iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 Issue: VI Month of publication: June 2023

DOI: https://doi.org/10.22214/ijraset.2023.54078

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Level Perspective

Dhirgham Treeko Murran

Abstract: Level Perspectives or so-called (Parallel and Angular Perspectives) appear when the camera is set level. In other words, the center line of vision is level. Such perspective drawings appear to converge in one or two vanishing points, in accordance with the position of the object with respect to the observer. Thus, the verticals will always remain vertical in Level Perspective.

Those who study perspective drawing are familiar with only one method that involves the Station Point to define the verticals in perspective. However, horizontal structures, such as, patterns on the floor or ceiling, or any top projection would be hard to draw by applying the conventional method. My approach is using a method appropriate to the line-directions in the top view or the plan. Thus, there is one method for each of the skew lines, vertical lines and horizontal lines in the plan. Each method is simple as it only consists of two or three lines. The conventional method also consists of two lines which is appropriate for all vertical edges, but it can't be applied to level structures. Interior Designs are hard to do using the conventional method. That is the reason to use freehand sketches in interior designs. However, it will be seen how easy to do interior perspectives using my methods.

I. INTRODUCTION

There are three important basics to consider, in order to understand the full scope of perspective techniques.

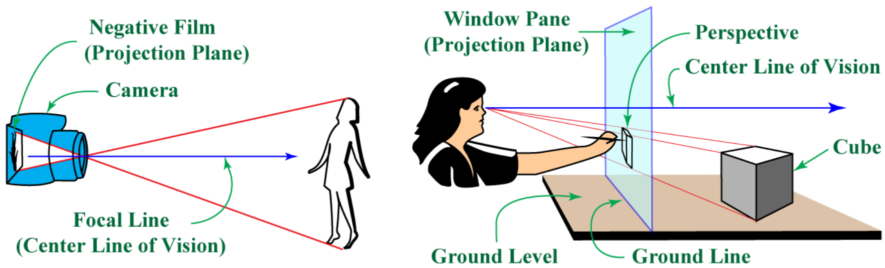
1) The definition of Picture Plane i.e. Projection Plane.
2) The definition of Vanishing Points and how they are located.
3) The basic Perspective Theorem established by me in 1979.

Upon understanding the above definitions, the entire research will be clear.

A. *Projection Plane (Picture Plane)*

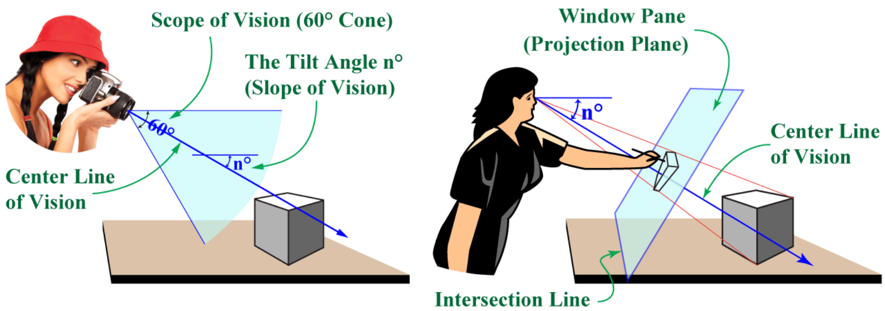
Projection plane is in some likeness of a negative film inside a camera on which an image appears. Projection plane can also be described as a window pane from which a person standing at arm's length traces upon the glass the scene outside. A person doing this will be drawing a picture in perspective (namely, a 3D projection), as shown in Fig. 01.

If the camera is tilted, then, its negative film (i.e. Projection Plane) will be tilted too. Thus, the window pane will be tilted as well, as it represents the negative film as a projection plane, as shown in Fig. 02. For now, the level setting of the camera as in Fig. 01 will be considered only in this research.



a. *A perspective drawing i.e. a photograph is projected inside the camera.* ***b.*** *A perspective is projected on the window pane by means of light rays coming to the eye.*

Fig. 01. Basic Interpretation of the Perspective Projection and Projection Plane.



a. *Tilted negative film (Projection Plane)* ***b.*** *Tilted window pane (Projection Plane)*

Fig. 02. If the camera is tilted, Projection Plane must be tilted.

B. Vanishing Points (VP)

Vanishing points are simply expressed as the points on picture plane that correspond to the farthest points of directed straight lines which are receding from the observer to infinity. To clarify such definition, Fig. 03 shows the vanishing point of the tightrope (ad). The observer who is looking at points (a, b, c and d) through the window pane (i.e. Picture Plane) will see the projections of these points on the window pane as (A, B, C and D) respectively. If point (d) goes farther and farther on the same path of (ad) until it reaches infinity, its light ray coming to the eye will tend to parallel the tightrope.

It is mathematically considered that the parallel lines tend to converge in infinity. When the infinite light ray intersects picture plane, it will determine the location of the vanishing point of the assumed tightrope.

Thus, a vanishing point of any straight line can be located on picture plane by drawing a straight line parallel to the assumed line from the eye to picture plane.

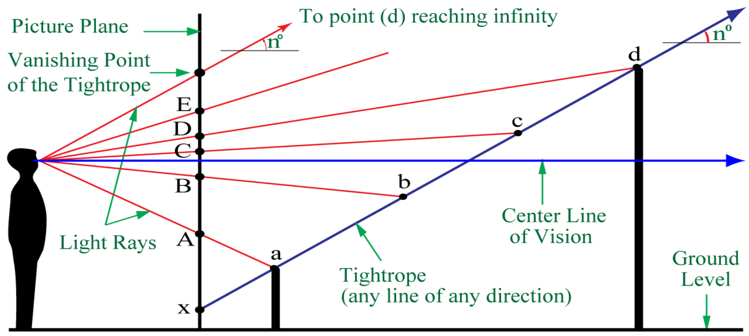


Fig. 03. Side view clarifying the vanishing point (VP) of tightrope (ad).

C. Perspective Theorem

Any straight line intersecting picture plane has one corresponding straight line in perspective view, drawn between the vanishing point of the assumed line and its point of intersection on picture plane.

In Fig. 04, line (ab) lies on the horizontal ground level and meets with picture plane by point (c). Line (ab) also has the vanishing point (d) which is defined by drawing (ed) from the eye point (e) parallel to the assumed line (ab). If a plane rests on the parallel lines (cb and ed) it will intersect picture plane making the intersection line (cd). Thus, line (cd) is the perspective image of line (cb) receding from point (c) to infinity on the ground plane. Axiomatically, the points c, a and b have their corresponding points c, A and B respectively, in perspective view, i.e. on line (cd) on picture plane.

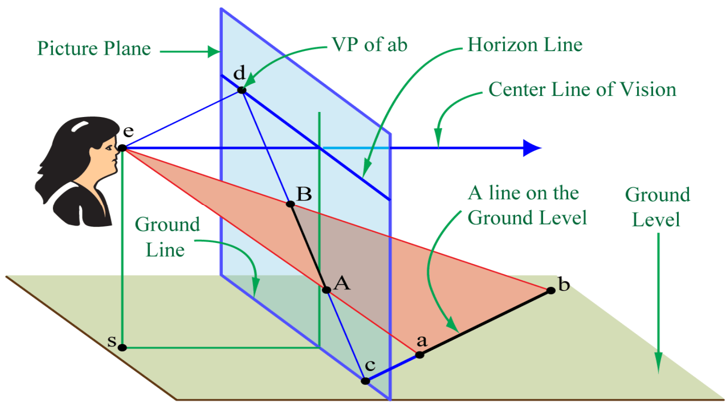


Fig. 04. Isometric drawing clarifying the perspective theorem.

D. Perspective Setup (1st Method)

Based on the theorem, all edges of the cube are extended to Picture Plane. The intersection points (f, g, k, l, F, G, K and L) are then connected to the vanishing points of the cube's edges defining the perspective drawing of the cube, as shown in Fig. 05.

Observe that the vertical lines fF, gG, kK and lL have the same height of the cube since they are the intersection lines of the cube's sides with picture plane. Thus, these vertical lines are called "True Heights". By taking the front view of Picture Plane, the perspective image will look as a true perspective view. On the other hand, the top view of Picture Plane will show a plan view of the object in front of Picture Plane, as shown in Fig. 06, below. Let's call this method "the 1st Method".

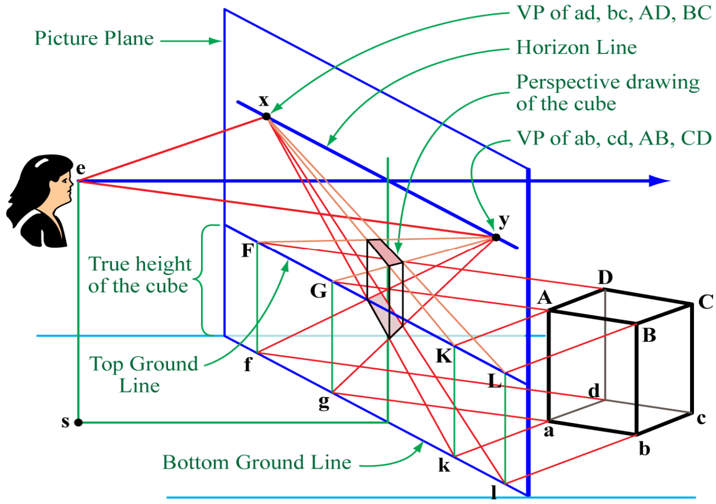


Fig. 05. Based on the perspective theorem, the perspective drawing of the cube is structured.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

In Fig. 06, the top view is taken in order to locate the intersection points f, g, k, l, and the vanishing points x and y. Then, the front view is taken to setup the horizon line and the top and bottom ground lines. Now, the true heights fF, gG, kK and lL are established from points f, g, k and l in drawing (a). Thus, the 1st method is used for all the skew lines in the plan, such as, cf, bg, dk and cl.

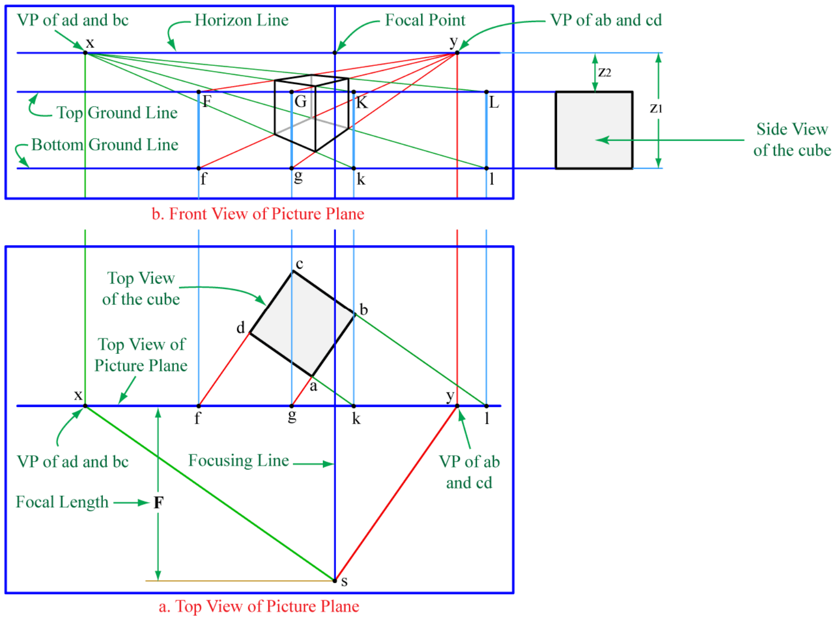


Fig. 06.

Top and front views of picture plane in order to setup a perspective drawing.

E. Application to the1st Method

In Fig. 07, in brief, it's an angular perspective of two vanishing points. The perspective theorem is applied. At the bottom, the plan lines are extended to picture plane, then relocated on "Ground Line 2" to establish the top projection of the plan itself, where lines from both vanishing points intersect each other to form "plan projection" below the ground level. The rest is easy, as verticals from the plan projection intercept the vanishing lines passing through the true heights established from a1, b1, e1, f1, c1 and d1. Fig. 08 is the finishing product.

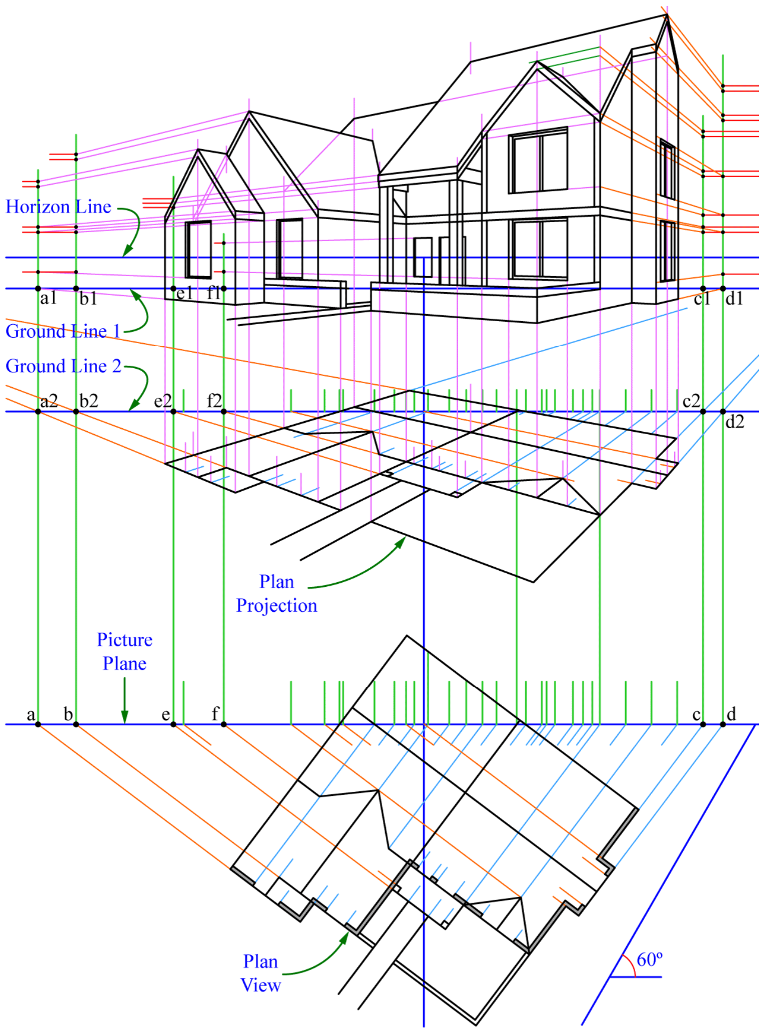


Fig. 07.

The 1st Method is applied to define the plan projection below the ground level.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Fig. 08. A perspective rendering painted in watercolors.

F. A high view perspective of a house, using the 1st Method

Fig. 09 is a high view of two point perspective. Keep in mind that it is not a Bird's-eye view (namely three point perspective). It is a common two point perspective with the camera being above the house. This is simply done by setting (h1) higher than the house. The same procedure as in the previous example is applied to define the top projection below the ground level through "Ground Line 2". Six true heights are established from (a, b, c, d, e and f) to define different parts of the house. For example, the line above (a) defines the garage, and so on.

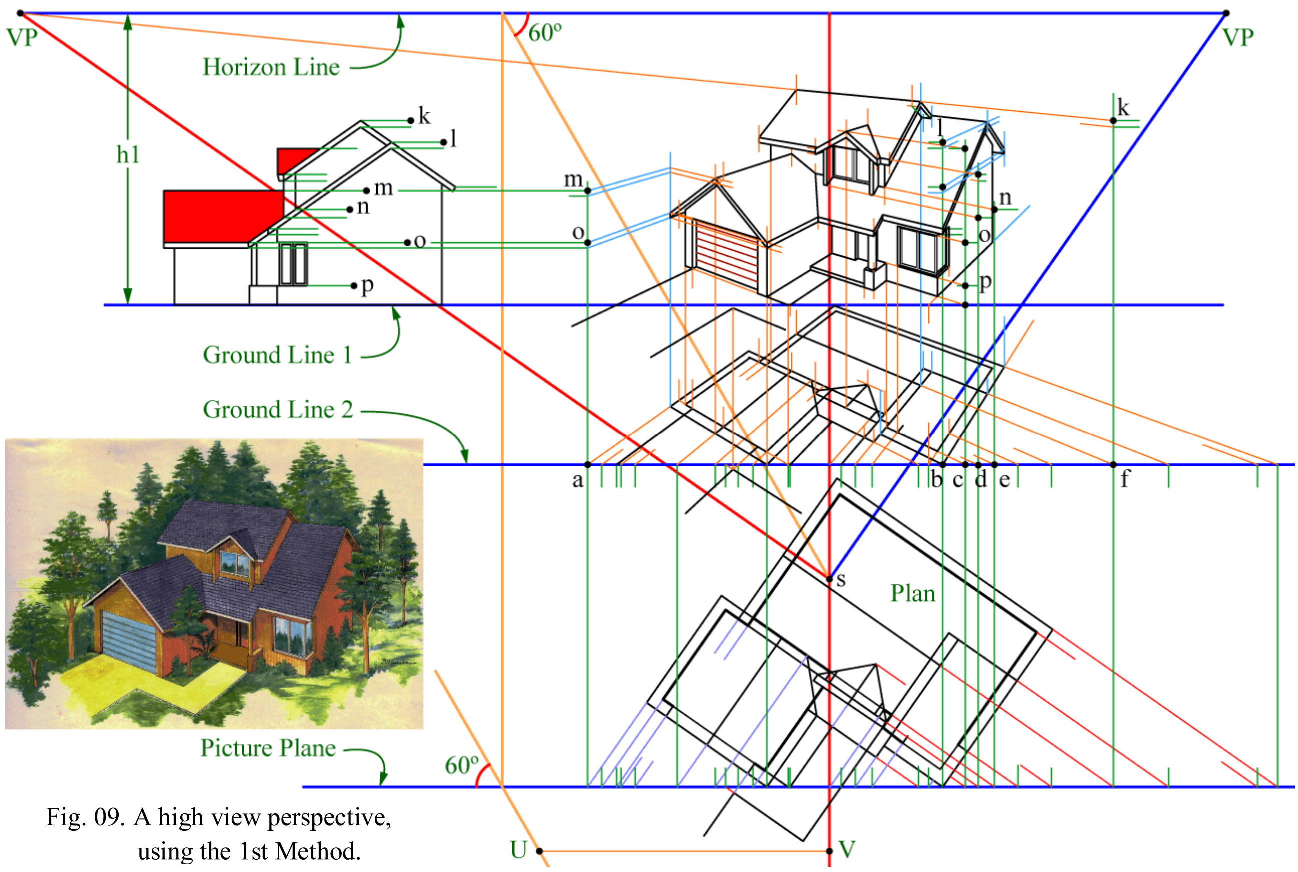


Fig. 09. A high view perspective, using the 1st Method.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

G. The 2nd Method (Conventional Method)

I haven't seen one book that shows the proof of the popular method. In fact, it is based on the Perspective Theorem as well. Look at Fig. 10, and observe the vanishing points of the radial lines converging in the Station Point (s). The vanishing points of these lines are, of course, the intersection points of their parallel lines (i.e. light rays) drawn from the eye to picture plane. In other words, the vanishing points of these radial lines are right above the intersection points (a, c, e and g) on the Horizon Line. According to the perspective theorem, the lines which are drawn between the intersection points and the vanishing points i.e. the vertical lines (aA, cC, eE and gG) represent those radial lines (ab, cd, ef and gh) respectively in perspective.

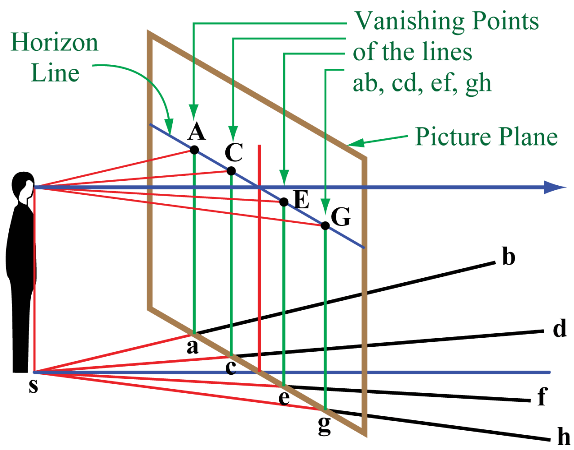


Fig. 10. An isometric drawing clarifying the vanishing points of the radial lines.

H. Application to the 2nd Method

This Method, contrary to the 1st Method, can't be used by itself in order to complete the whole perspective drawing. But, using it together with any other method will do the job. Thus, I used the 1st Method to define the true heights rising from a, b, c, d, e, f and g. The rendering is shown in Fig. 12.

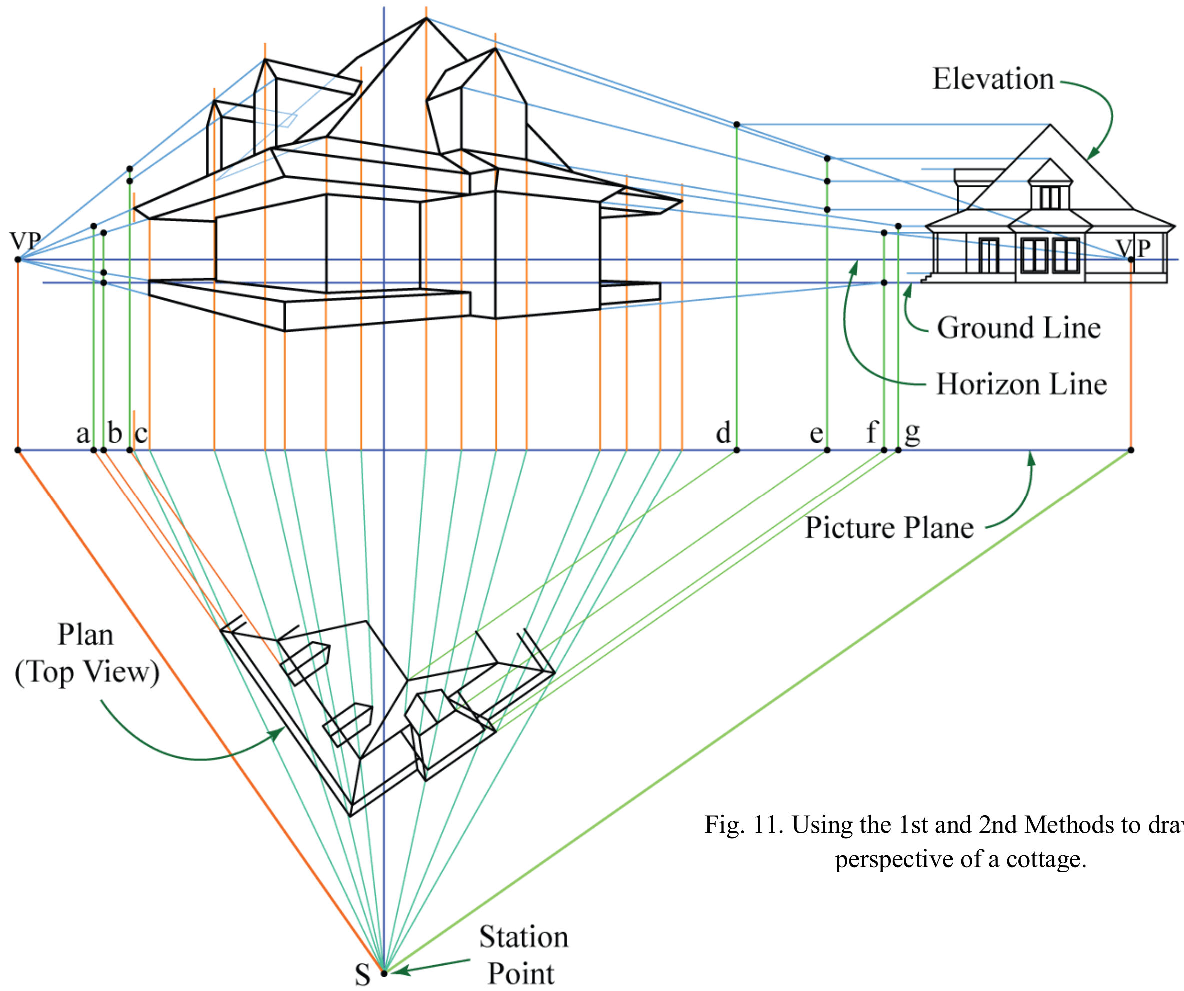


Fig. 11. Using the 1st and 2nd Methods to draw a perspective of a cottage.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Fig. 12. Sunset rendering of the country cottage, done in watercolors.

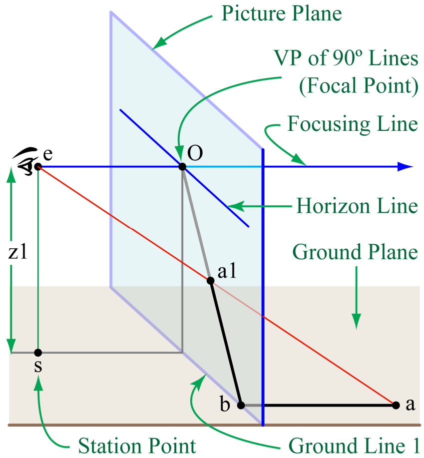


Fig. 13. An isometric drawing showing the center VP of the lines vertical to Picture Plane.

I. 3rd Method. Using The Center VP (Focal Point)

The center VP (Focal Point O) is obviously the vanishing point of all the lines drawn perpendicular to the projection plane (i.e. Picture Plane), as shown in Fig. 13. In Fig. 13, line (ab) is drawn on the Ground Plane perpendicular to Picture Plane. Thus, according to perspective theorem, the line segment between the vanishing point (O) and intersection point (b) will be the perspective image of (ba) receding from (b) to infinity.

This procedure will be best applied to one point perspectives, as shown in the following Fig. 14. Since this is the simplest method, it can be useful to define points, or intercept lines in perspective.

J. Sitting Room (One Point Perspective)

In Fig. 14, as similar to defining the top projection of the plan below the ground level, I defined a side projection on a wall (ab) next to the right wall of the living room. I used the 1st Method with VP of 60° (VP2). All the horizontal lines of the plan are extended to (ab), then reflected at 60° to picture plane. The intersection points are then relocated on Ground Line 2. Through VP2, the points on (AB) are defined. With the true height established from (f), the side projection of the seats and coffee tables is defined. As the vertical lines from the top projection meet the horizontal lines from the side projection, the perspective drawing of the living room is complete. The finishing drawing is shown in Fig. 15.

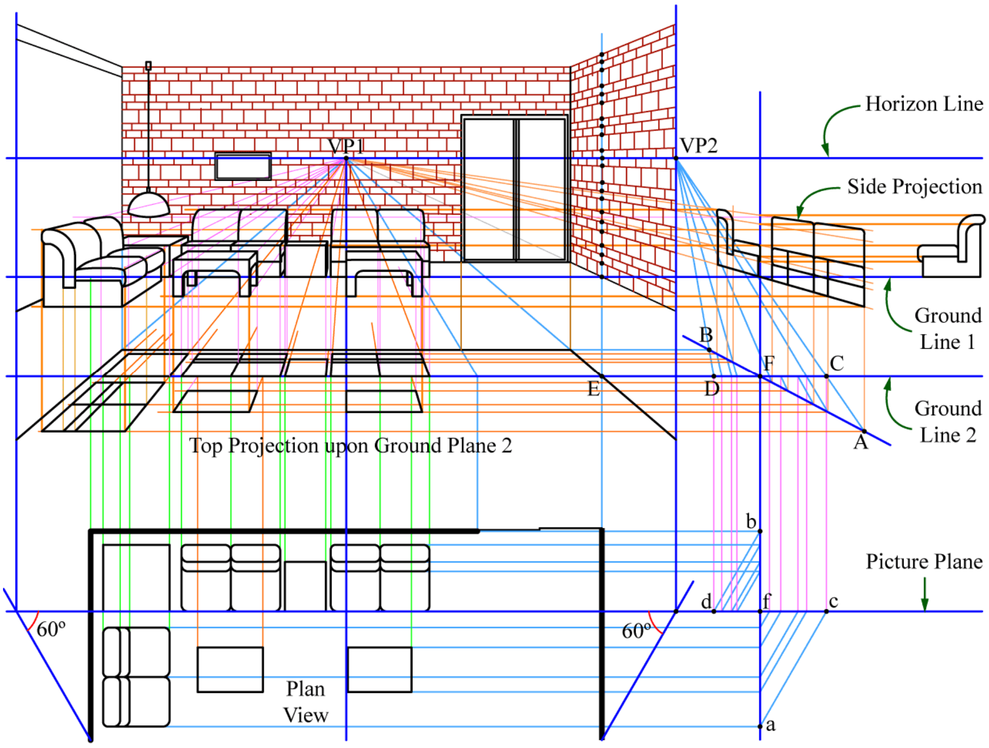


Fig. 14. A simple and clear one- point perspective procedure, using the 3rd Method.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

K. A cube with a cast shadow

Fig. 16 is simply a two point perspective of a cube, using the 1st Method. But, the wall AB is vertical to Picture Plane. Thus, the center VP is applied to define the wall AB. In the plan, the light direction is not horizontal. Thus, I drew the cyan lines (representing the shadow) to the wall. If you follow the cyan lines, you will see how the shadow projection on the wall AB is defined, with the helpof the 1st Method. In the front view of the cube, the light rays of three corners are extended to the wall AB to give me the height of the shadow vertices. The true height points of the shadow are taken on the vertical line established from (B), as based on the 3rd Method. The finishing drawing is at the lower right corner.

Fig. 15. A perspective rendering painted in Prismacolor pencils on rough surfaced paper.

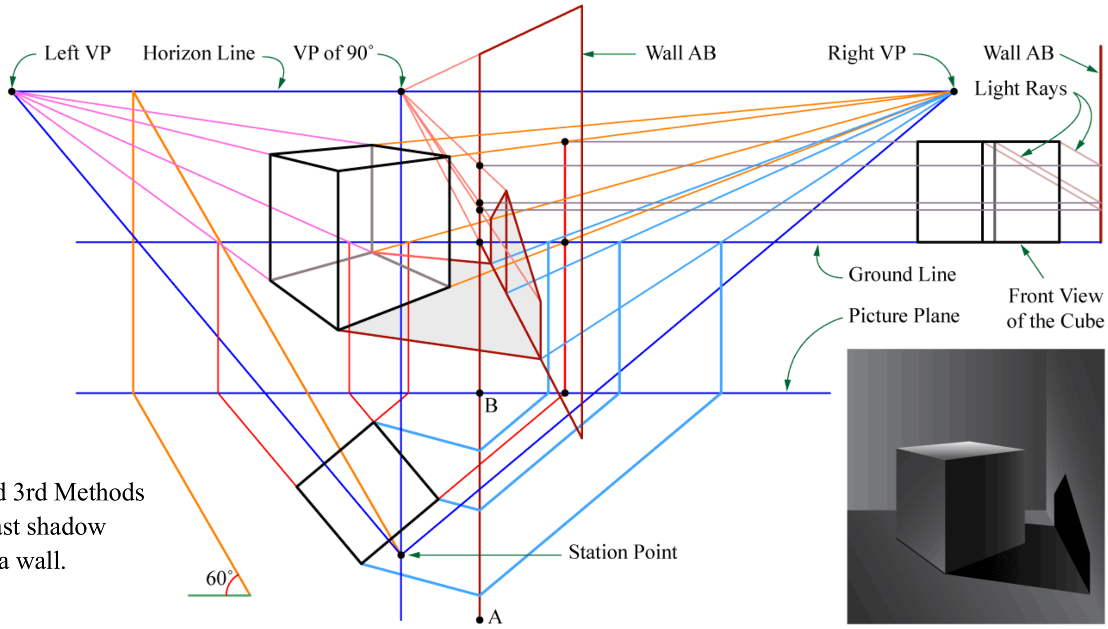


Fig. 16.

Using 1st and 3rd Methods to define a cast shadow of a cube on a wall.

L. Square Tiles

Another application to one point perspective is using the center VP and VP of 45°. Fig. 17 is quite simple. I used the 3rd Method to plot all the verticals. Then, the diagonal of the tiles is set at 45°. So, I defined its VP of 45°. Now, the vanishing line from (VP of 45°) to (a1) intersects all the vanishing lines stretched from (VP of 90°). Then, the horizontal lines are drawn from every intersection point on the diagonal from point (a1).

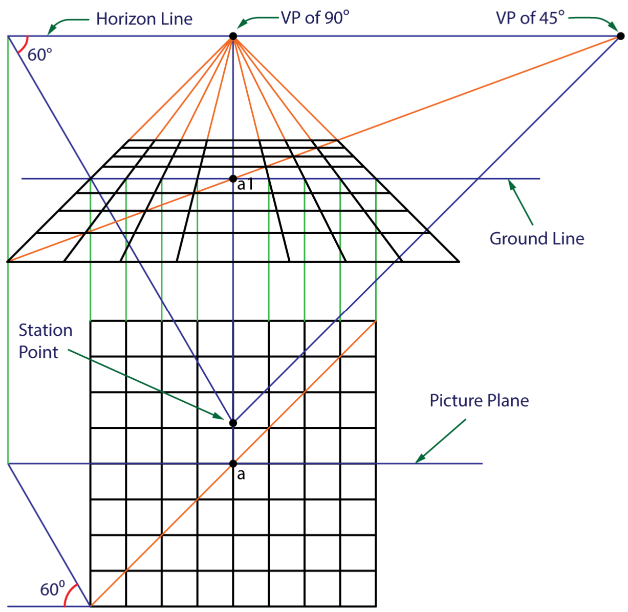


Fig. 17. The tiles are defined by using the focal point and one diagonal from (a).

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

M. The Horizontal Lines in the Plan (4th Method)

Although I demonstrated how the horizontal lines are defined in Fig. 14 by using the 1st Method as applied to skew lines of 60º angle. However, we can equally apply the 2nd and 3rd Methods to establish the horizontal lines in perspective.

In Fig. 18, the horizontal lines, such as, (ae) are extended to any line (except vertical) drawn from the station point (s). According to the 2nd method, any point located on (se) has an equivalent point in perspective located on the vertical line (fF). Then, applying the 3rd method, point (e) is vertically projected to Ground Lines and then deflected from a ground line heading to vanishing point (O), defining point (e1 or e2) on (fF). Consequently, the horizontal line drawn from (e1 or e2) is the perspective image of the line ea, because the horizontal lines in the plan remain horizontal in perspective.

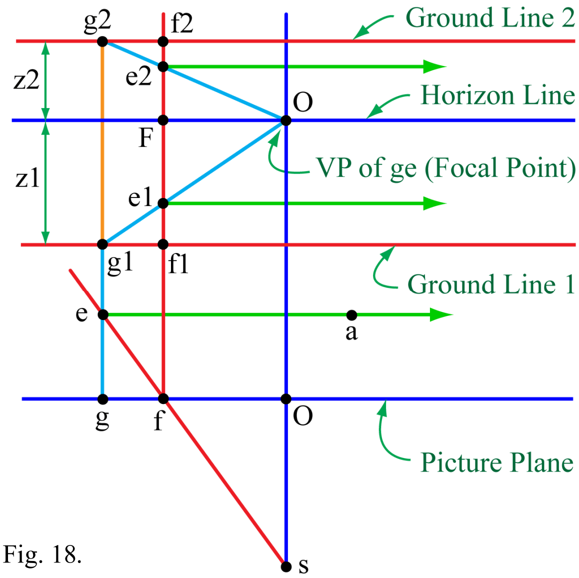


Fig. 18.

The 4th method is a combination of the 2nd and 3rd methods. It is applied to all the horizontal lines in the

N. Application

In Fig. 19, the 2nd Method is only used to locate the vertical line (tT). For the rest of the procedure, the 3rd method is applied. The bottom of the cube is defined by stretching lines from the focal point (O), and passing through (e1, f1). The 4th Method is then applied for the horizontal lines. Two horizontal lines from (b and c) intersect (st) at (p) and (g). Then, the vertical lines from (p) and (g) are deflected from (O) to define (g1) and (p1). Similarly, (i2) is projected to (p2), and the whole perspective view is done.

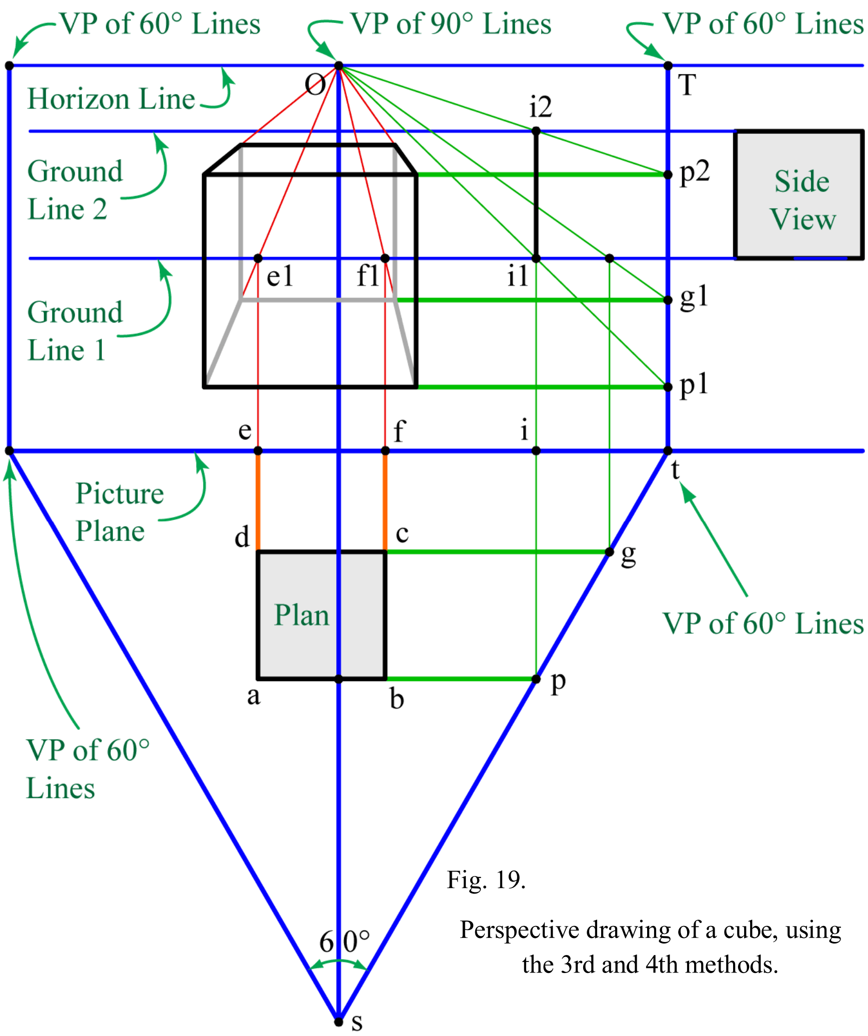


Fig. 19.

Perspective drawing of a cube, using the 3rd and 4th methods.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

O. Another Procedure

It is equally possible to apply the 1st method instead of the 4th method in order to define the depth and height of the cube, as shown in Fig. 21. By drawing lines from (b) and (c) at any selected angle (say 60°), then, the intersection points (j1) and (k1) established from (j) and (k) define the depth of the cube by intersecting the vanishing line (O f1) with the vanishing lines (T j1) and (T k1). Then, I considered one true height (k1 k2) above (k) to define the height of the cube.

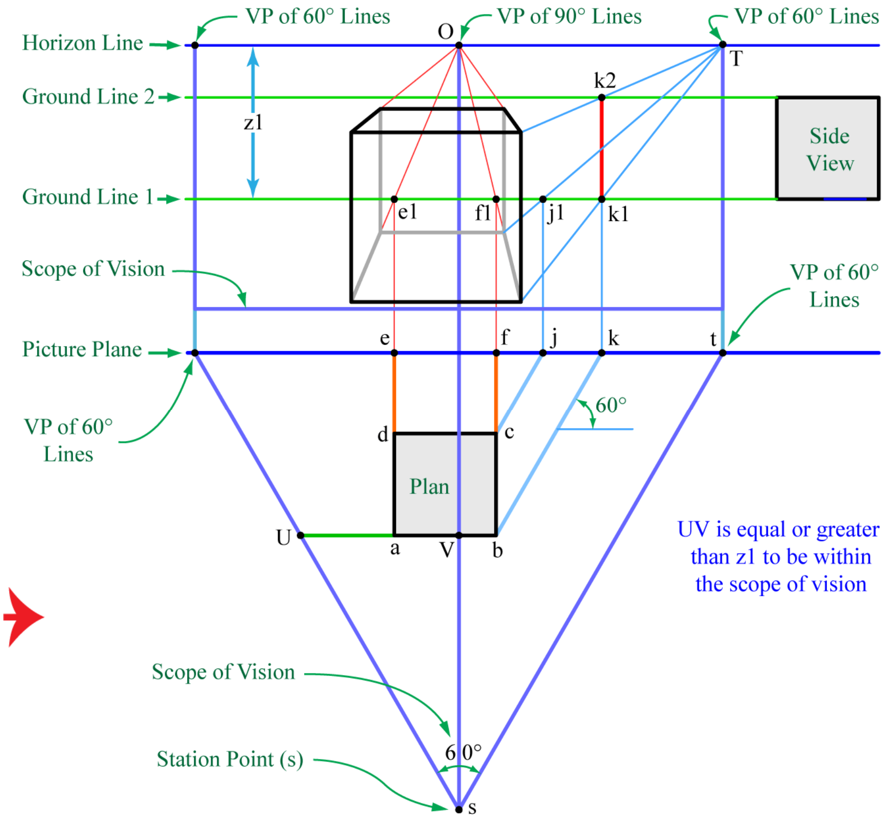


Fig. 20. Perspective drawing of a cube using the 1st and 3rd methods.

P. Vanishing Point outside the Drawing Board

It will be quite easy to exclude one vanishing point if it becomes outside of the drawing board. By using more true heights with any of the perspective methods will be enough to substitute the missing vanishing point, as shown in Fig. 21 and Fig. 22. In both figures, the right vanishing point is not used.

The 1st and 3rd methods are used in Fig. 21; whereas, in Fig. 22, the 1st and 2nd methods are used. In both figures, the true heights established from (a) and (b) define two vertical sides that connect the vanishing lines. If the missing vanishing point is available you only require one true height for this object to be drawn.

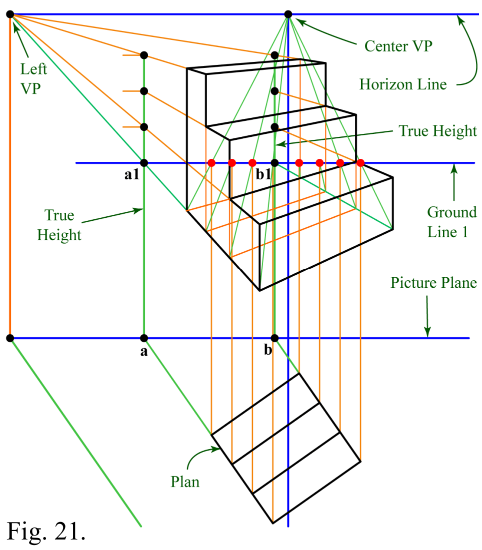


Fig. 21.

Two point perspective drawn by using the 1st and 3rd Methods with two true heights to replace the undefined right VP.

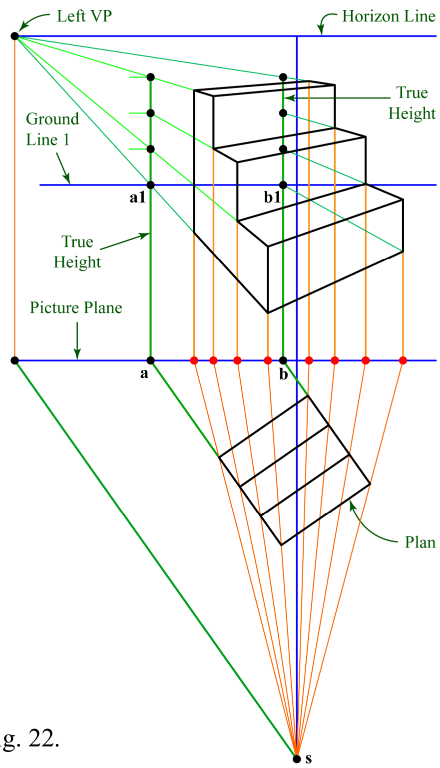


Fig. 22.

Two point perspective drawn by using the 1st and 2nd Methods with two true heights to replace the missing VP.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Q. Miniatures to Replace Remote Objects

You may have heard that miniatures have been used in the movies. As a matter of fact, a miniature will look exactly like a full size object if it is placed in certain position with respect to the camera. It is hard to draw two houses with a large space between them, as it requires a large sheet of paper. Wouldn't be more convenient to place a miniature beside a full scale object and make it appear as a remote object?

In Fig. 23, the perspective is constructed by applying the 1st Method to each of the cubes A and B. For cube (A) of scale 1:1, points C1, D1, E1, F1, and the true height D1D2 or E1E2 define the perspective drawing. On the other hand, points e1, f1, c1, d1 of the miniature B (scale 1:3) and the true height e1e2 or d1d2 define the same perspective drawing. Thus, the same result can be obtained whether plan (A) or the miniature plan (B) is used. It is very easy to understand the relationship between the cube A and its miniature B. It is totally relative to the scale of the drawing. Since miniature B is 1/3 scale of cube (A), then, each of the distances z and y must be 1/3 the actual distances Z and Y respectively.

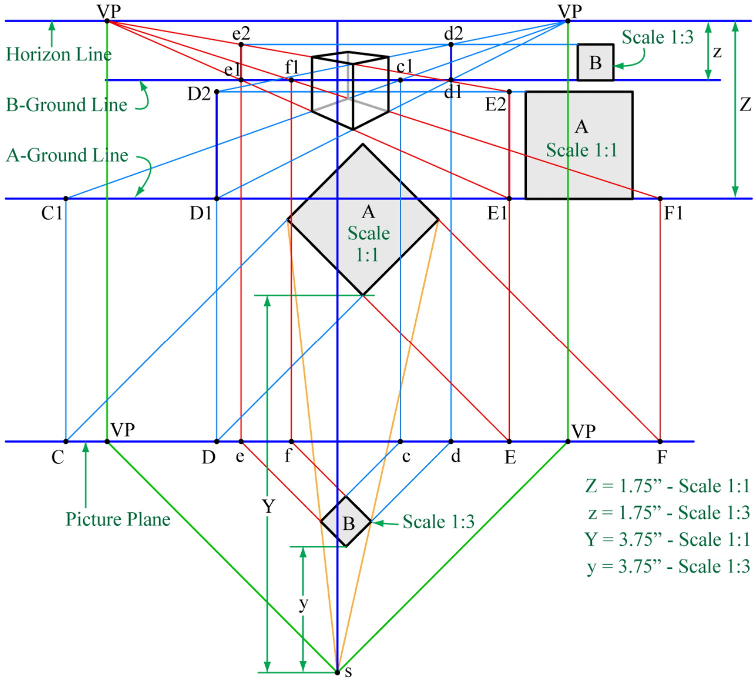


Fig. 23. A miniature can replace a remote object in perspective if the distances (z and y) are taken on the miniature scale.

R. A Remote Cube Replaced by its Miniature

The purpose of using miniatures in perspective is to reduce the distance between two objects, as shown in Fig. 24. The top views of the cubes (A) and (B) are situated beside each other. If cube (B) is a half scaled miniature of cube (A) it will definitely replace a third cube (not shown) that can be positioned behind cube (A) at double the distance between (A) and the station point i.e. a little over double the distance between (s) and the horizon line. Using the 1st Method, top projections (A) and (B) are defined on A-Ground Level by means of A-Ground Line. On the other hand, B-Ground Line is located at half of (Z) since the altitude (z) is equal to (Z) on scale 1:2. Both cubes are drawn in perspective taking into consideration the true height lines (F1F2) for cube (A) and (f2f3) for cube (B). The perspective structure is not unusual. In fact, both cubes are treated as if they are two objects of different sizes positioned beside each other on the ground level. The only difference is that the true height lines are established from different levels, where cube (B) is shifted above the ground level to give the impression of being faraway.

Observe that we saved a lot of space in the plan by replacing the remote cube by its miniature (B). Looking at the perspective view of those cubes, one may realize how pictures can be illusive. Cube (B) does look farther than cube (A). On the other hand, it may look like a small cube standing in the air beside a bigger cube. As a matter of fact, both relations are true, but it is more logical to say that cube (B) is placed farther than cube (A) on the ground level.

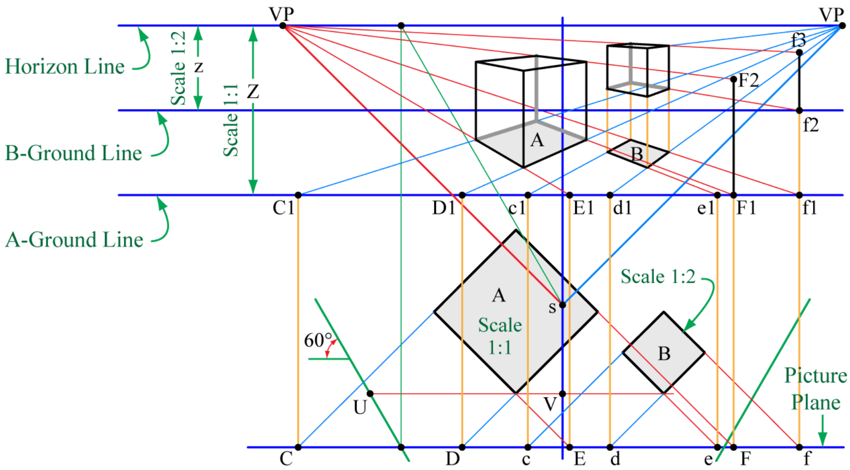


Fig. 24. A miniature is used in perspective in order to reduce the distance between two objects in the plan.

S. A House Seen Through a Window

This example clarified in Fig. 25 is an application to miniatures, as based on the technique in Fig. 24. The plan of the house (scale 1:500) is placed beside the plan of the bedroom (scale 1:50), just behind the bedroom window. Both, the bedroom and the house, are drawn by using the 1st Method. The top projection of the bedroom is drawn on the ground level itself. The bed is constructed in perspective by using the true height line established from point (a) on Ground Line 1. As regards the miniature house, I tried to draw the top projection on the ground level behind the bedroom window (such as B), but it looked too foreshortened to define such details in the plan. Therefore, Ground Line 3 is located and the top projection (A) is drawn on Ground Plane 3. In fact, there is no other space on the paper in order to squeeze in the top projection. The perspective drawing of the house is structured, as the vertical lines are immediately established from the top projection (A), and the vanishing lines are, simply, receding from the true height lines established from points (c, d, e and f) on Ground Line 2.

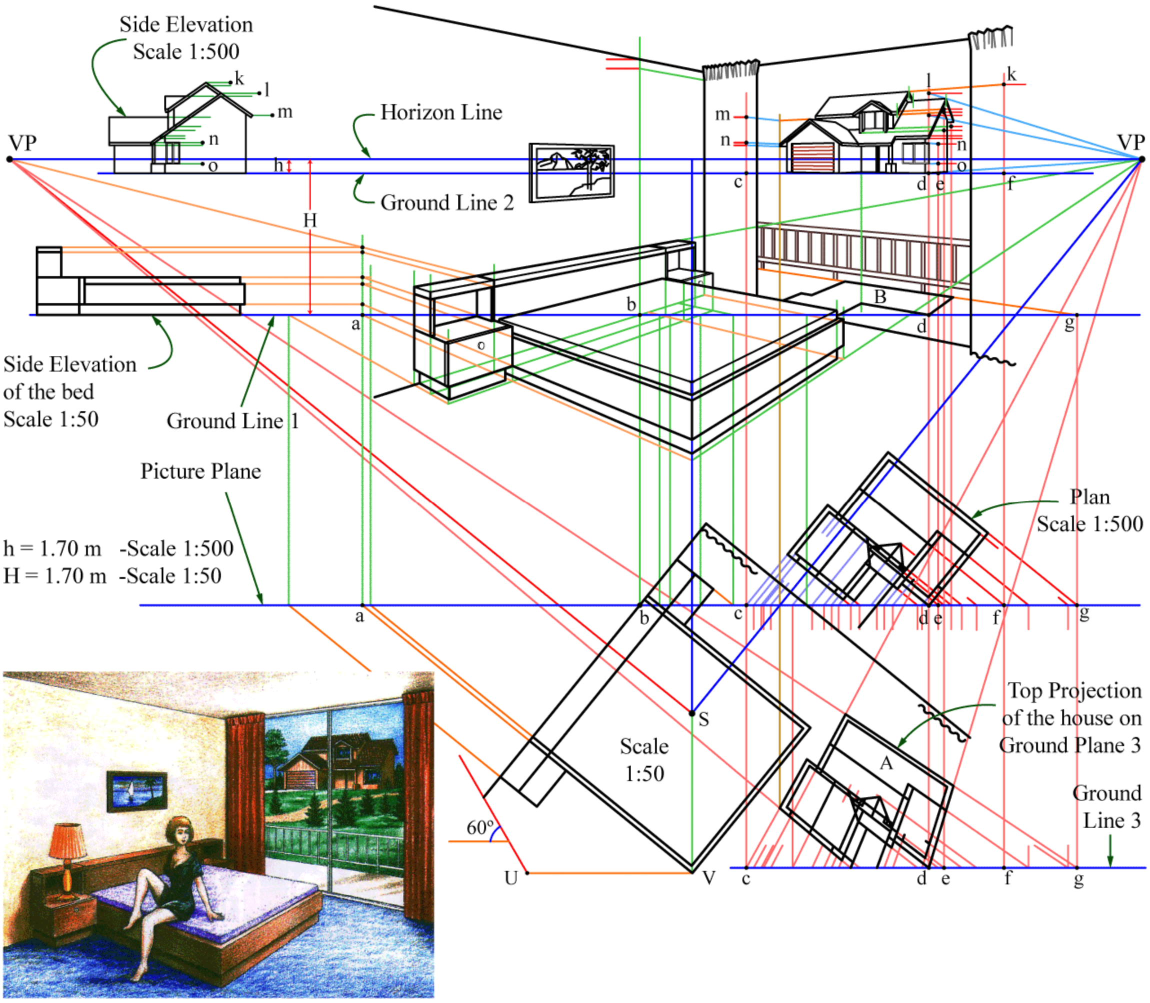


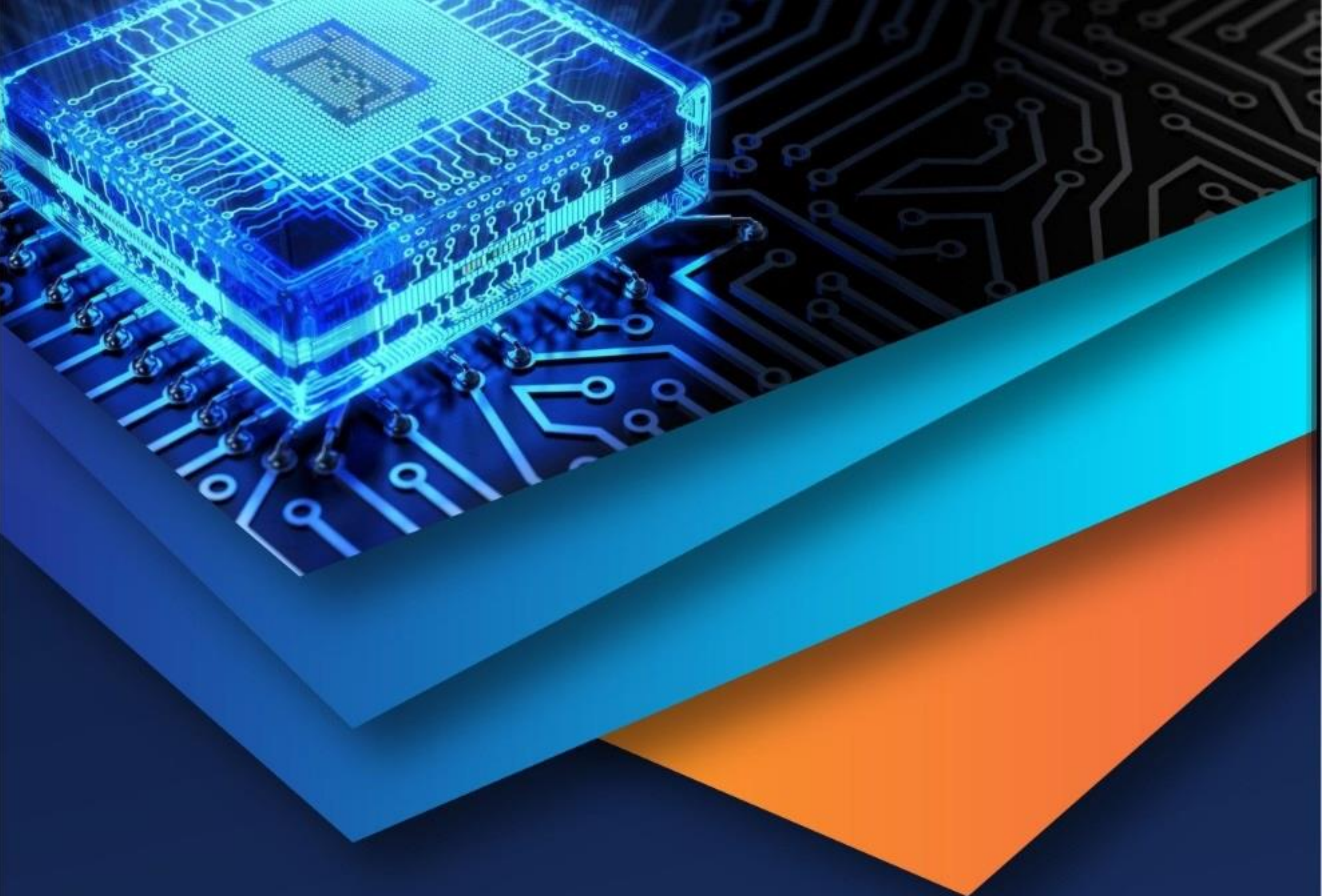
Fig. 25. Based on the technique clarified in Fig. 24, the remote house is drawn using its miniature.

REFERENCES

[1] UK Patent Application GB 2 069 938 A. Published on 3rd of Sep. 1981. Inventor: Dhirgham Murran. Series of letters related to the research were sent to Patent Agents: Barker, Brettell & Duncan. 138 Hagley Road, Edgbaston, Birmingham, B16 9PW,

[2] A revised digital edition of the original manuscript (of 1980) - New Methods in Perspective Drawing (Not Published) by Dhirgham Murran (2000) – Revised Copy.

[3] https://drive.google.com/file/d/11HcDnoRUp_mUANDzfohpJoA0FA_C0__O/view?usp=drivesdk



10.22214/IJRASET

INDEX COPERNICUS 45.98

ISRA JIF IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)