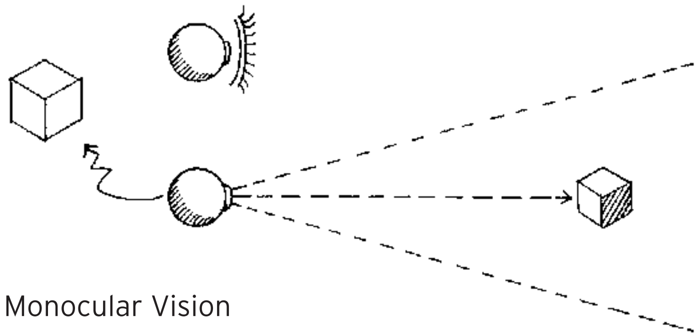
Optics of the Eye Relative to the Cone of Vision

Each eye perceives the object from a slightly different angle. This gives the brain a strong cue as to the depth of the object. The brain harmonizes both two-dimensional views and creates a three-dimensional image.



Binocular Vision

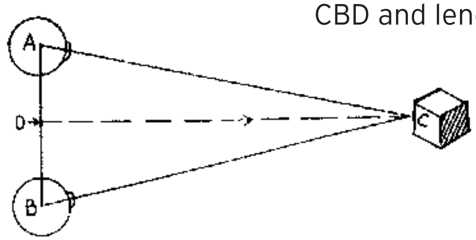
In perspective drawing, it is necessary to use only one eye. Remember that the perspective system is based on one point of view. In other words, the two-dimensional drawing is based on the two-dimensional view from a single eye.



Monocular Vision

Our eyes remain at a constant distance from each other as they angle toward the object of focus. Thus, through a kind of intuitive triangulation, we are aided in estimating the distance to the object. This intuitive aid is lost when only one eye is used; as a result, there will always be a marked difference between the drawn image and the observed world. Stereoscopes and stereo cameras attempt to put this vision back together by showing slightly different views to each eye, thereby creating a sense of depth artificially.

With geometry, one can find distance DC if angles CAD and CBD and length AB are known.

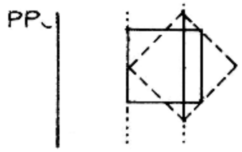


Depth Perception and Stereo Vision

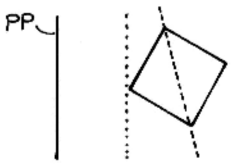
FOUR PERSPECTIVE ANGLES

The angle at which the object is viewed through the picture plane is an important factor in determining the method of drawing a perspective view.

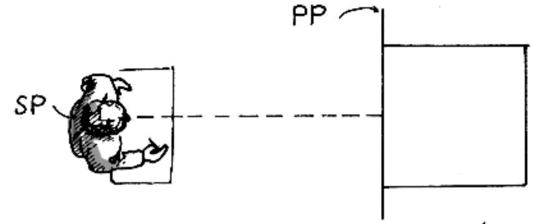
One- and two-point parallel perspective can have a major axis parallel to the picture plane.



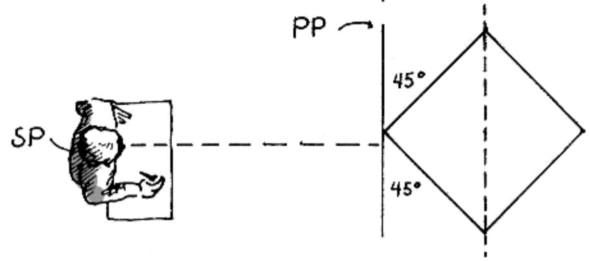
The object can be at an angle to the picture plane, so that not even its 45-degree diagonal is parallel.



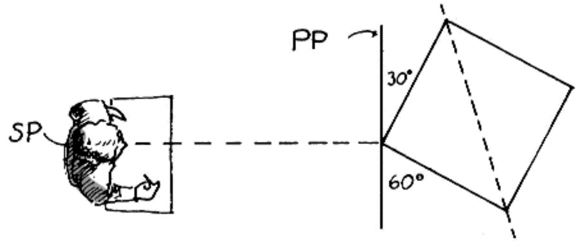
Three-point perspective can be drawn with either of the above object angles.



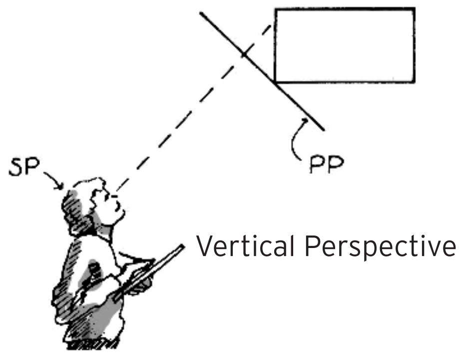
One-Point Parallel Perspective



Two-Point Parallel Perspective



Two-Point Angular Perspective



Three-Point Angular or Parallel Perspective

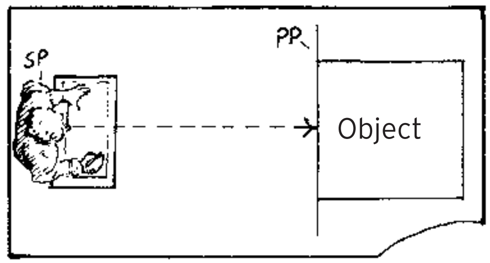
Here, "point" refers to the number of vanishing points in each type of view.

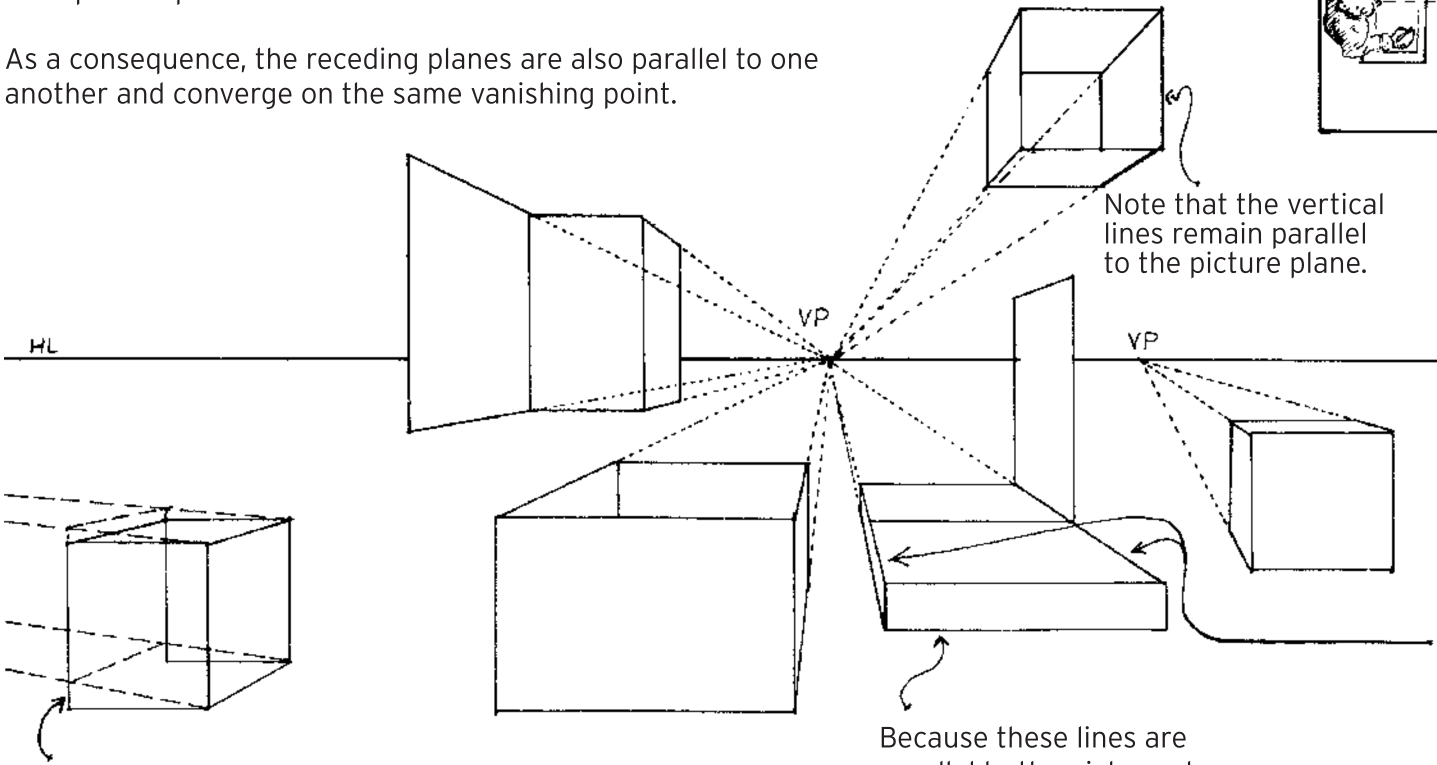
One-Point Parallel Perspective

The rectilinear objects shown here have the following characteristics:

- One set of planes parallel to the picture plane
- One set of planes parallel to the ground and perpendicular to the picture plane

As a consequence, the receding planes are also parallel to one another and converge on the same vanishing point.





Note that the vertical lines remain parallel to the picture plane.

This box is not parallel to the others, so its lines converge on their own VP.

These lines are perpendicular to the picture plane, so the space between them diminishes until they reach the vanishing point.

Because these lines are parallel to the picture plane, they do *not* converge.

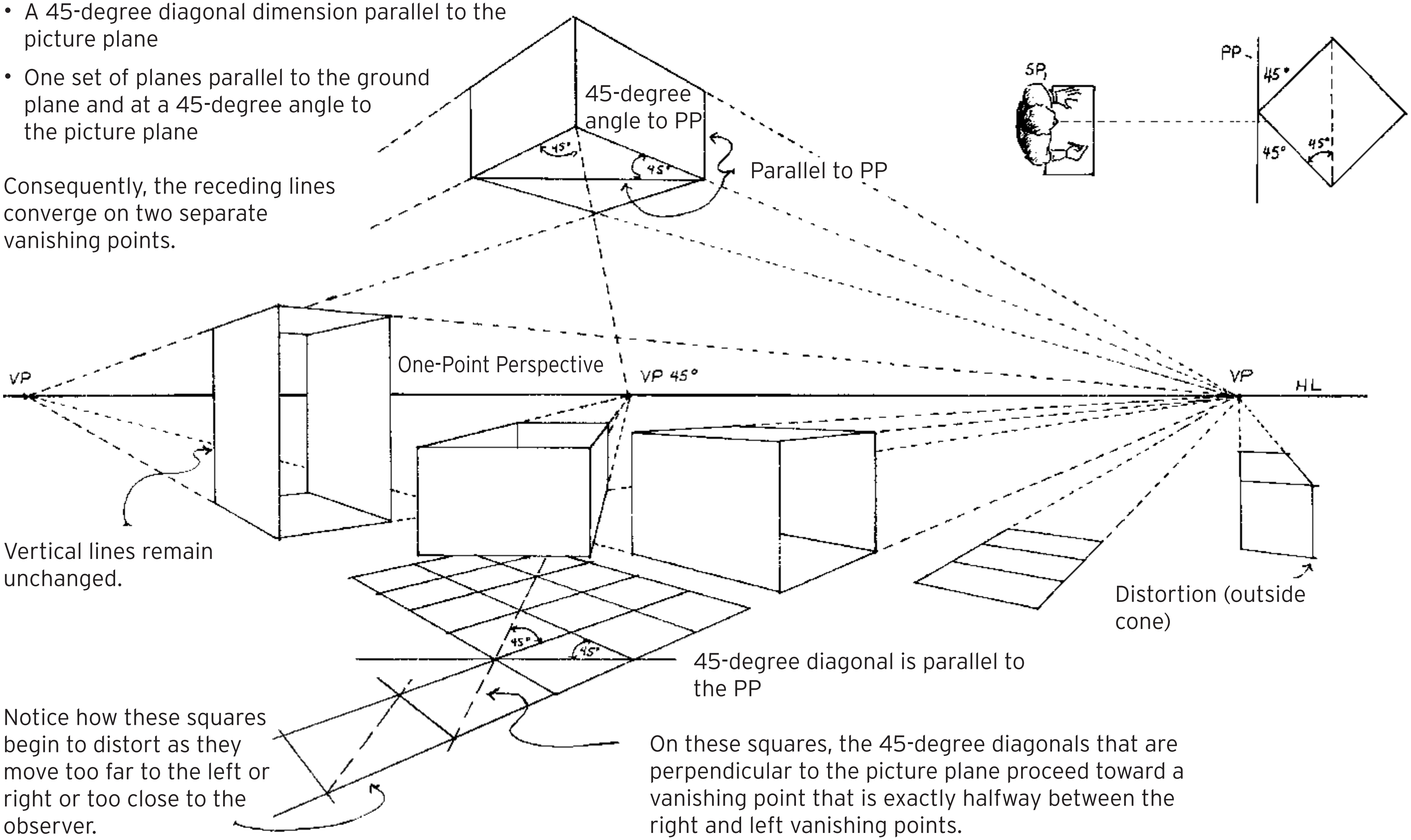
This box is located at the extreme edge of the cone of vision and is beginning to distort. Its left edge is farther away and should appear smaller than the closer right edge, as the dotted lines indicate.

Two-Point Parallel Perspective

The rectilinear objects shown here have the following characteristics:

- A 45-degree diagonal dimension parallel to the picture plane
- One set of planes parallel to the ground plane and at a 45-degree angle to the picture plane

Consequently, the receding lines converge on two separate vanishing points.



Vertical lines remain unchanged.

Notice how these squares begin to distort as they move too far to the left or right or too close to the observer.

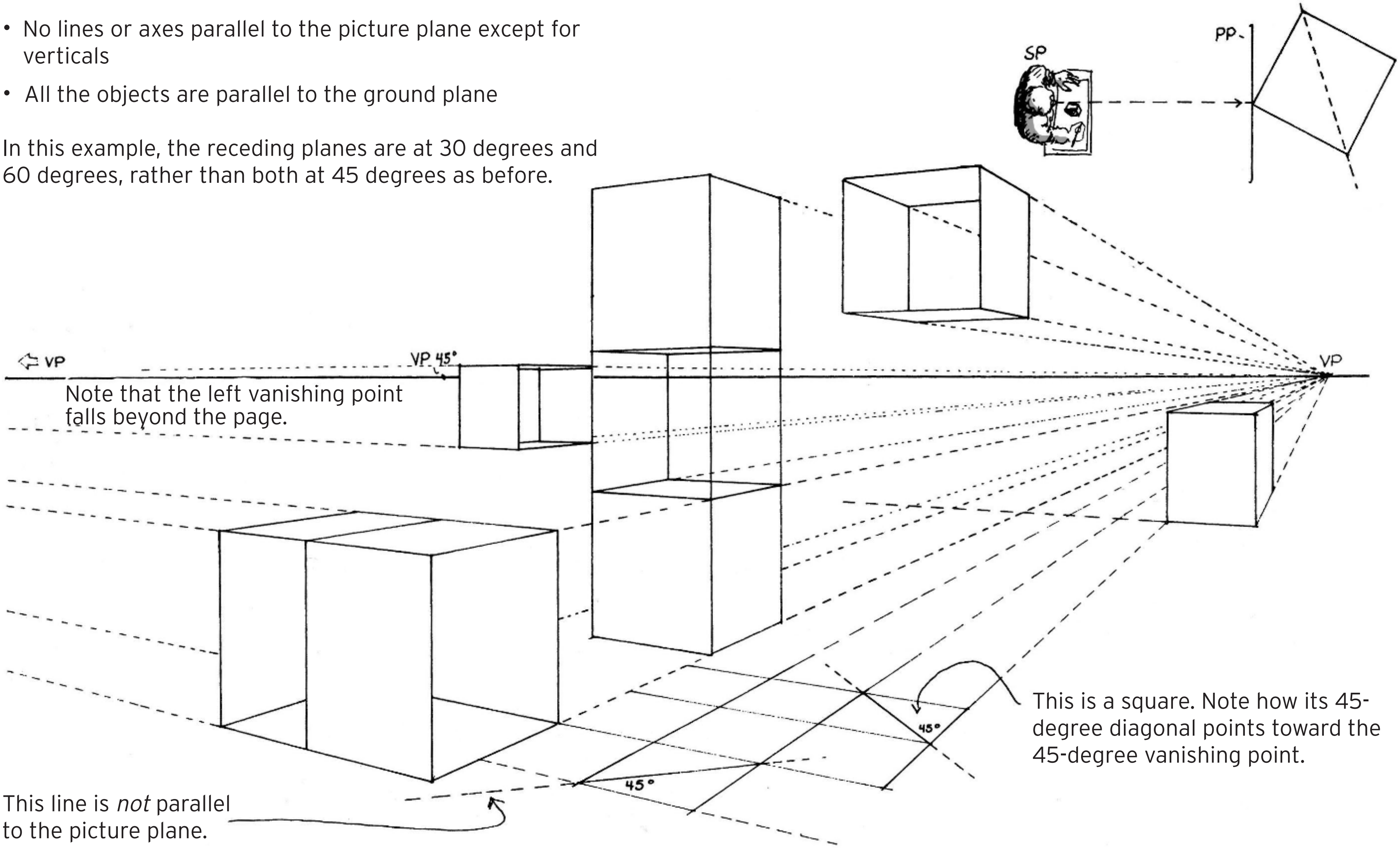
On these squares, the 45-degree diagonals that are perpendicular to the picture plane proceed toward a vanishing point that is exactly halfway between the right and left vanishing points.

Two-Point Angular Perspective

The rectilinear forms shown here have the following characteristics:

- No lines or axes parallel to the picture plane except for verticals
- All the objects are parallel to the ground plane

In this example, the receding planes are at 30 degrees and 60 degrees, rather than both at 45 degrees as before.

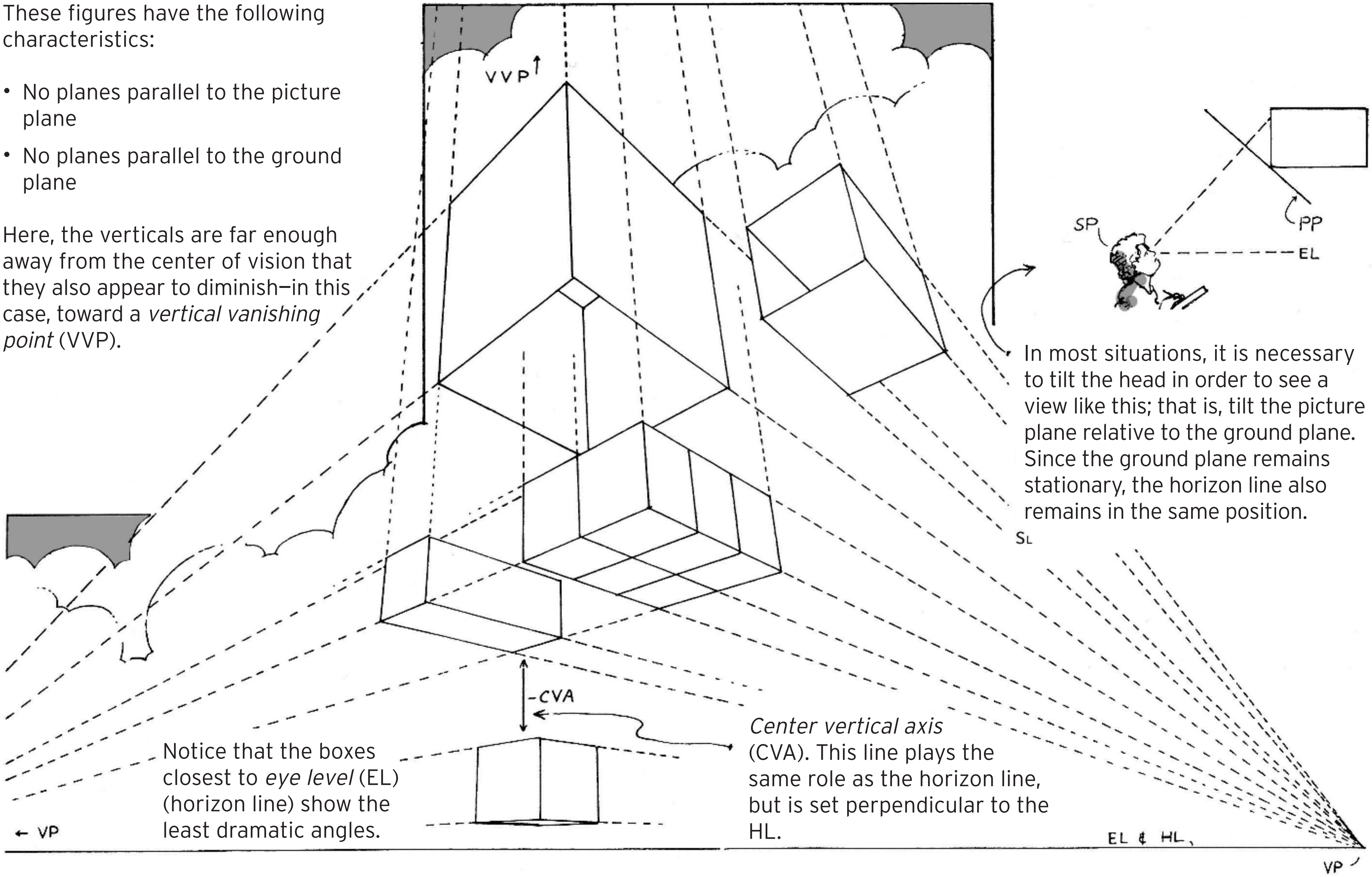


Three-Point Angular or Parallel Perspective

These figures have the following characteristics:

- No planes parallel to the picture plane
- No planes parallel to the ground plane

Here, the verticals are far enough away from the center of vision that they also appear to diminish—in this case, toward a *vertical vanishing point* (VVP).



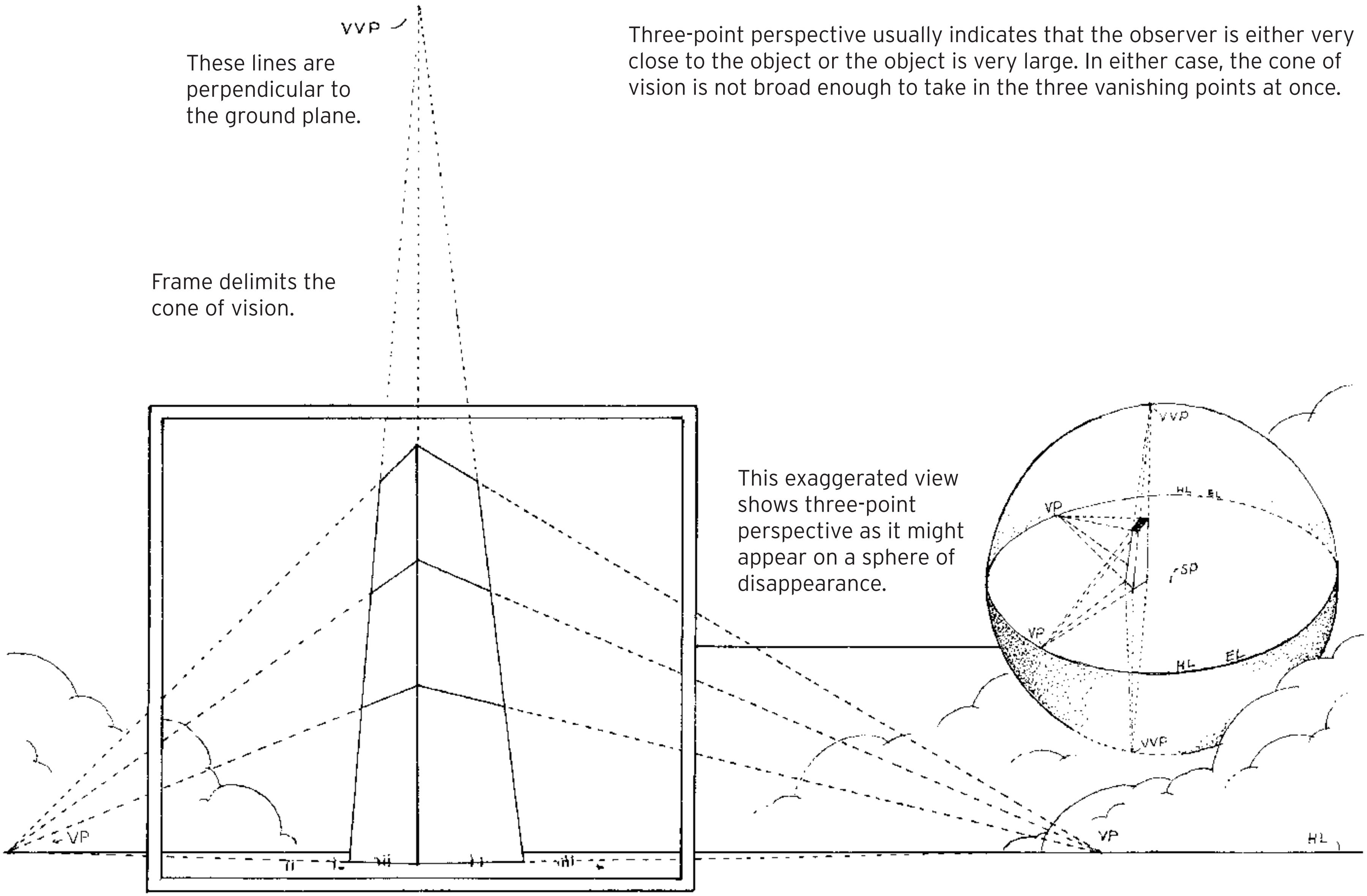
In most situations, it is necessary to tilt the head in order to see a view like this; that is, tilt the picture plane relative to the ground plane. Since the ground plane remains stationary, the horizon line also remains in the same position.

Notice that the boxes closest to *eye level* (EL) (horizon line) show the least dramatic angles.

Center vertical axis (CVA). This line plays the same role as the horizon line, but is set perpendicular to the HL.

Turn this image upside down for an aerial view of the verticals diminishing downward.

Three-point perspective usually indicates that the observer is either very close to the object or the object is very large. In either case, the cone of vision is not broad enough to take in the three vanishing points at once.



These lines are perpendicular to the ground plane.

Frame delimits the cone of vision.

This exaggerated view shows three-point perspective as it might appear on a sphere of disappearance.