Advanced Perspective Techniques

3

Taking Perspective to the Next Level

The study of perspective begins with some relatively simple processes, like learning to draw a cube and construct ellipses, which help to introduce concepts that are essential to understanding both freehand and technical perspective. For some students and some courses, this will be enough. For others, there may be an interest in learning more about perspective and how it can be applied to both observational drawing and drawing purely from imagination (Figure 3-1). Some of the perspective processes covered in this chapter are more technically based, while others allow you to explore and discover all the different ways perspective can be utilized to create

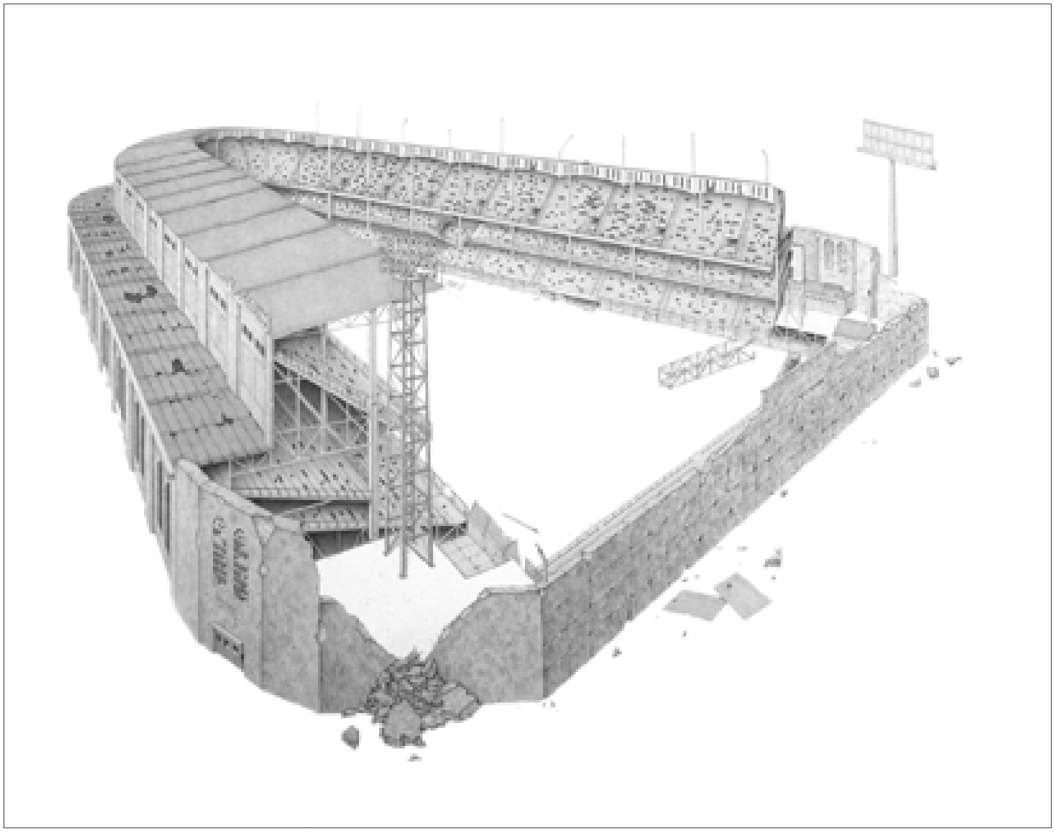


Figure 3-1. Nathan Heuer, American, *Stadium*, 2008. Graphite on paper, 50 × 71 inches. Courtesy of the artist. This drawing was done entirely from imagination and would not have been possible without a thorough understanding and working knowledge of the principles of perspective.

more complex forms. It is important that you understand the fundamental skills covered in Chapter Two before exploring perspective at a more advanced level.

Mathematically Precise Cubes in Two-Point Perspective

CONSTRUCTING A 30°/60° CUBE BASED ON THE HEIGHT OF THE LEADING EDGE

The following steps create the height of the leading edge of a cube and a horizontal foreshortened square that becomes the *base* of a cube in 30°/60° two-point perspective. A 30°/60° cube in two-point perspective is a cube whose foreshortened sides are at different angles to the picture plane, one at 30° and one at 60° (Figure 3-2). The leading edge of a 30°/60° cube will be positioned halfway between the CVP and VPR or VPL.

1. All preliminary information should be established and drawn, including scale, eye level/horizon line, ground line, station point, central vanishing point, vanishing points left and right, units of measure along the horizon line that reflect your scale, units of measure along a vertical measuring line that reflect your scale, and cone of vision.
2. Bisect the distance between the CVP and VPL or VPR to locate point A.
3. Bisect the distance between A and VPL to locate measuring point B.
4. Draw a vertical line through point A and determine on this vertical the desired location of the leading corner (L) of the cube, which may be positioned above or below the horizon line.
5. Draw a horizontal measuring line (ML) through L. If you placed your leading corner on the ground line, the ground line functions as the horizontal measuring line.
6. Determine the height of the leading (F) edge from L. Rotate the leading edge to the left and right from point L to the horizontal measuring line, locating points X and Y.
7. Draw lines of convergence from L and F to vanishing points left and right to construct the leading corner and to begin cube construction.
8. Draw a line from CVP to X, locating its point of intersection (C) along the line of convergence. Draw a line from B to Y, locating its point of intersection (D) along the line of convergence.
9. Draw lines of convergence from C and D to the opposite vanishing points to complete the base or horizontal square of the cube (LCGD).
10. Draw verticals at the sides (C and D) and back corner (G) of the square. Draw the remaining lines of convergence to VPL and VPR to complete your cube.

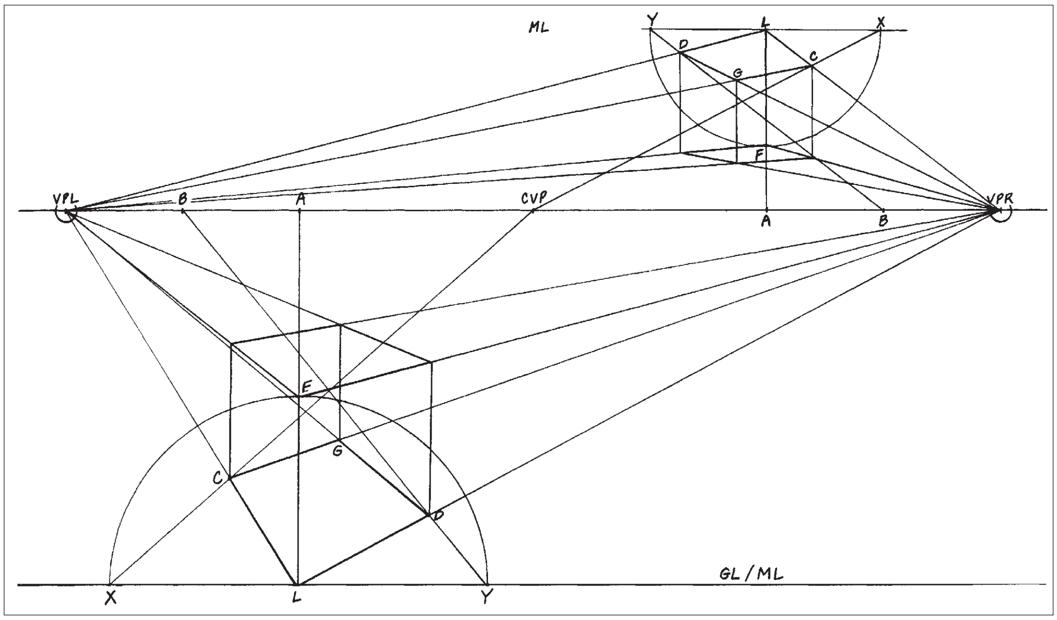


Figure 3-2. This illustration shows the construction of a 30°/60° cube based on initial determination of the height of the leading edge. Note that the process flips for cubes that are positioned above the eye level.

This is an accurate 30°/60° cube that can be positioned noncentrally in a perspective environment. Keep in mind that distortion will become pronounced if the cube, through cube multiplication, crosses over the center of the perspective environment (indicated by the location of the CVP) or approaches either vanishing point too closely.

CONSTRUCTING A 45°/45° CUBE BASED ON THE SIZE OF THE BASE SQUARE

The following steps create a horizontal or foreshortened square in 45°/45° two-point perspective, which becomes the *base* of a cube in 45°/45° two-point perspective. A 45°/45° cube in two-point perspective is a cube that rests halfway or nearly halfway between the VPL and VPR and whose foreshortened sides are each at a 45° angle to the picture plane (Figure 3-3).

1. All preliminary information should be established and drawn, including scale, eye level/horizon line, ground line, station point, central vanishing point, vanishing points left and right, units of measure along the horizon line that reflect your scale, units of measure along a vertical measuring line that reflect your scale, and cone of vision.
2. Drop a vertical line (in the case of the *exact* 45°/45° method) or a slightly diagonal line (in the case of the *off-center* 45°/45° method) from the CVP to the ground line (GL). This line will become the diagonal of the foreshortened base square (Figure 3-4).
3. Draw two lines of convergence, one each from VPL and VPR, to intersect at the point along the vertical (or diagonal) line where you wish to position the nearest angle or corner of the foreshortened base square (L).
4. Draw two more lines of convergence from VPL and VPR to intersect at a second point along the vertical (or diagonal) line based on the desired *depth* of the cube (B), and *through* the vertical (or diagonal) line to intersect the original lines of convergence established in step 3. This defines the back angle or corner of the foreshortened base square (B), locates points C and D, and completes the base plane or square of the foreshortened cube (CBDL).

To Complete the Cube by Building Off the Base Square

1. Draw vertical lines up from all four corners of the square (C, B, D and L).
2. Rotate CD 45° upward to create point X (CX is equal in length to CD), and draw a horizontal line through point X to intersect the two side verticals of the cube (Y and Z).

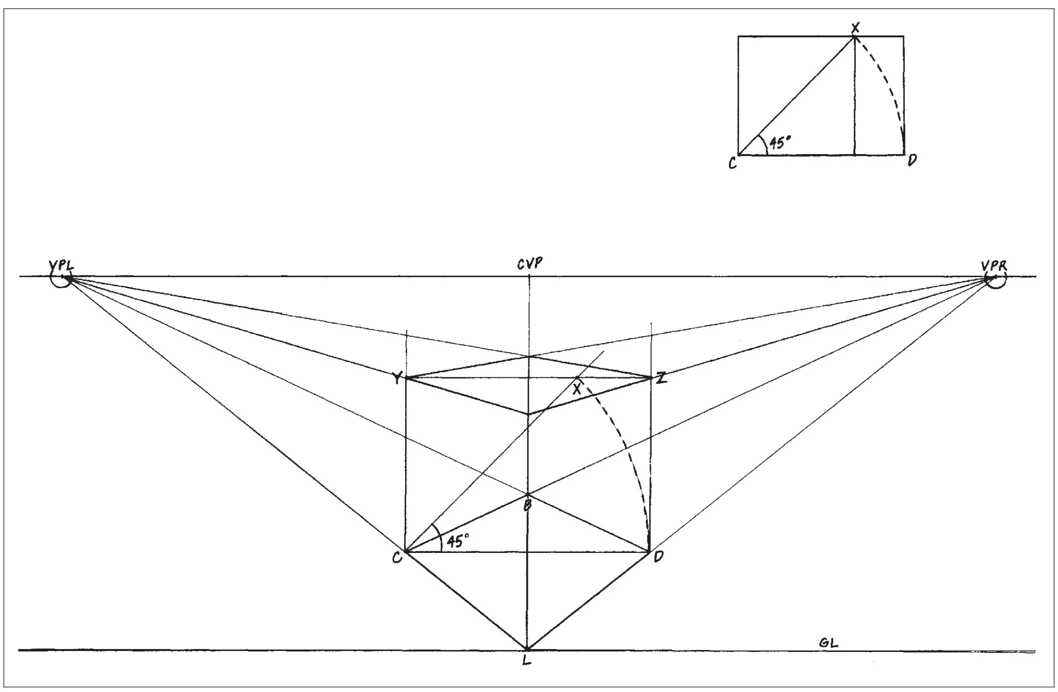


Figure 3-3. Shown here is the construction of a 45°/45° cube directly aligned with the CVP based on initial determination of the size of the base square. The upper right drawing illustrates the geometric principle guiding the process.

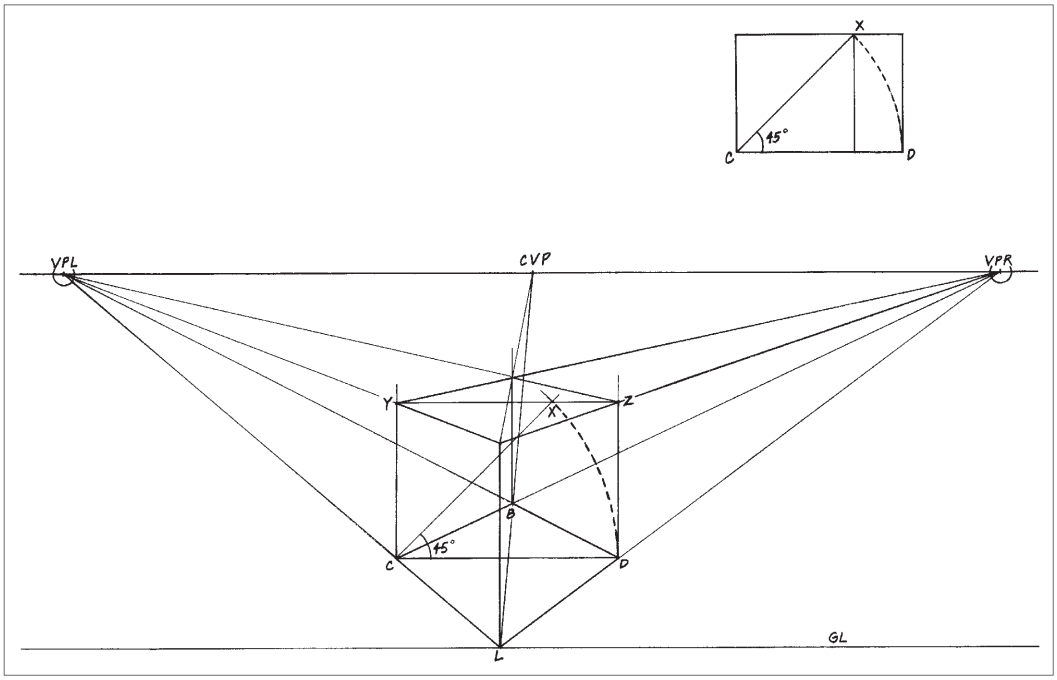


Figure 3-4. Shown here is the construction of a 45°/45° cube slightly off-center of the CVP based on initial determination of the size of the base square. The upper right drawing illustrates the geometric principle guiding the process.

3. Construct the upper square or plane of the cube by drawing four lines of convergence from these two points of intersection (Y and Z) to VPL and VPR. Two of these lines of convergence must also be pulled forward to meet at the leading edge of the cube and define its height.

This is an accurate 45°/45° cube that can be positioned in a variety of centrally located positions in a perspective environment. Keep in mind that distortion will occur if the diagonal of the base square deviates *significantly* from a true vertical. In cube multiplication, distortion will become pronounced as the cube approaches the point halfway between the CVP and VPL or halfway between the CVP and VPR.

FIRST ALTERNATIVE METHOD FOR CONSTRUCTING A 45°/45° CUBE

1. All preliminary information should be established and drawn, including scale, eye level/horizon line, ground line, station point, central vanishing point, vanishing points left and right, units of measure along the horizon line that reflect your scale, units of measure along a vertical measuring line that reflect your scale, and cone of vision (Figure 3-5).
2. Draw the leading edge of a 45°/45° cube to the desired height. This is a vertical line that should be located directly below the CVP and should remain within the COV. The height of the leading edge is a random decision unless a specific height is desired.
3. Draw lines of convergence from the top and bottom of the leading edge to VPL and VPR.
4. From this leading edge (LA), construct a square to the left or right side, and extend the base of the square to the left and right to establish a measuring line (ML). If the leading edge rests on the ground line, then the ground line functions as a measuring line. Draw the diagonal of the square (LB) from the bottom of the leading edge (L) to the opposite upper corner of the square (B).
5. Rotate the diagonal down in an arc from the upper corner until it intersects the measuring line. From this point of intersection (Z), draw a diagonal measuring line (DML) back to the opposite VP.
6. Where the DML intersects the lower line of convergence (Y) indicates the depth of one side of the cube. From this point of intersection, draw a vertical line to meet the upper line of convergence. This establishes one foreshortened plane of the cube.
7. From this same point of intersection (Y), draw a true horizontal line (parallel to the ground line/measuring line) across the base of the cube until it intersects the opposite line of convergence. This point of intersection (X) indicates the depth of the remaining side of the cube.

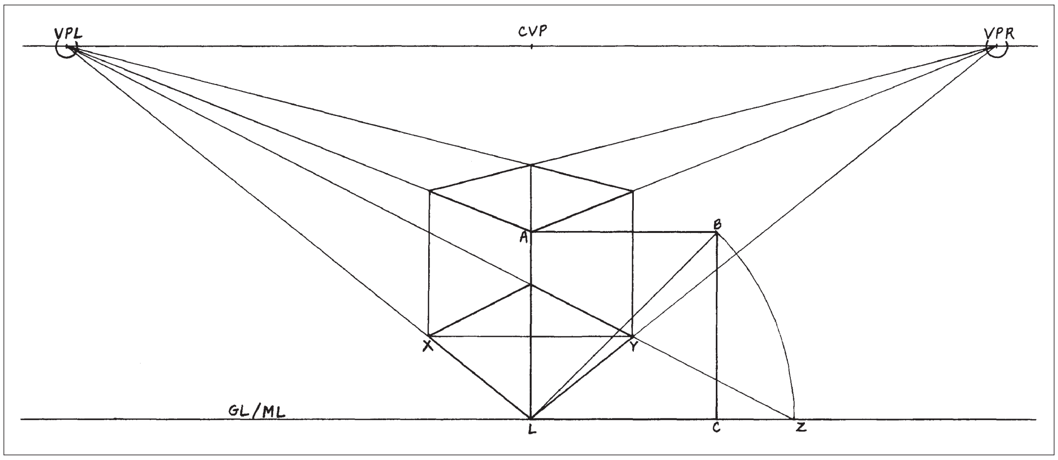


Figure 3-5. This drawing illustrates the first alternative method for constructing a 45°/45° cube based on initial determination of the height of the leading edge.

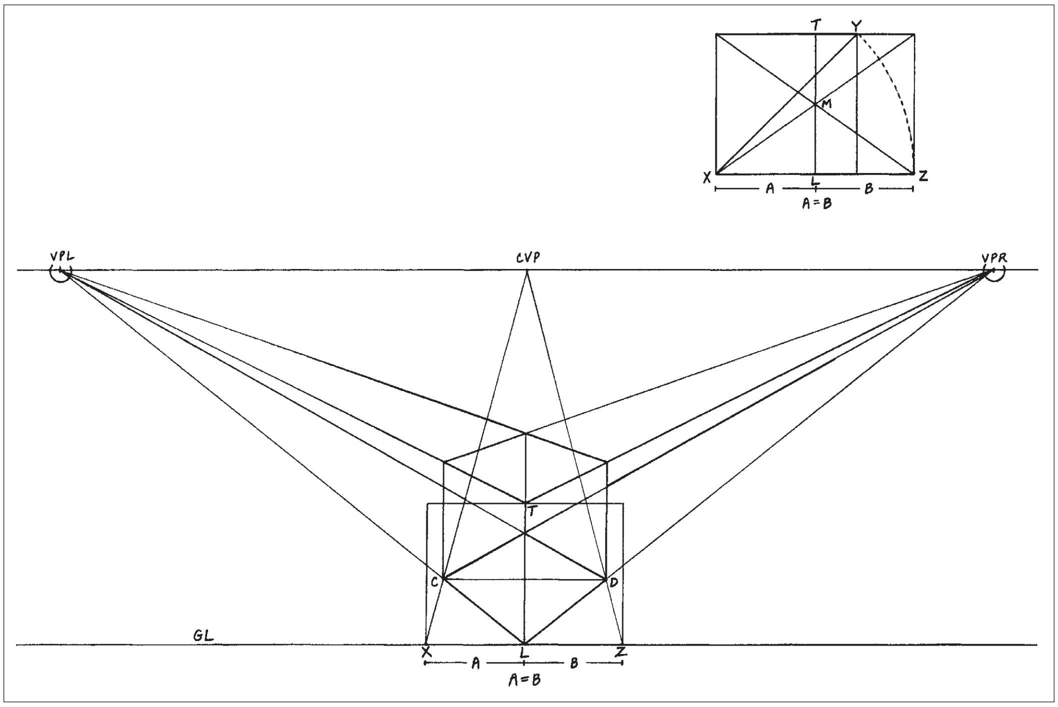


Figure 3-6. This drawing illustrates the second alternative method for constructing a 45°/45° cube based on initial determination of the height of the leading edge. The upper right drawing illustrates the geometric principle guiding the process.

8. From this point of intersection (X), draw a vertical line to meet the upper line of convergence. This establishes the remaining foreshortened plane of the cube. Note the depth of the two sides of the cube is equal.
9. From the four back corners of these foreshortened planes, draw lines of convergence to the opposite VPs. Where these lines intersect establishes the back edge of the cube, which aligns with the leading edge. Constructing a vertical between these points of intersection completes the 45°/45° cube.

SECOND ALTERNATIVE METHOD FOR CONSTRUCTING A 45°/45° CUBE

1. All preliminary information should be established and drawn, including scale, eye level/horizon line, ground line, station point, central vanishing point, vanishing points left and right, units of measure along the horizon line that reflect your scale, units of measure along a vertical measuring line that reflect your scale, and cone of vision (Figure 3-6).
2. Outside of your desired image area, construct a square whose height is equal to the desired height of the leading edge of a 45°/45° cube.
3. Draw the diagonal of the square (XY) and rotate the diagonal down in an arc until it meets a horizontal extension of the bottom edge of the square. From this point (Z), draw a vertical line up until it meets a horizontal extension of the top edge of the square. You now have a rectangle that is derived from the diagonal of the original square.

4. Find the center of the rectangle by drawing the two corner-to-corner diagonals of the rectangle. Their point of intersection (M) is the center of the rectangle.
5. Draw a vertical line through the center point, bisecting the rectangle. This completes the schematic form that will be used to construct the 45°/45° cube.
6. Moving back to your perspective environment, draw the bisected rectangle in the desired location with the vertical bisection aligned with the CVP. This vertical bisection (LT) is the leading edge of your cube. Draw lines of convergence from the top and bottom of the leading edge to VPL and VPR.
7. From the lower right and left corners of the rectangle (X and Z), draw DMLs to the CVP. Where the DMLs intersect the lower lines of convergence indicates the depth of the left and right sides of the cube. From these points of intersection (C and D), draw vertical lines to meet the upper lines of convergence. This establishes the left and right foreshortened planes of the cube, which are equal in depth.
8. From the four back corners of these foreshortened planes, draw lines of convergence to the opposite VPs. Where these lines intersect establishes the back edge of the cube, which aligns with the leading edge. Constructing a vertical between these points of intersection completes the 45°/45° cube.

Using Measuring Lines for Equal and Unequal Divisions of an Area

We have already seen how horizontal measuring lines can be used for multiplying any unit in perspective—a cube, a rectangular solid, a horizontal or vertical plane of any dimensions, or even an empty space. The use of a horizontal measuring line (HML) also allows us to divide and subdivide a cube, a plane, a rectangular solid, or an empty space into either regular (equal) or irregular (unequal) increments. The measuring line method allows cube divisions that are not available using the corner-to-corner, or "X"ing, method, as this technique is only capable of creating one-half divisions of any given area.

SETTING UP THE MEASURING LINE

To use the measuring line method, draw a horizontal line (the measuring line) that touches the nearest corner of the vertical or horizontal plane or cubic structure you wish to divide and extend it to the left and right. This line should be parallel to both the ground line and the horizon line. In the case of a cube whose nearest or leading corner rests directly on the ground line, the ground line will function as the horizontal measuring line. Since the measuring line is parallel to the picture plane, it is not affected by diminution and can provide constant measurable units. Remember that your HML, like your horizon line, can extend infinitely to either side and may extend beyond the edges of your drawing format if necessary.

THE PROCESS OF DIVIDING A FORM

1. To begin the process of dividing a form into equal or unequal increments, you must mark a length or increment of your choosing along the measuring line that represents the total depth of the plane or cubic structure or space you wish to divide (Figure 3-7). This increment originates at the point where the measuring line touches the nearest corner. If you are dividing a form that converges toward VPR, your increment will be drawn to the right along the measuring line, and vice versa. The length of the increment is arbitrary, although if it is too small it can more easily lead to error or inaccuracy, and if it is too large it can require extensions of your paper surface and become unwieldy. Common sense should prevail.
2. For purposes of explanation, imagine that a 2″ increment on the measuring line represents the depth of the plane or cube or space you wish to divide. Draw a DML from the 2″ mark through the back bottom corner or edge of the form you wish to divide and extend it until it intersects the horizon line. This point of intersection establishes an SVP upon which all other DMLs will converge when dividing that particular form.
3. To determine the location of a point one-third of the way along the depth of the form, come back to the 2″ increment on the HML and locate a point one-third of the way along its length. Draw a DML from this point to the established SVP. Where this DML intersects the base of the original form indicates a one-third division of the form as it recedes in space.

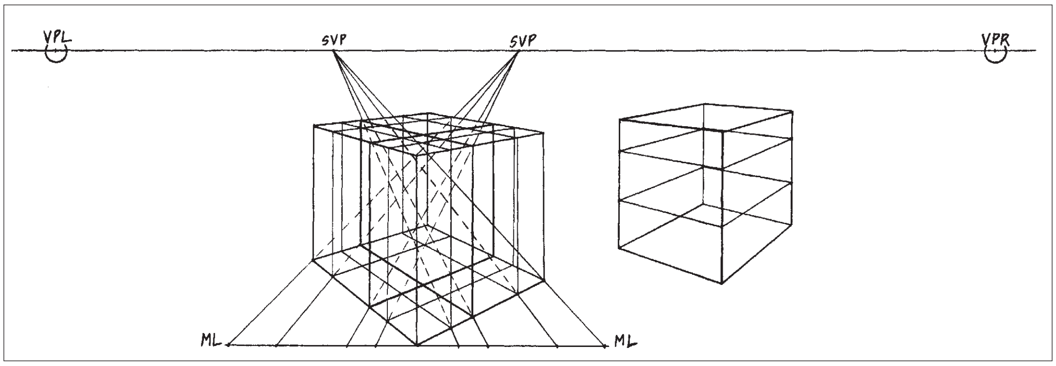


Figure 3-7. Irregular divisions of a cube or cube face using a horizontal measuring line can be wrapped around all faces of the cube. The cube on the right shows unequally spaced horizontal planar divisions of a cube using the leading edge as a measuring line.

4. If you are dividing a vertical plane, you can extend a line up from this point of intersection, and if the vertical plane is one side of a cubic structure, you can wrap the line of division around the cubic structure (respecting perspective convergence) to find the corresponding one-third division on additional faces of the form. If you are dividing a horizontal plane, you can pull a line across the plane from this point of intersection, making sure to respect the perspective convergence.
5. If you have a plane or a cubic form that you wish to divide into ten equal units, then you will have ten equal increments within the original 2″ increment along your HML. If you have a plane or a cubic form that you wish to divide into a number of unequal units, then you will first establish these unequal units within the original 2″ increment along your HML.
6. It is equally viable that you initially decide to use an increment other than 2″, such as a ½″ increment on the measuring line to represent the depth of the original plane or cube to be divided. But if you are going to subdivide a number of times, whether regular or irregular divisions, an initial ½″ increment may be a bit small to work with comfortably.

These techniques assist you in identifying the location of a point from side to side on any given foreshortened plane. To locate the height of a point from top to bottom on a vertical foreshortened plane, you can use the leading edge of the plane as a vertical measuring line. Because this vertical edge is not foreshortened, you can apply measurements directly to it and pull them back across the foreshortened plane toward the appropriate vanishing point to identify the height of points located on the foreshortened plane.

APPLICATIONS FOR THE USE OF REGULAR AND IRREGULAR DIVISIONS

You may be asking yourself under what circumstances would you use this process of division, which essentially allows you to identify different points along a line or plane that is receding in space. There are innumerable applications. Imagine, for example, that you are drawing a rectangular solid that represents a house based on the scale you have established for your drawing (Figure 3-8). On any given side of the house are windows and doors and other architectural elements that are positioned at irregular intervals and at various heights, and you want to represent their location accurately on the foreshortened planes of the house. By determining their location on any given side of the house when it faces you directly, without foreshortening, you can translate that information to a foreshortened representation of that side of the house by using the measuring line system as described here. In order to identify the height of doors or windows or other architectural elements, use the vertical leading edge as a vertical measuring line. Again, because it is not foreshortened, it can be used to transfer measurements directly.

That same rectangular solid, with a different scale applied to it, may represent the basic geometric shape of a computer monitor, a child's toy, an automobile, an air-conditioning unit, a reclining chair, a gasoline-powered generator—the possibilities are endless. A thinner rectangular solid could represent an iPod or a cell phone, for example. Using the measuring line system can help you identify the correct location of knobs, buttons, slots, wheels, doors, switches, and any other details, variations, or elaborations of the form.

If the form you wish to represent is roughly ½ cube deep, 2 cubes tall, and 3½ cubes long, you can create

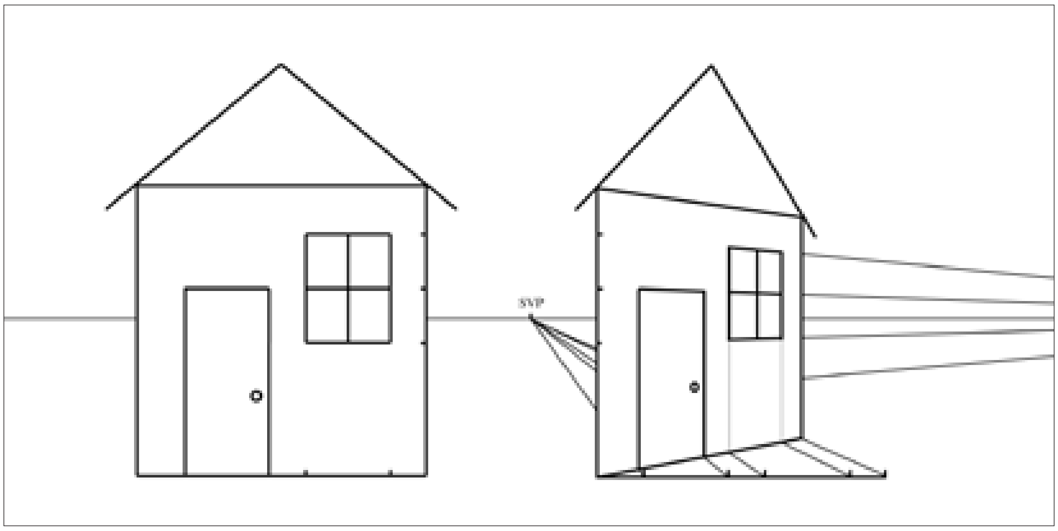


Figure 3-8. The use of a horizontal measuring line makes it possible to translate information found on a nonforeshortened plane (left) to a corresponding foreshortened plane (right).

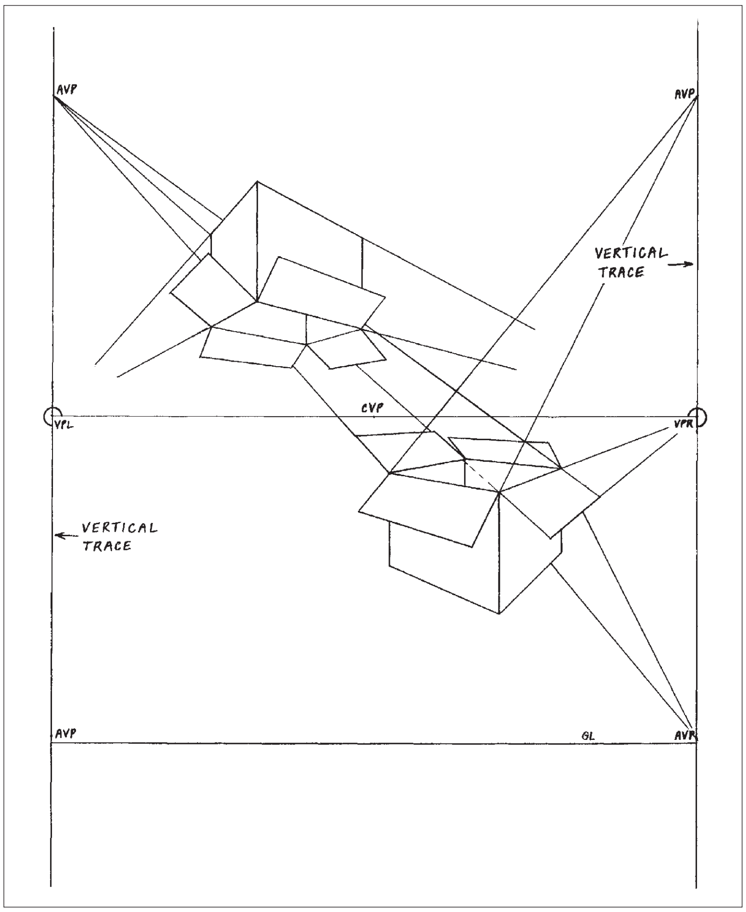


Figure 3-9. Inclined planes in the form of box flaps are explored in a variety of positions. Note that each flap has two points of convergence, one on the eye-level line at VPL or VPR and one above or below a vertical extension of VPL or VPR. Note the floating, inverted box above the eye level. Not all construction lines or lines of convergence are shown in this illustration. See if you can locate the vanishing points for the inclined planes of the box flaps that do not have visible construction lines.

the basic geometric solid from which the form is derived by first drawing a precise cube, then finding the depth of ½ cube by using cube-division techniques, then extending it up to a height of 2 cubes by stacking it, and finally extending it back in perspective 3½ cubes by using cube-multiplication techniques. This process forms the basis for transparent construction drawing, described later in this chapter.

Inclined Planes in Perspective

Inclined planes in perspective are neither parallel to the ground plane nor perpendicular, and so the rules that govern the construction of vertical and horizontal planes do not fully apply to inclined planes. Inclined planes are tilted in space, angling up or down as they recede in space (Figure 3-9). Some examples of inclined planes include rooftops at various pitches, wheelchair ramps, box flaps in a variety of positions, and stairways, which are essentially a series of small vertical and horizontal planes that fall within a larger inclined plane.

Inclined planes, whether seen in one-point or two-point perspective, are governed by principles of perspective with which we are familiar, along with some variations of these principles. We know that a plane derived from any rectangular solid, whether inclined, vertical, or horizontal, is composed of four sides. The sides or edges opposite each other are parallel. Unless these edges are vertical in their orientation (perpendicular to the ground plane), we know that as they recede in space they will converge upon a common vanishing point that is located on the horizon line. Here is where the variation occurs. In representing an inclined plane, any parallel receding edges that are not vertical or horizontal (perpendicular or parallel to the ground plane) will converge on a common point that is positioned directly above or below the VPL or VPR. This vertical extension of the VPL or VPR is called a vertical trace, and any vanishing points located on the vertical trace are called auxiliary vanishing points (AVPs).

AUXILIARY VANISHING POINTS AND THE VERTICAL TRACE

In the case of an inclined plane that angles *up* as it recedes away from us, the AVP will be positioned *above* the corresponding vanishing point. How far above the vanishing point the AVP is positioned is determined by the degree of the incline (Figure 3-10). In the case of an inclined plane that angles *down* as it recedes away from us, the AVP will be positioned *below* the corresponding vanishing point. How far below the vanishing point the AVP is positioned is determined by the degree of the incline. Vertical traces (the line along which AVPs are located) can be extended above and below vanishing points left and right as far as you desire. It is important to note, however, that once an inclined plane reaches 90°, it is no longer treated as an inclined plane but as a vertical plane whose vertical edges do not converge.

In the examples given of inclined planes (rooftops, box flaps, and stairs), it is important to note that each inclined plane seen in two-point perspective has one set of vanishing points located directly on the horizon line and one set of vanishing points located on a vertical trace that is an extension up or down from the remaining vanishing point. In the case of one-point perspective, vertical trace lines extend from the CVP. More specifically, those edges of an inclined plane that are horizontal (parallel to the ground plane) will converge on a traditional vanishing point left or right. The two remaining edges that are neither parallel nor perpendicular to the ground plane will converge on an AVP located above or below the opposite vanishing point (Figures 3-11 and 3-12). In the case of one-point inclined planes, receding edges will converge on an AVP located above or below the CVP (Figures 3-13 and 3-14). All inclined planes in two-point perspective will have one point of convergence to the left and one point of convergence to the right.

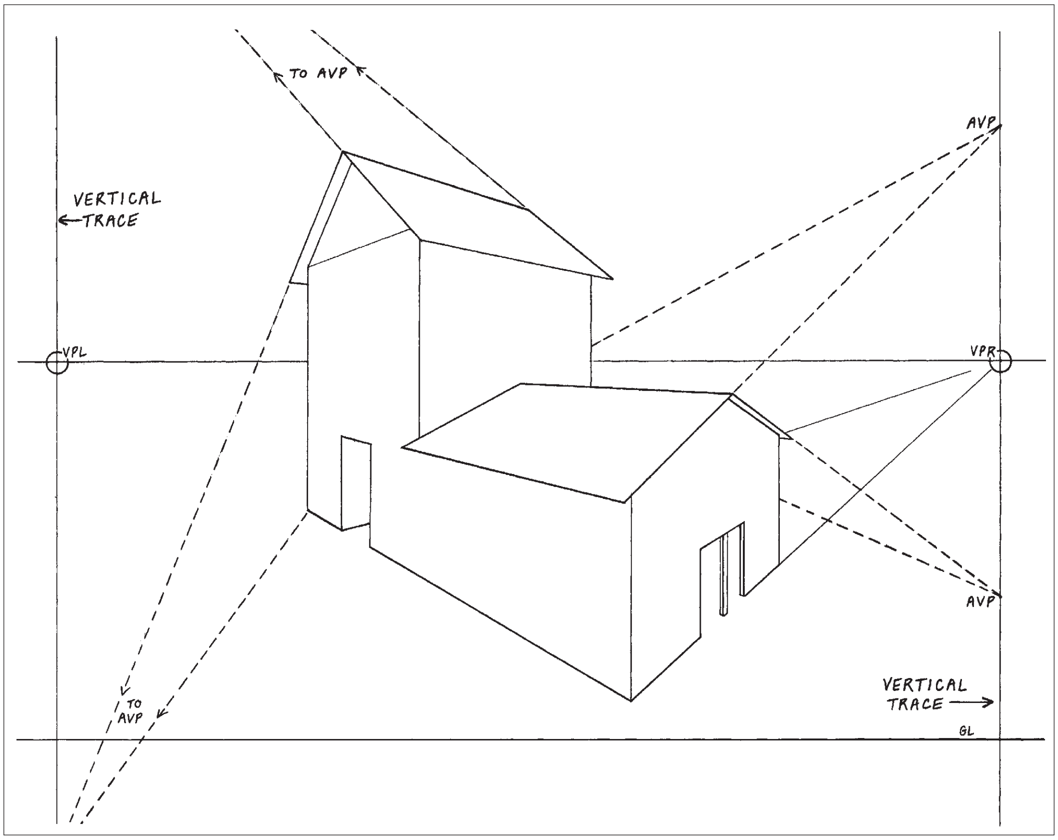


Figure 3-10. This drawing of a compound form shows two separate rooftops at different pitches or degrees of incline. Note that the greater the incline, the farther the AVP is positioned above or below the corresponding vanishing point. Both rooftops are equally pitched on either side, resulting in an equal distance above and below the vanishing point for the AVP.

Figure 3-11. A two-point perspective view of *ascending* stairs shows the inclined planes within which the stairs are positioned. The greater the incline, the farther the AVP is positioned above or below the corresponding vanishing point.

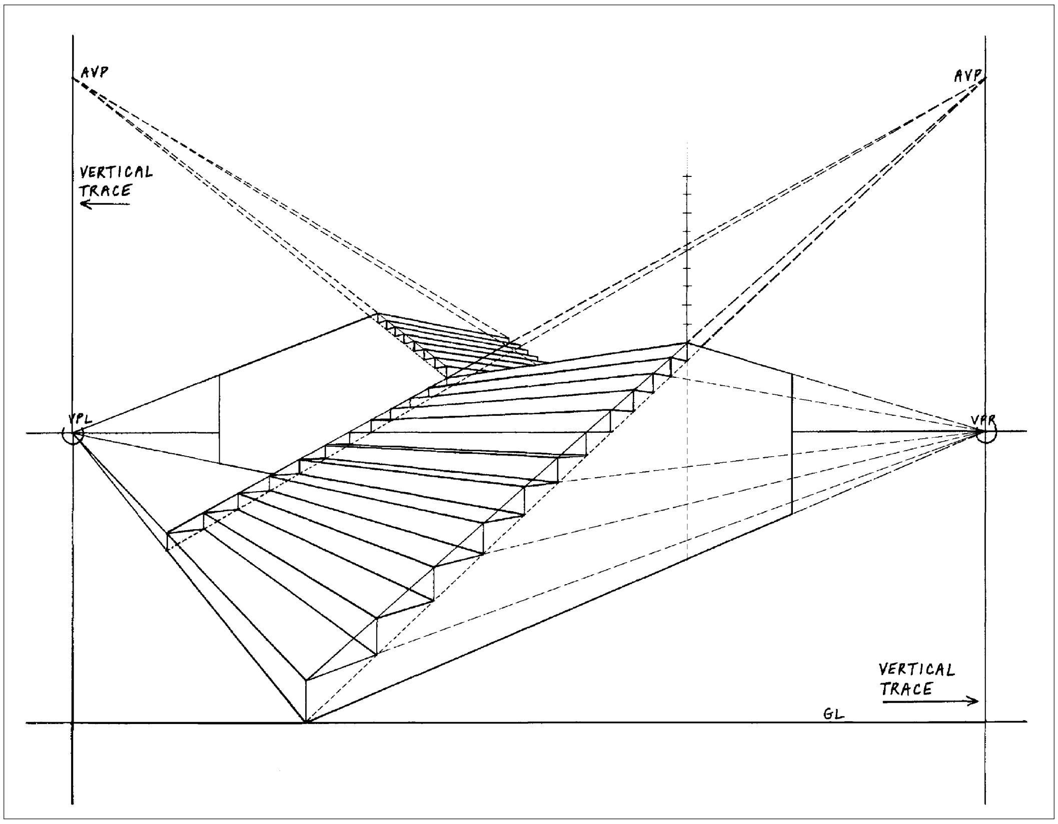
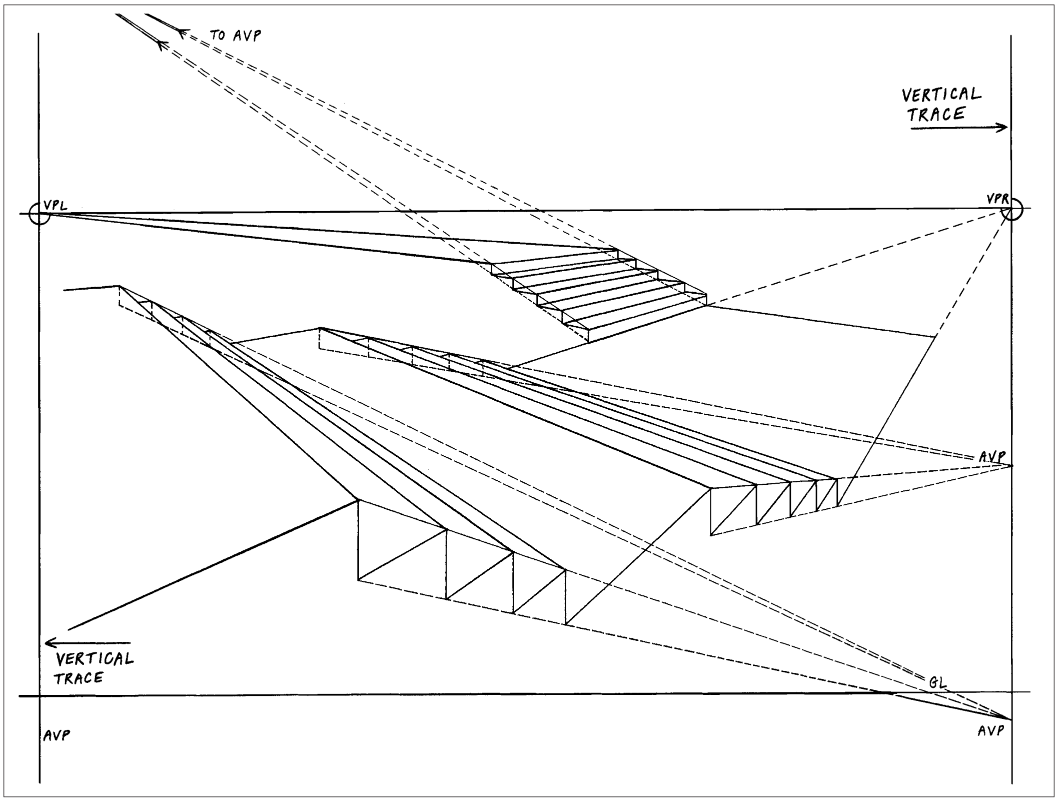


Figure 3-12. A two-point perspective view of *descending* stairs shows the inclined planes within which the stairs are positioned. Landings are positioned between each stairway's pitch or directional change. The two closest sets of stairs are at different pitches, the first steeper than the second. This is indicated by different positions of the AVPs. The most distant stairs are *ascending* at the same pitch as the central stairs.



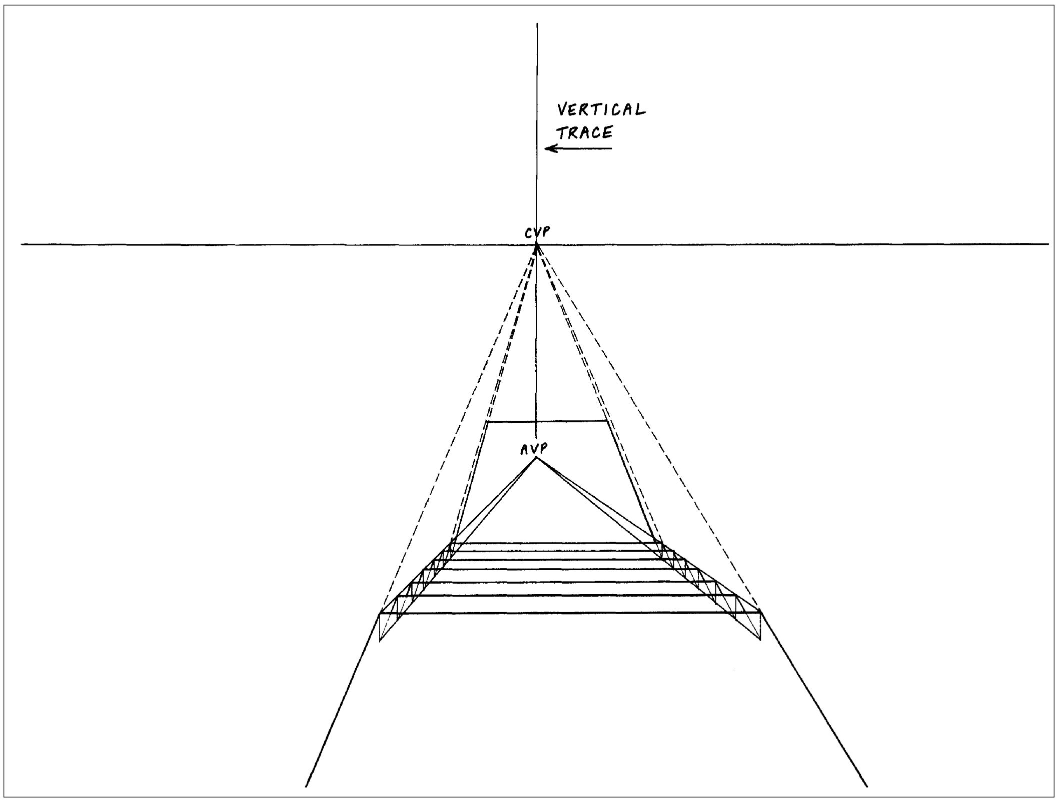


Figure 3-13. This drawing illustrates a one-point perspective view of *descending* stairs as inclined planes with a landing at the top and bottom. Note that the AVP is located along a vertical extension of the CVP. Only the treads, or horizontal planes, of the stairs are actually visible from this viewpoint.

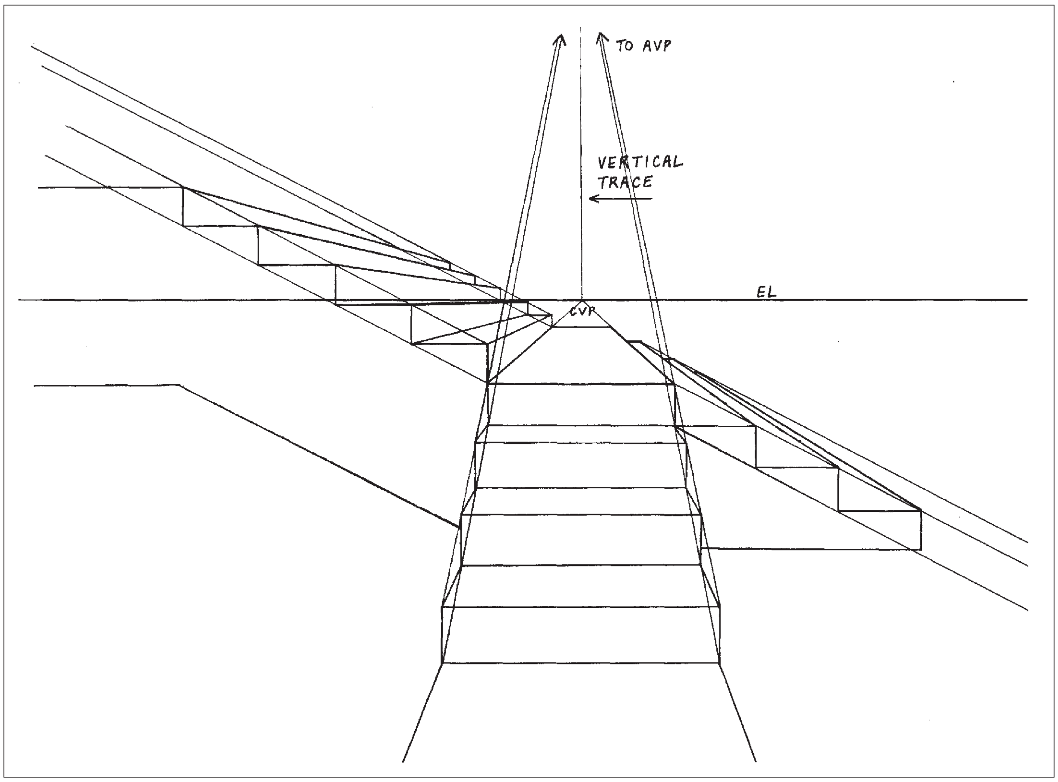


Figure 3-14. A one-point perspective view of two adjoining sets of stairs shows only one set with a receding inclined plane (foreground). No convergence is necessary for the pitch of the other inclined plane that moves across the picture plane rather than into it.

In the case of a peaked rooftop that has an equal pitch on both sides, the AVPs for the upward pitch and downward pitch are positioned equal distances above and below the horizon line to assure uniform pitch on both planes of the roof (see Figure 3-10). For inclined planes that have no edges parallel or perpendicular to the ground plane, both left and right points of convergence will fall on an AVP located on a vertical trace, one above the horizon line and one below the horizon line.

Geometric Solids and Transparent Construction

The geometric or Euclidean solids known as the cube, the cylinder, the cone, the sphere, and the pyramid provide the basic forms from which all other forms are composed. All forms, to varying degrees, can be ultimately reduced to one of these geometric solids or a combination of these geometric solids (Figure 3-15). With an understanding of cube construction and ellipse construction as it relates to a cube, any of these basic forms can be created, as well as infinite variations of these forms.

WHAT IS TRANSPARENT CONSTRUCTION?

Geometric solids, along with gridded ground planes, cube multiplication, and cube division, also provide the foundation of understanding for transparent construction. Transparent construction involves the reduction of three-dimensional forms, both simple and complex, to their basic geometric solids (Figure 3-16) and a depiction of these three-dimensional forms that suggests their transparency, essentially defining information that is not actually visible from a fixed viewpoint. For example, one may draw a shoe in which we see simultaneously both the near side of the shoe and the far side of the shoe—a perspective version of X-ray vision (Figure 3-17)! The most basic skill necessary for exploring transparent construction is the ability to draw a transparent cube in perspective, defining all six faces of the cube as if it were made of glass.

To apply transparent construction to the depiction of an object, it is best to start with a form whose relationship to a cubic structure is readily apparent—a form that is composed of simple planes and perhaps some curvilinear contours that are rooted in ellipses. Certain children's toys, for example, are excellent subjects for beginning to explore transparent construction because of their inherent simplification and their obvious relationship to a rectangular solid. Examples include toy cars, trucks, or trains; cash registers; telephones; work benches; and other simplified versions of cube-based forms that are typically constructed of wood or plastic (Figures 3-18 and 3-19). More complex forms may be introduced as comprehension of the process increases.

ESTABLISHING THE CUBIC CONNECTION

The important first step in the process involves determining the relationship of the form to a cube. Pick

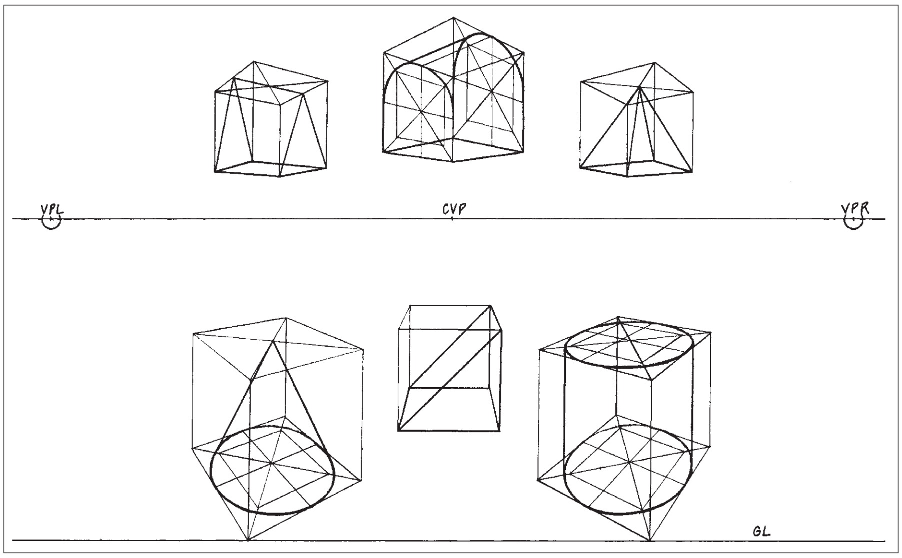


Figure 3-15. A variety of geometric solids and related forms are shown in their relationship to cubes. As cubes (such as the one on the lower right) approach the cone of vision, some distortion in the resulting geometric solid begins to appear, as evidenced by the tilting ellipses of the cylindrical form.

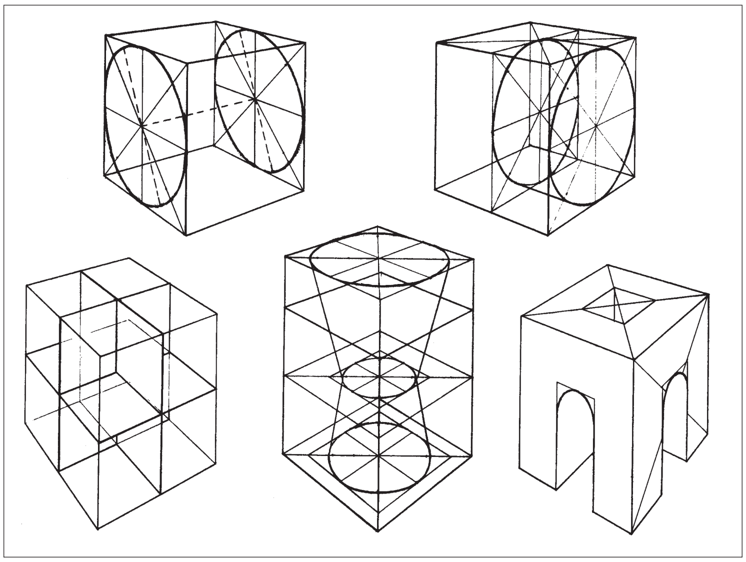


Figure 3-16. Cubes and cubic forms provide the structure for a variety of both simple and compound geometric solids and ellipses.

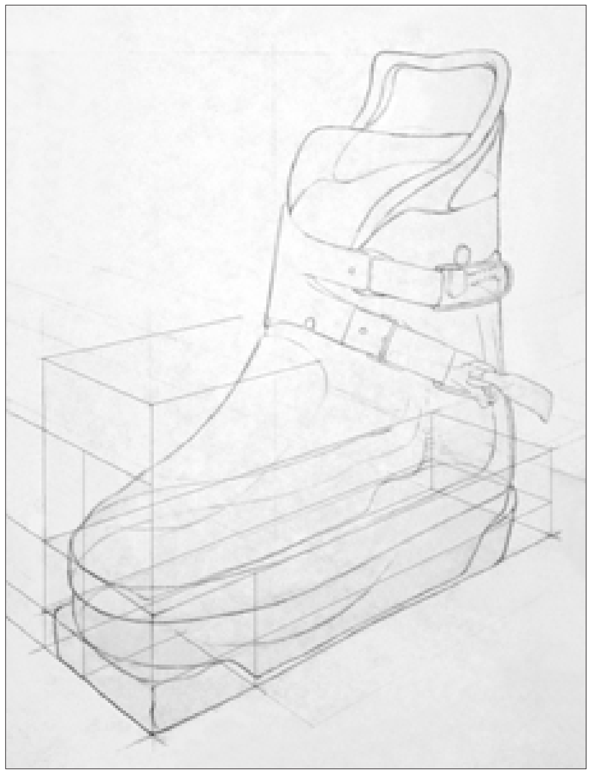


Figure 3-17. Student work. Scott Luce. A transparent construction drawing of a ski boot shows both the visible near side and the invisible far side. Cubic forms that remain lightly visible in the drawing provide a structural basis for analyzing the boot.

up the object you are going to draw and, by viewing it from all sides, determine what its cubic dimensions are (Figure 3-20). An object that roughly measures 12″ tall, 18″ long, and 6″ deep can be translated into cubic dimensions a few different ways. If you wish to work with a 12″ cube as the basic unit of measure, then the object in its simplified form can be represented as 1 cube tall, 1½ cubes long, and ½ cube deep, using cube multiplication and division to create the proper dimensions. If you wish to work with a 6″ cube as the basic unit of measure, then the object can be represented as 2 cubes tall, 3 cubes long, and 1 cube deep. If you wish to work with a 3″ cube as the basic unit of measure, then the object can be represented as 4 cubes tall, 6 cubes long, and 2 cubes deep. If you encounter dimensions that involve more irregular fractions of a cube, such as thirds, you can either estimate thirds of a cube or use a measuring line for a precise determination of thirds. A gridded ground plane may also be used as a sort of template in helping to determine cubic dimensions. The object's relationship to a gridded ground plane in a plan or overhead view can be translated to the object's relationship to that same gridded ground plane when seen in perspective.

If you wish to begin your drawing with a cube whose dimensions are estimated, then you can place

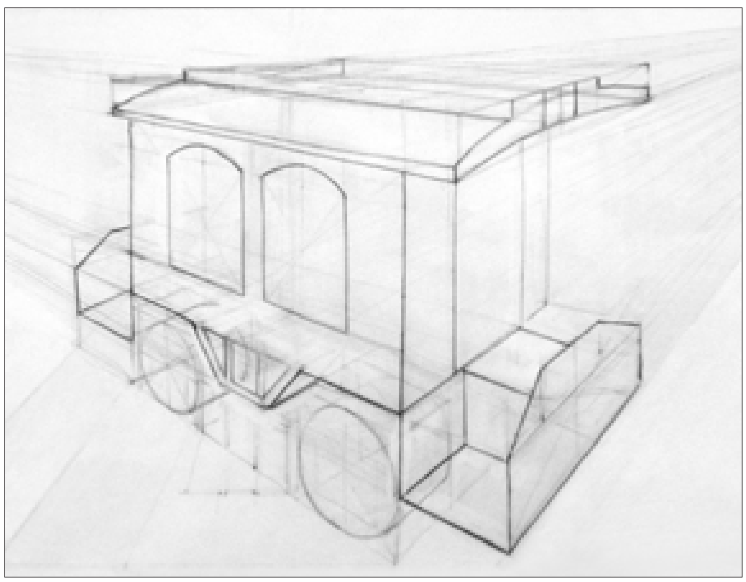


Figure 3-18. Student work. Theron J. Willis. An in-progress transparent construction drawing of a toy train car provides evidence of the numerous two-point perspective lines that guide the transparent construction of this form.

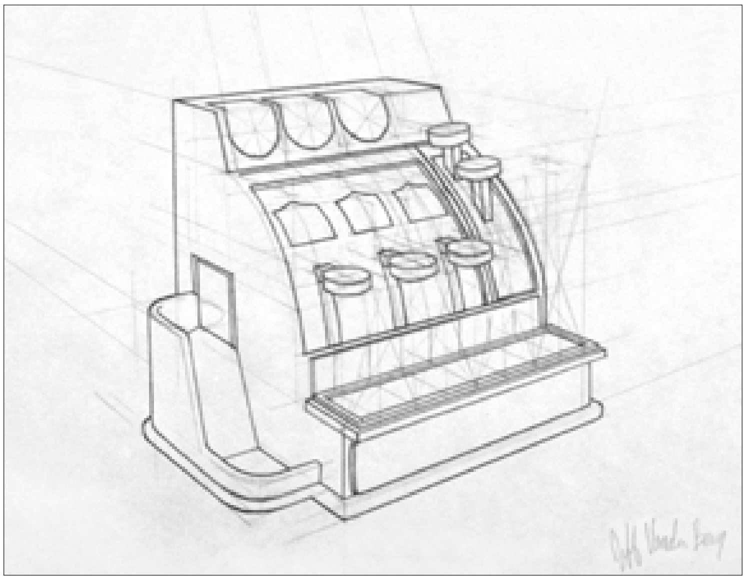


Figure 3-19. Student work. Jeff VandenBerg. A fully developed transparent construction drawing of a toy cash register reveals numerous delicate construction lines that guide the drawing process.

Figure 3-20. Student work. Comparing the underlying structure of a boot to a corresponding cubic structure provides vital information for a more informed investigation using transparent construction. Transparently drawn cubes allow you to draw the boot transparently as well.

your initial cube in any number of positions within your perspective environment, being careful not to violate your cone of vision as you multiply the initial cube to create the overall dimensions (Figures 3-21 and 3-22). If you wish to begin with a drawn cube whose dimensions are precise, then you must determine whether you want to work with a 45°/45° view of the object you are drawing or a 30°/60° view, and construct your initial cube using one of the appropriate cube-construction methods described earlier in this chapter. With the object in front of you as a reference, you can represent the form from any desired vantage point—above or below or on eye level—without actually viewing it from that particular vantage point.

Initially, the process of transparent construction can be time-consuming and somewhat frustrating, as it requires patience and some careful consideration about the best way to approach the form. It is helpful to work from general to specific, identifying and defining the largest and simplest characteristics of the form first before addressing more detailed information that is rooted in the simpler form (Figure 3-23). If you are initially approaching transparent construction through technical perspective, then the use of rulers and T-squares and other mechanical devices requires a bit more care and precision (Figure 3-24). Once you have an understanding of the process, it is wise to explore the application of transparent construction principles in a freehand manner as well, using no mechanical aids or using them minimally (Figure 3-25).

Three-Point Perspective

In one- and two-point perspective, it is assumed that all edges that are truly vertical (perpendicular to the ground plane) are also parallel to the picture plane, and therefore do not converge on a vanishing point but rather remain true verticals in the drawing. In three-point perspective, which is typically used to address forms that extend well above or below the eye level/horizon line, it is acknowledged that in order to observe these forms we must tilt our head up or down. Because the picture plane remains parallel to the plane of our face in perspective, the picture plane must also tilt in relation to the object or objects being observed, and consequently no edges of a cube-based structure remain parallel to the picture plane.

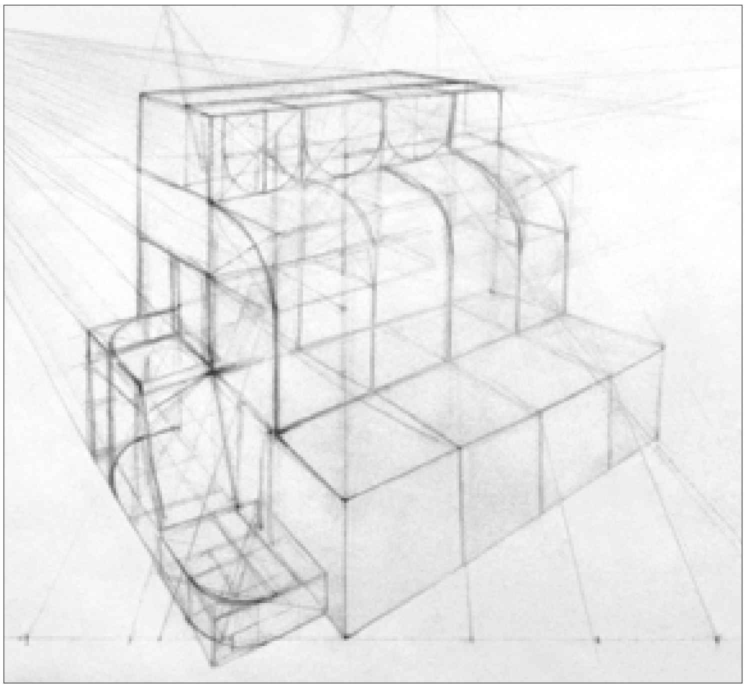


Figure 3-21. Student work. The cubic structure of this toy cash register is shown to be approximately 5 cubes wide including the side tray, 3½ cubes deep, and 3½ cubes high. The eye level (horizon line) is just beyond the upper edge of the drawing surface.

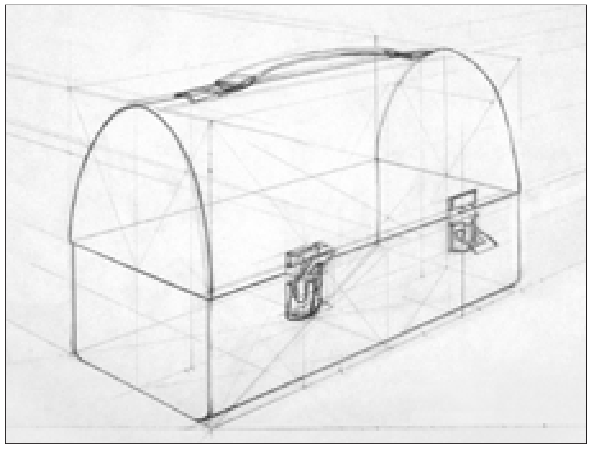


Figure 3-22. Student work. The cubic structure of this lunchbox is shown to be approximately 4 cubes wide, 2 cubes deep, and 2½ cubes high.

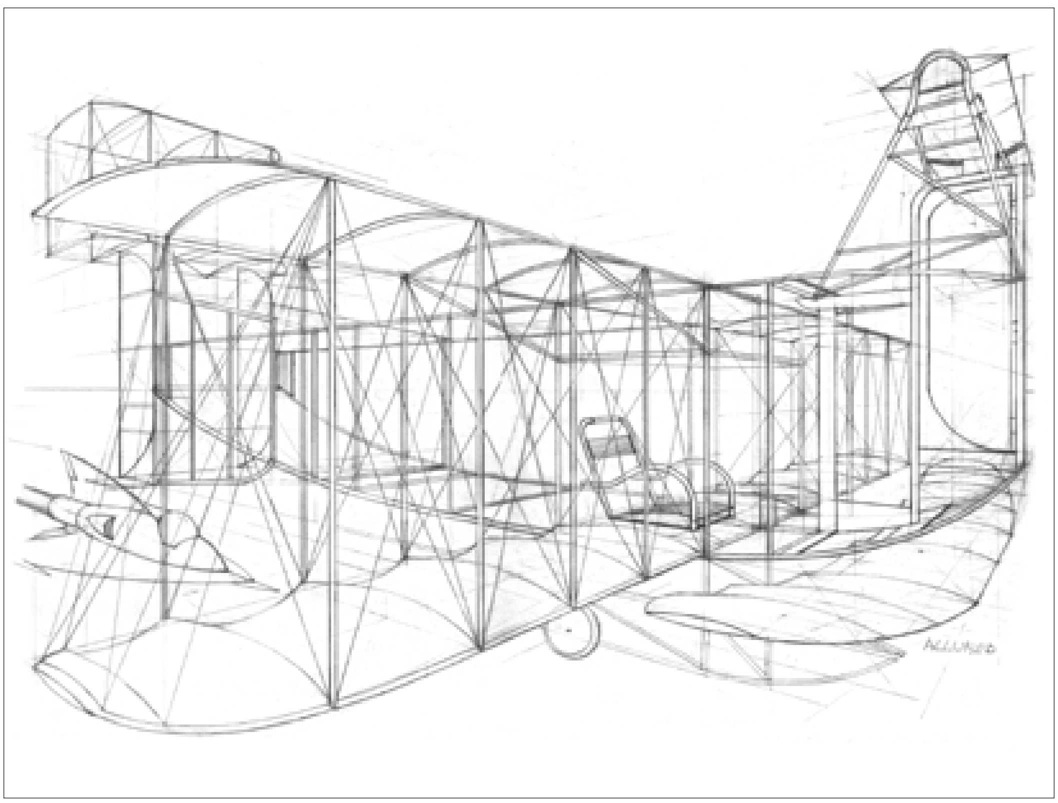


Figure 3-23. Ralph Allured, American, *Imaginary Flying Machine in Two-Point Perspective*, 1997. Graphite on paper, 11 × 17 inches. Courtesy of the artist. The large, basic shapes of the wings and body of this imagined flying machine were established, first using technical perspective and some mechanical aids, followed by details in the structure of the wings and the body using both technical and freehand methods.

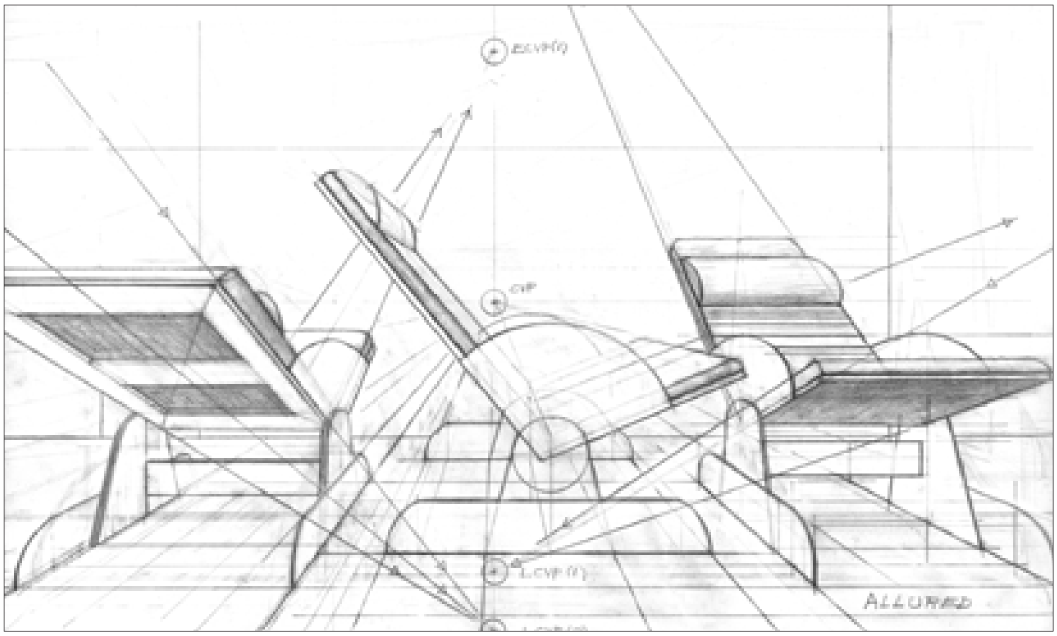


Figure 3-24. Ralph Allured, American, *Study of Reclining Chairs in Two-Point and One-Point Perspective*, 1997. Graphite on paper, 11 × 17 inches. Courtesy of the artist. A ruler, compass, and gridded ground plane were used to develop this technical perspective drawing of reclining chairs viewed in a variety of positions. A number of inclined planes in this study converge on AVPs, but here the AVPs are labeled as ECVP (elevated central vanishing point) and LCVP (lowered central vanishing point).

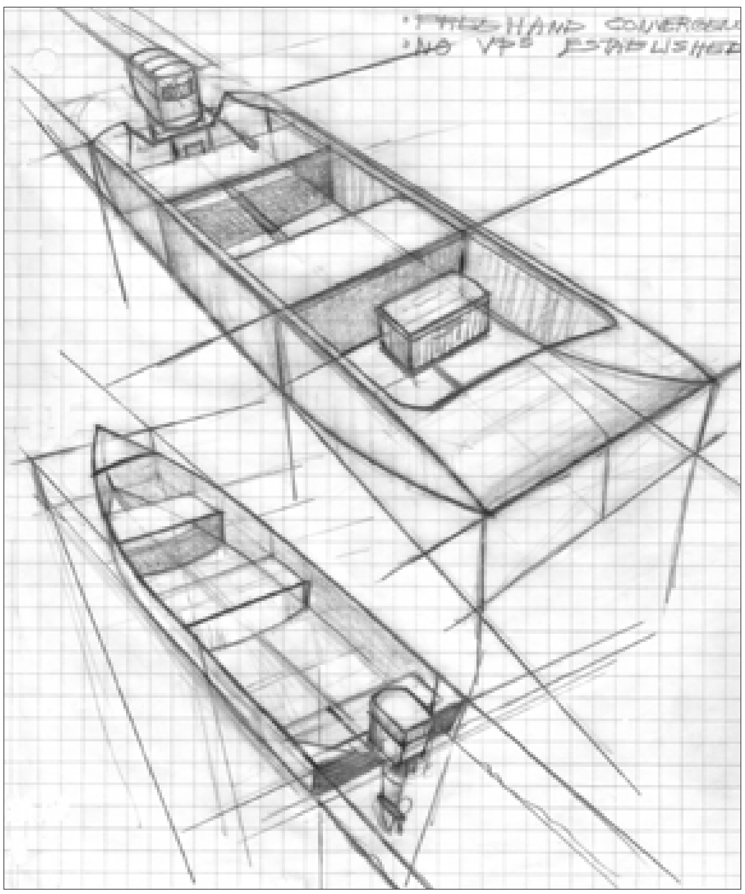


Figure 3-25. Ralph Allured, American, *Boat Studies in Three-Point Perspective,* 1997. Graphite on graph paper, 11 × 8½ inches. Courtesy of the artist. As the artist's notes in the upper right corner indicate, these three-point perspective studies of two boats are drawn freehand, with no established vanishing points. A ruler is used to sharpen significant edges when considered necessary.

Therefore, all parallel edges (including verticals) must converge on vanishing points (Figure 3-26).

We already know that all edges that are parallel to the ground plane (horizontal) and moving away from us converge on either VPL or VPR. The third vanishing point, upon which vertical edges parallel to each other will converge, is positioned directly above or below the CVP, depending upon whether the form is viewed from a low vantage point or a high vantage point.

Three-point perspective is actually applicable far more often than it is used, but because of its increased complexity and time intensity, its use is reserved for drawings that demand three-point perspective for visual accuracy or effect. For some artists or designers, mathematical precision may be desirable or mandatory, and a more in-depth investigation of strict three-point perspective may be required for work of greater complexity. Because in three-point perspective there are many more steps required for the precise construction of even a simple cube, we allow here for informed estimation of heights, widths, and depths as often as possible to make the process more expedient and user-friendly. This more relaxed approach is especially applicable for artists whose work does not require absolute precision but who are simply interested in the ability to convey the illusion of three-dimensional form and space convincingly.

CONSTRUCTING A FORM IN THREE-POINT PERSPECTIVE

1. All preliminary information should be established and drawn, including scale, eye level/horizon line (EL/HL), ground line (GL), station point (SP), central vanishing point (CVP), vanishing points left and right (VPL/VPR), vanishing point three (VP3), units of measure along the horizon line that reflect your scale, units of measure along a vertical measuring line that reflect your scale, and cone of vision (Figure 3-27).
2. If your EL is high, as in a **bird's-eye view** (if you are above, looking down), position your EL/HL nearer the *top* of your drawing format. If your EL is low, as in a **worm's-eye view** (if you are below, looking up), position your EL/HL nearer the *bottom* of your drawing format. From this point on, we are assuming a worm's-eye view in three-point perspective for purposes of explanation.
3. In establishing the scale for your drawing, think in terms of a scale that can represent larger structures such as buildings (e.g., 1″ = 10′ or ½″ = 10′).
4. Draw a vertical line up from the CVP and off the top of the drawing format. The third vanishing point (VP3), which identifies the point of convergence for all vertical edges in three-point perspective, must be plotted somewhere along this line. The *farther up* this line VP3 is located, the *less* the picture plane is assumed to be tilted, and the *less* the verticals will be foreshortened. This yields a more subtle effect. Conversely, the *closer* VP3 is located to the EL/HL, the *more* the picture plane is assumed to be tilted, and the *more* the verticals will be foreshortened. This yields a more dramatic effect. As a general rule, the *minimum* distance of VP3 from the eye level/horizon line should be no less than the *total* distance between VPL and VPR. This serves to minimize distortion. If VPL or VPR or VP3 are located outside of your drawing format, then wings will need to be attached to your paper.
5. Locate and *estimate* the height of the leading edge of a cubic structure in a centrally located position, along or near the vertical line that passes through the CVP. This leading edge must converge upon VP3. Keep in mind the scale you have established in estimating the height of the leading edge. Because the leading edge is foreshortened (contrary to two-point perspective), it will be shorter than if the same size cubic structure were drawn in two-point perspective. This will be your "key" structure, which will help to determine the size of all other structures. Stay within the cone of vision to avoid distortion.
6. Draw lines of convergence from the top and bottom of the leading edge to VPL and VPR,

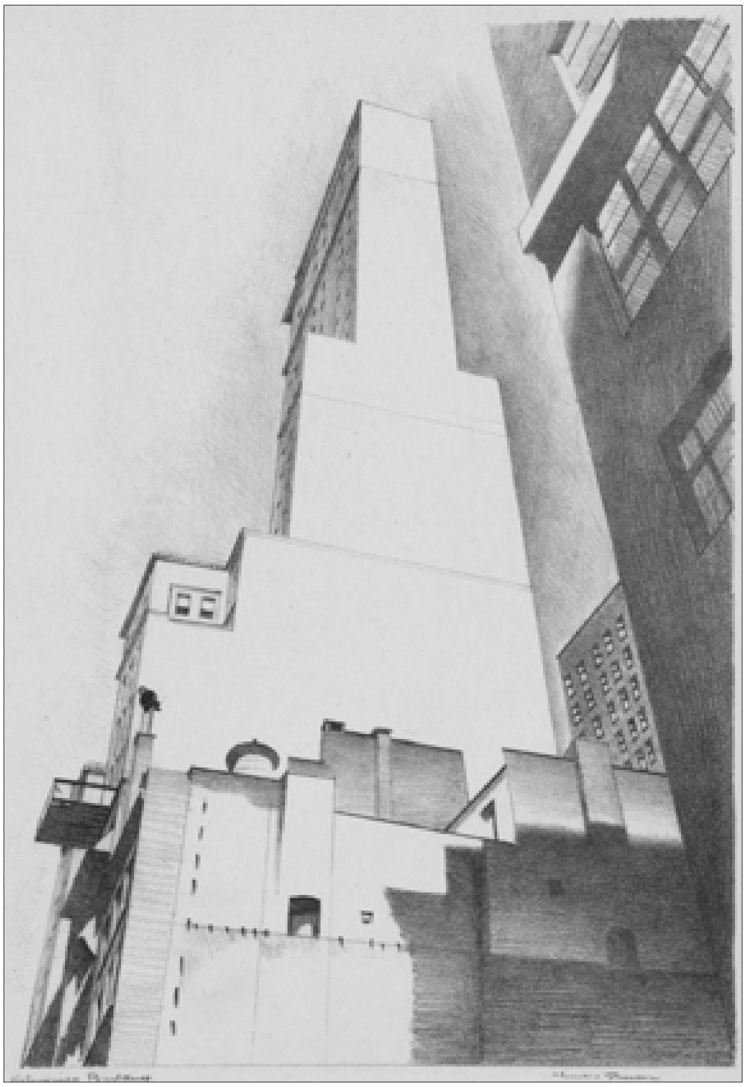


Figure 3-26. Charles Sheeler, American, 1883–1965, *Delmonico Building*, 1926. Lithograph. Composition: 9¾ × 16 11⁄16 inches; sheet: 14 7⁄8 × 11 3⁄8. Gift of Abby Aldrich Rockefeller. The Museum of Modern Art, New York. Digital Image © The Museum of Modern Art/Licensed by SCALA / Art Resource, NY. In three-point perspective, shown here from a worm's eye view, the vertical edges of the buildings converge on a single vanishing point that is positioned directly above the CVP located on the eye level line.

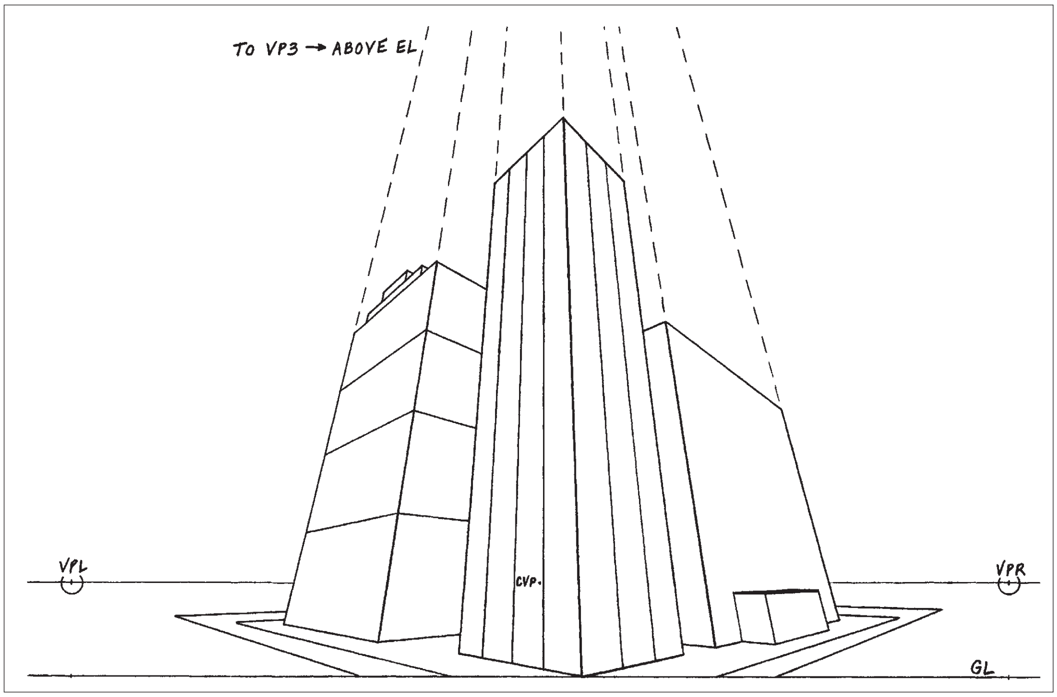


Figure 3-27. This drawing illustrates three-point perspective from a low eye level or worm's-eye view. The perspective set up is the same as for a two-point perspective drawing, with the addition of a third vanishing point (VP3) that is positioned well above the eye level and upon which all vertical edges converge. The convergence of vertical edges is indicated by dotted lines.

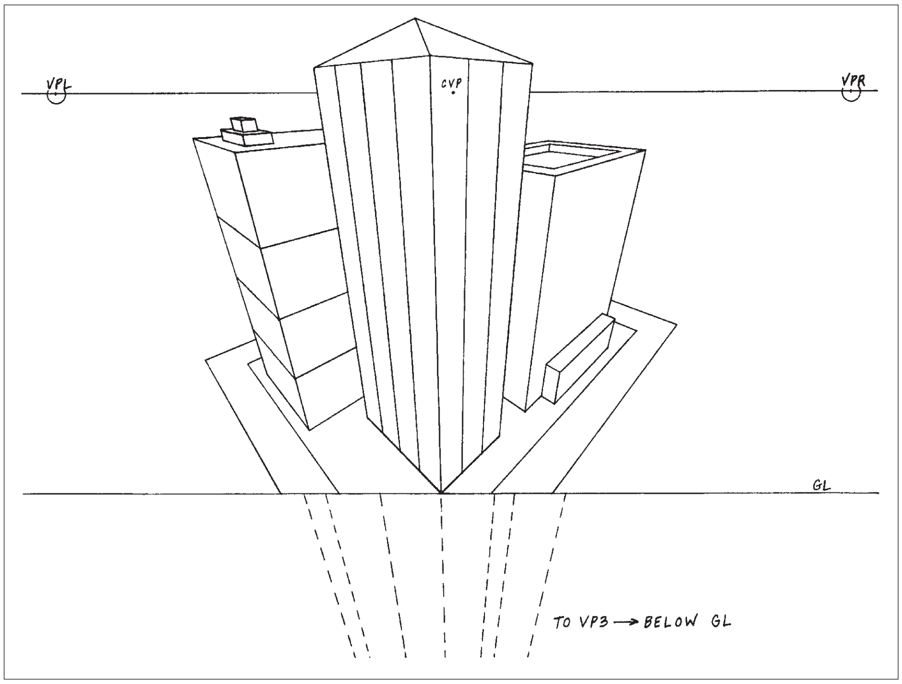


Figure 3-28. This drawing illustrates three-point perspective from a high eye level or bird's-eye view. The three main structures are similar to those presented in the worm's-eye view, but because they are viewed from such a different eye level, their appearance changes dramatically. A horizontal measuring line was used in this drawing and in Figure 3-27 to determine the vertical divisions in the tallest structure.

estimate the desired width of the structure, and extend all verticals to converge at VP3. This completes your cubic structure in three-point perspective.

7. The height of the leading edge of additional structures can be scaled as usual from the leading edge of the key structure, using SVPs located along the horizon line. Additional structures can be made larger, smaller, or the same size as the key structure. This process is essentially the same process used for scaling the height of a leading edge in one- or two-point perspective, but all verticals determined by scaling will converge on VP3.

8. To determine divisions in the width of a structure (either equal or unequal divisions), use the familiar horizontal measuring line system explored in two-point perspective and explained earlier in this chapter (Figure 3-28).

9. For determining divisions in the height of a structure (comparable to the number of stories in a building), it is recommended that you estimate these divisions, keeping in mind that as you move up the structure (a worm's-eye view) or down the structure (a bird's-eye view), the increments will become increasingly smaller to reflect diminution.
10. For drawing inclined planes in three-point perspective, AVPs will still be located on vertical traces, but these vertical traces will extend from VP3 to VPL and VPR and beyond rather than being truly vertical.

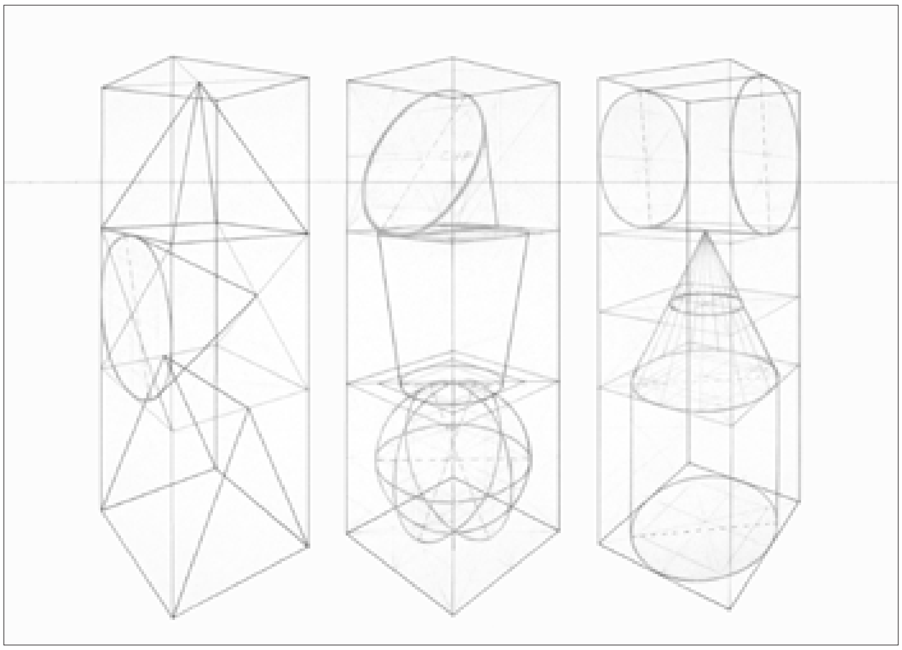
Suggested Perspective Exercises

Following are some suggestions for both technical and freehand exercises that encourage creative exploration and application of both beginning-level and more advanced and complex perspective processes and techniques. These exercises are accompanied by illustrations of various solutions. They require your understanding of the essential building blocks of perspective, including systems and processes such as one- and two-point cube construction, one- and two-point gridded ground planes, scaling techniques, sliding vanishing points, ellipse construction, various methods for cube multiplication and division, inclined planes, the relationship of geometric solids to transparent construction, and three-point perspective.

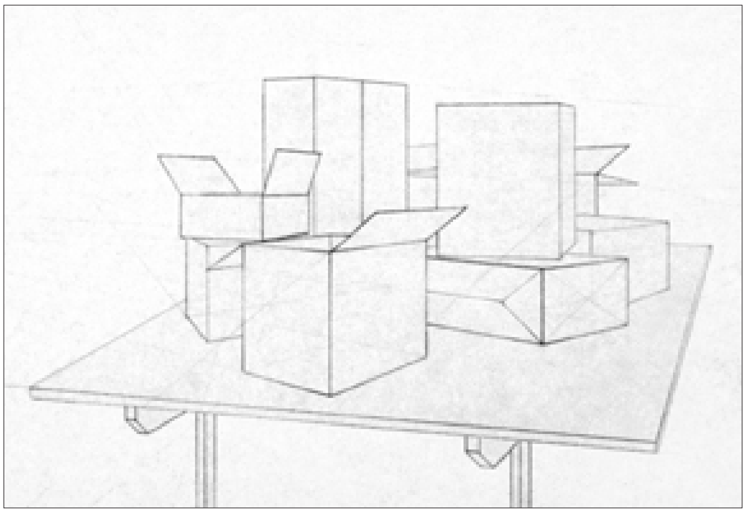
You are encouraged to determine the specifics and the variables of the exercises, including any restrictions or requirements you wish to impose upon yourself. While some exercises are better suited for technical perspective, it is reinforcing to explore a technical system using freehand techniques. It is strongly suggested that you incorporate at all levels of exploration the use of a variety of different eye levels, scales, and station points, including forms drawn below, at, and above the eye level, both grounded and floating.

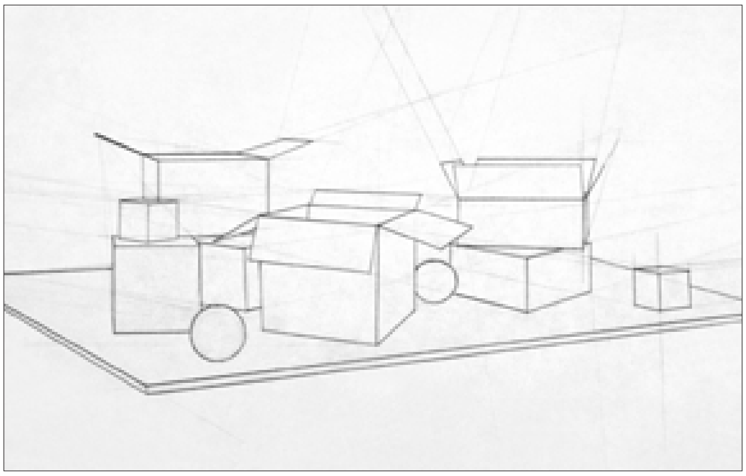
In all of these exercises, make sure that you know where your eye level/horizon line is positioned, whether it falls on the drawing surface or is positioned above or below the drawing surface.

- Draw a series of cubes in both one- and two-point perspective and practice constructing various geometric solids that incorporate both straight lines and planes and elliptical forms within the cubes (Figure 3-29).
- Create and draw a still life of various boxes—small, medium, and large—and arrange them in a variety of positions. Stack them, lay them on their side, and arrange the flaps at different angles.



Figures 3-29. Student work. Dean E. Francis. The relationship of various geometric solids to a cube is explored in this linear perspective study. Cubes, cones, cylinders, vessels, a wedge, a pyramid, and a sphere are shown at different positions in relation to the eye level and the central vanishing point. Can you explain why there is mild distortion in the ellipse that forms the base of a more complex object on the lower right? Look at the foreshortened square that guides construction of the ellipse. Do you see any problems? What do you know about the foreground corner of a foreshortened square?

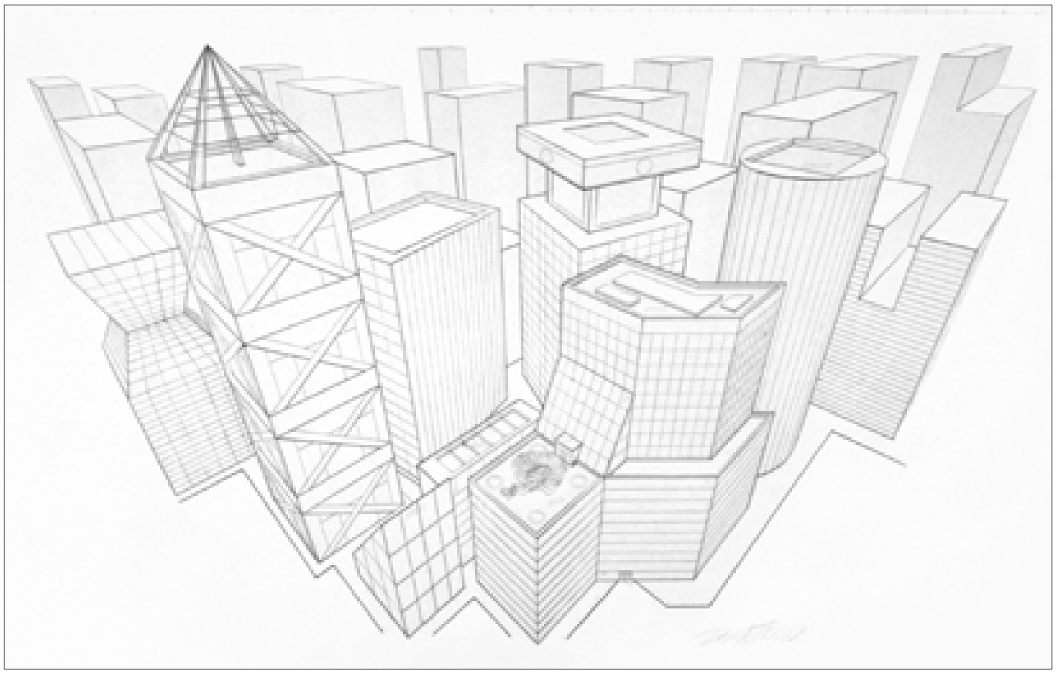




Figures 3-30 (student work—Matt Grindle) and **3-31** (student work—Jeff VandenBerg). Arrangements of boxes and box flaps on tabletops are explored in these two drawings. Sighting, freehand perspective, and technical perspective are used together to create convincing illusions of three-dimensional forms and space.

Remember that, in these various positions, there will be multiple sets of vanishing points upon which the receding planes will converge (Figures 3-30 and 3-31).

- From imagination and/or observation, draw a cityscape in one-, two-, or three-point perspective. Vary the shape, height, and position of the buildings, and include architectural details and embellishments. You may also wish to incorporate natural forms such as trees and other landscape elements. You can work freehand or use straight-edges or rulers (Figures 3-32 through 3-35).
- From imagination, draw a two-point perspective environment or structure(s) of some kind. This environment or structure does not have to be based in reality. It does not have to actually exist. Your drawing may include cubic-based forms, structures that incorporate elliptical elements, inclined planes, and any other variations that require the use of perspective. You may also want to include some organic or natural forms as part of the environment or structure. You may choose to work with straight-edges or rulers, or you can work entirely freehand (Figures 3-36 through 3-38).
- From observation, draw a familiar room interior from a two-point perspective viewpoint, including furniture, windows, doorways, countertops, and other elements. Work freehand when possible, and use sighting and your understanding of perspective principles to accurately identify angles, representing the structure of the room and the things found in the room. You may also choose to identify the approximate position of vanishing points (which will likely be well off the page) to guide you in your observations (Figures 3-39 through 3-42).
- From observation, practice transparent construction processes in relation to both simple and more complex forms using both cubic-shaped objects, objects that include ellipses, and objects that are irregular in their structure. The more clearly you can see the relationship of the object to a cubic shape, the easier it will be to apply transparent construction. Be patient as you explore complex forms, as they require more time and incorporate a greater range of perspective processes (Figures 3-43 through 3-57).



Figures 3-32 (student work—Dean E. Francis), 3-33 (student work—Gill Whitman), 3-34, and 3-35 (student works—Doug Stahl). These drawings are examples of both imagined and observed cityscapes using knowledge of perspective. The three-point cityscapes use technical perspective and are constructed from imagination utilizing a bird's-eye view, while the freehand marker drawings are done from direct observation.

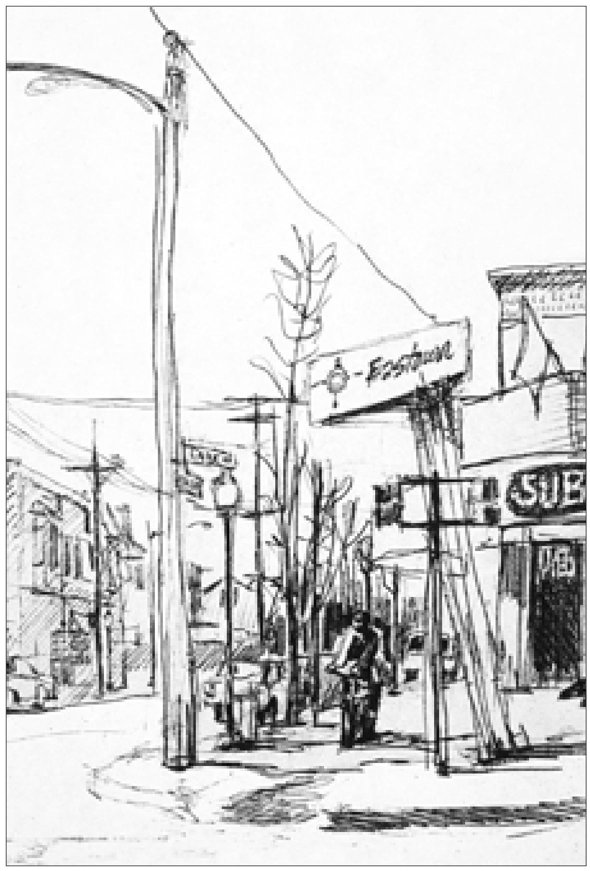
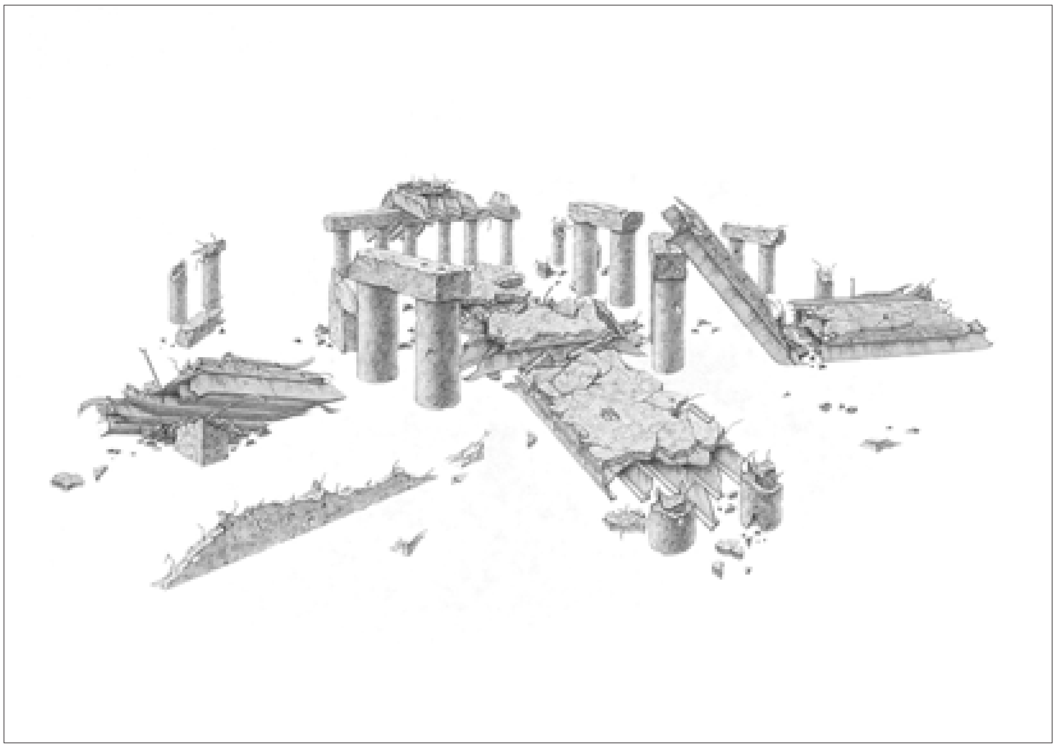
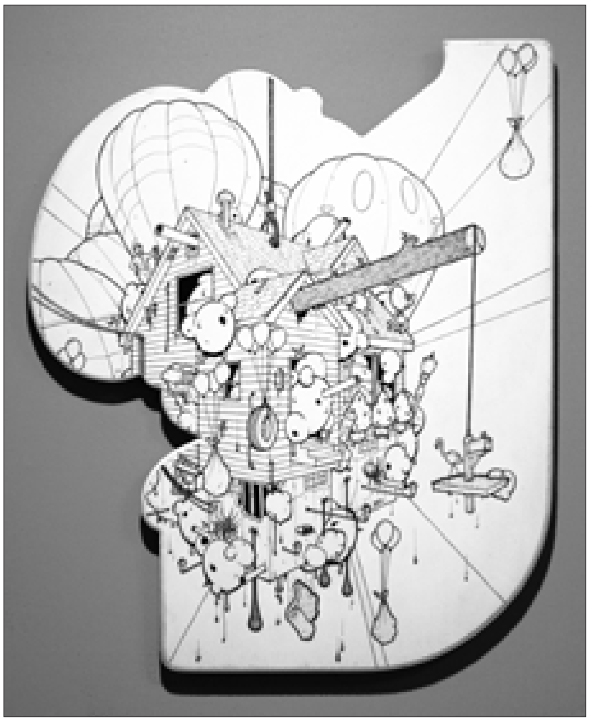
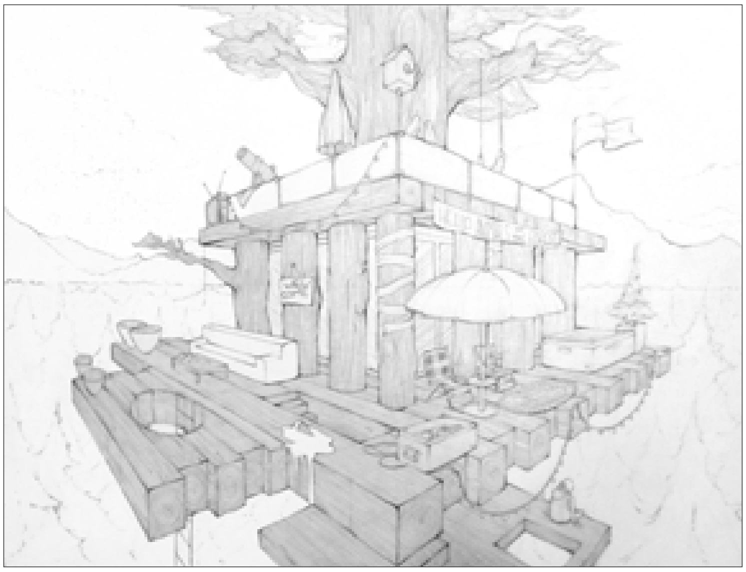


Figure 3-36. Nathan Heuer, American, *Interchange*, 2008. Graphite on paper, 30 × 44 inches. Courtesy of the artist. Heuer's graphite drawing of imaginary collapsed freeway overpasses makes reference to the prehistoric monument of Stonehenge and its post (vertical stone columns) and lintel (horizontal stones supported by the columns) construction. The drawing makes a comparison between ancient and contemporary structures.

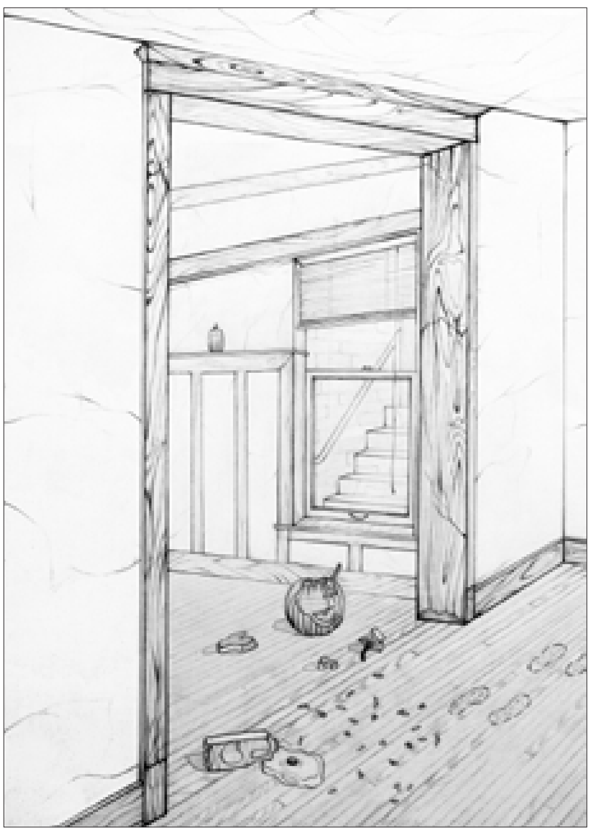


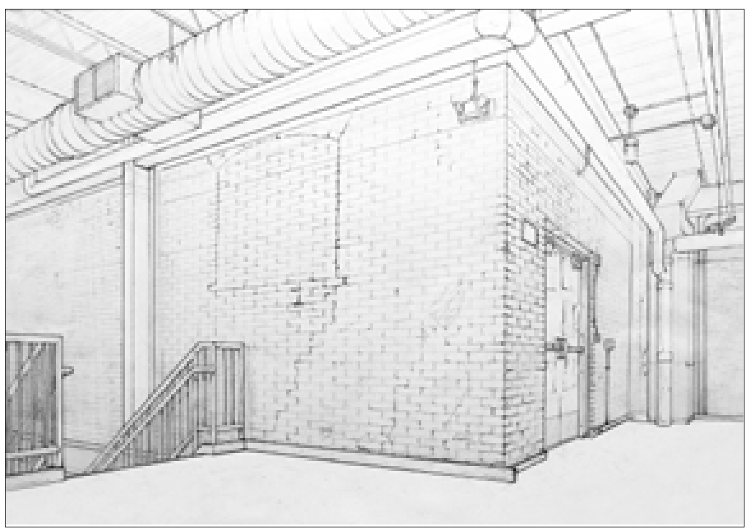


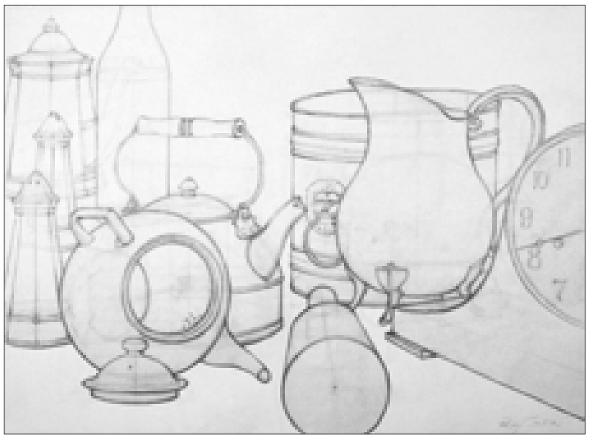


Figures 3-37 (student work—Donald Barkhouse III) and **3-38** (student work—Pat Perry). These two-point perspective drawings, executed with different media on different surfaces, explore creative and humorous invented structures and environments.

Figures 3-39 Student work. Jenna Simmons (Instructor: Sarah Weber); **3-40** Student work, Alyssa Parsons (Instructor: Gypsy Schindler); **3-41** Student work, Kalle Pasch (Instructor: Devin DuMond), and **3-42** Student work, Tim Crecelius (Instructor: Michael Ingold). These four drawings are all based on direct observation of an interior space, the use of sighting, and knowledge of perspective principles for angles and proportional relationships. Notice that there are different eye levels employed in each of the drawings.





Figures 3-43 (student work—April Maturia) and **3-44** (student work—Peggy Jackson). Delicate construction lines indicate that these drawings include an exploration of transparent construction. The construction lines guide the shape and placement of ellipses and help to maintain the relative symmetry of the forms.

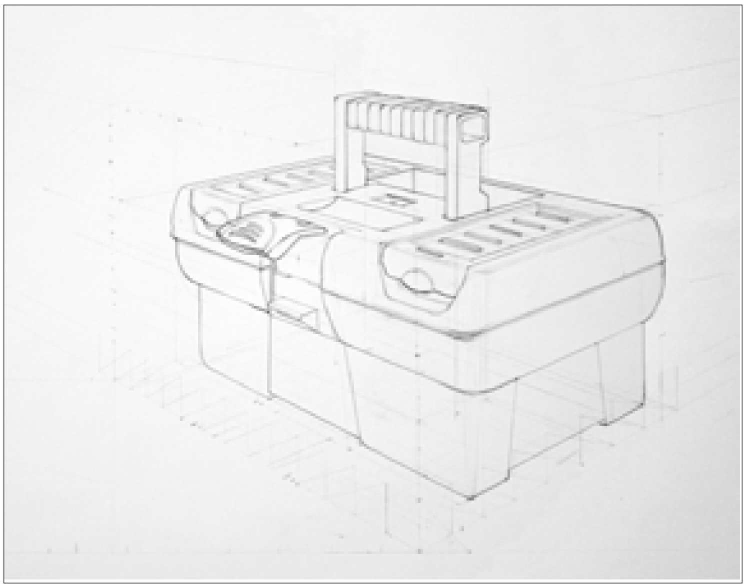


Figure 3-45. Student work. J. Castillo. This exploration of transparent construction in relation to the cubic form of a supply box shows a strong understanding of the process as it relates to two-point perspective and scaling methods.

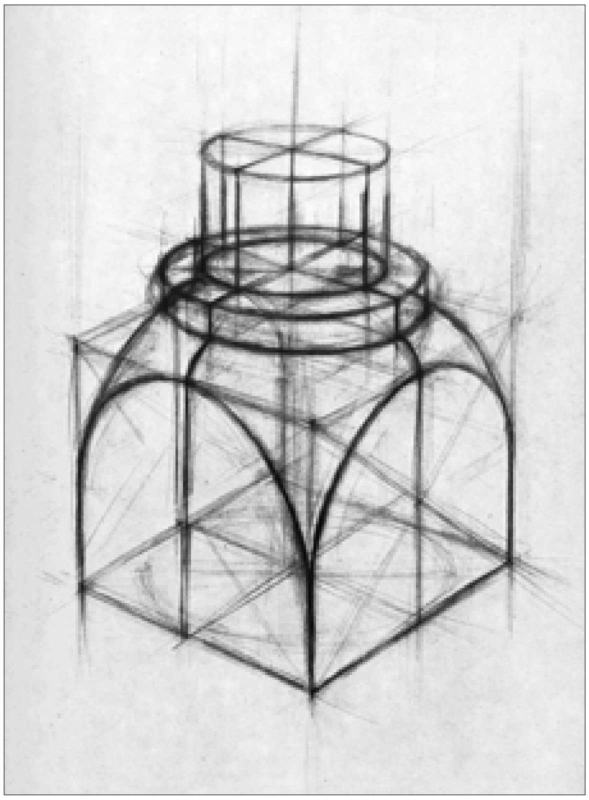
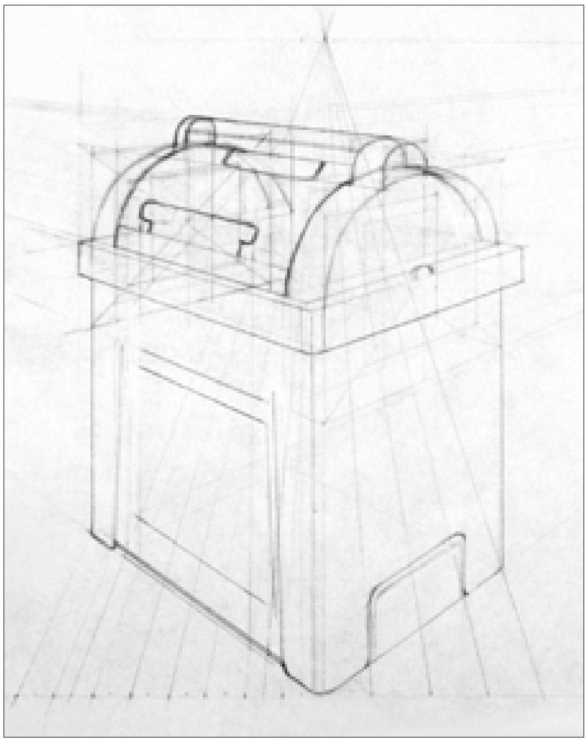
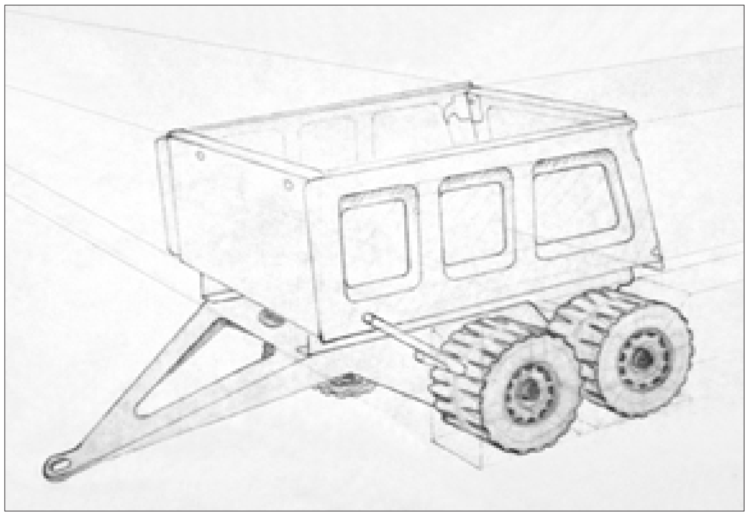


Figure 3-46. Student work (School of Design, Basel, Switzerland). The underlying cubic structure of this compound geometric solid is drawn transparently (as if made of glass), revealing the process of describing various forms—arches, ellipses, cylinders, etc.—that have a relationship to the cube. The cube is the starting point from which information is carved away or added on.





Figures 3-47 (student work), **3-48** (student work—Matt Grindle), and **3-49** (student work—School of Design, Basel, Switzerland). Children's toys provide a good opportunity to investigate transparent construction as it might apply to actual full-scale forms such as a mailbox, a truck trailer, or a steamroller. All three of these drawings were done from direct observation of children's toys. **Figure 3-49** is an excellent example of the relationship of various forms to a basic cube and its variations.

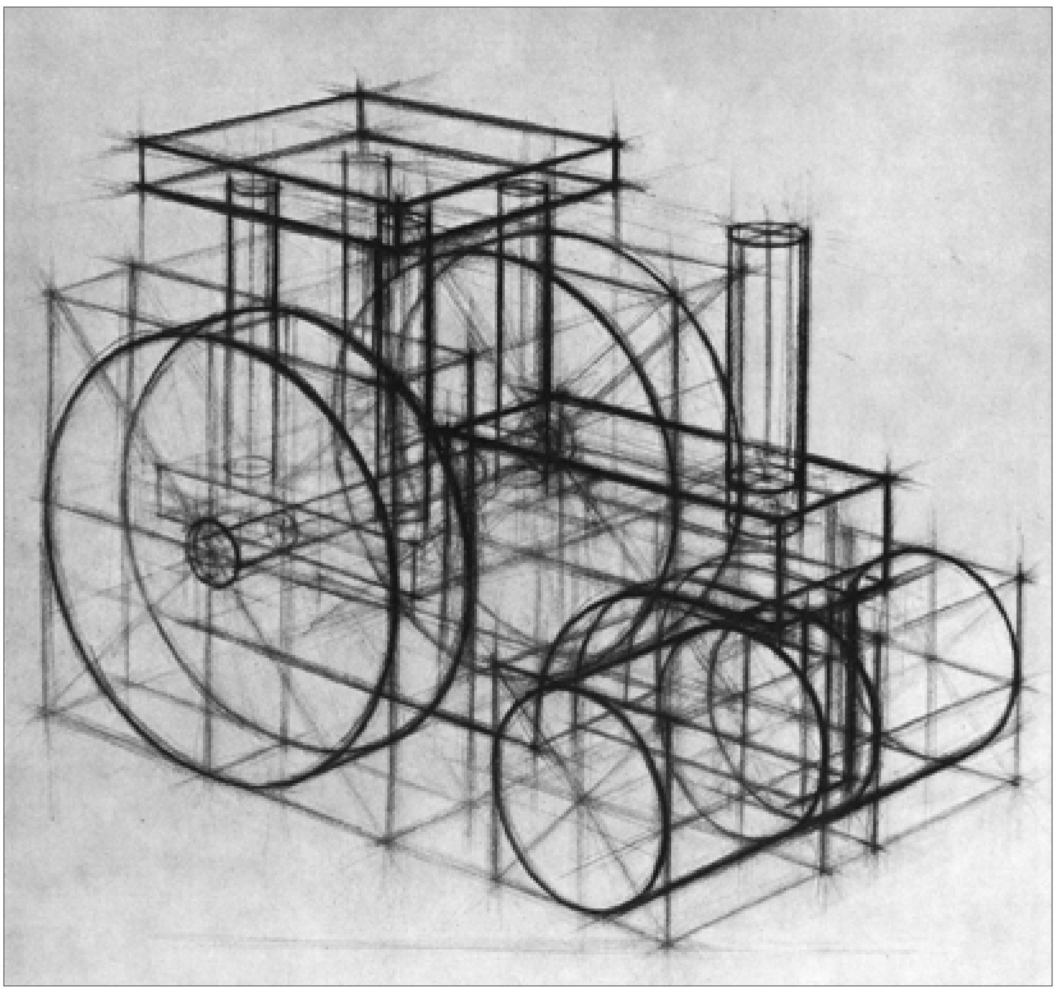


Figure 3-50. Student work. Cubic forms can easily be compared to the strong vertical and horizontal aspects of a ski boot, providing a form with more detail for the investigation of transparent construction. Establishing the larger and simpler forms first establishes more structure for drawing the details.

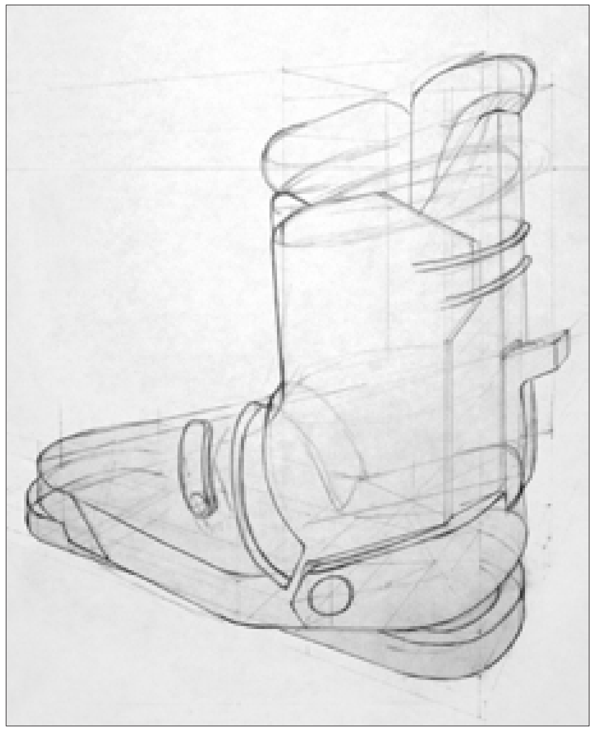
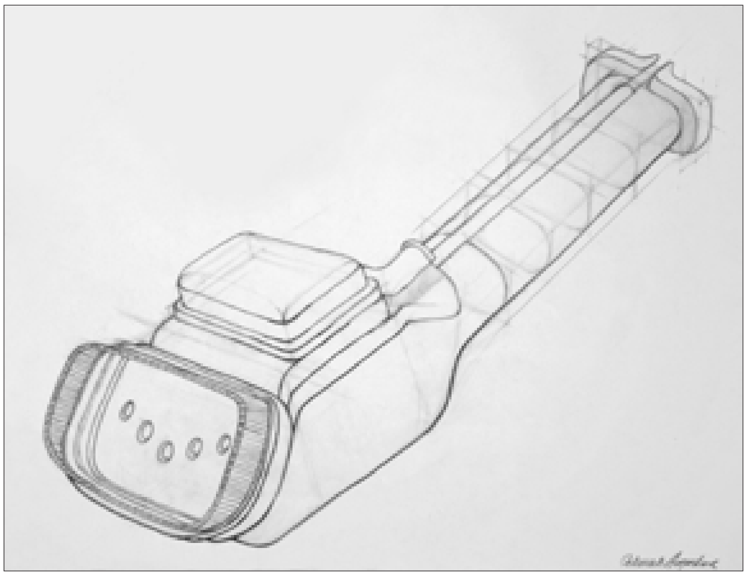
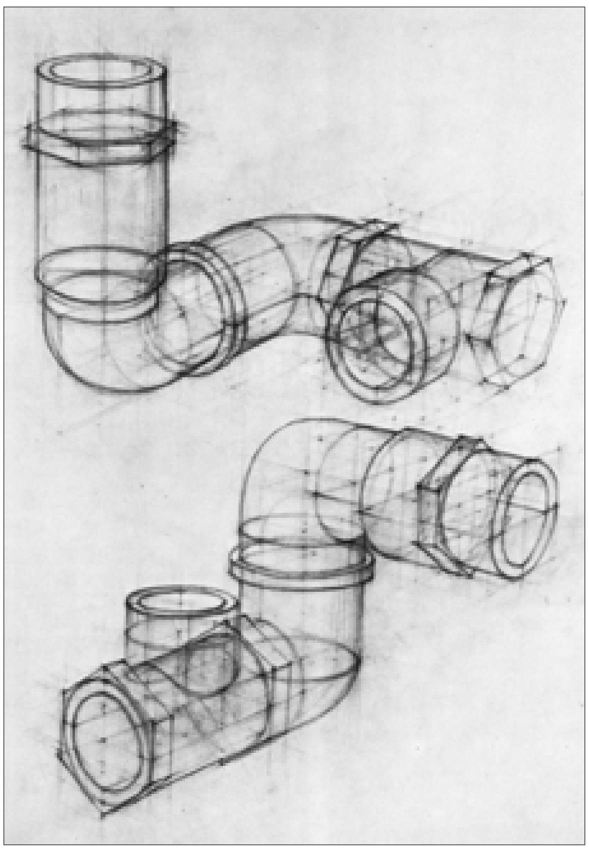
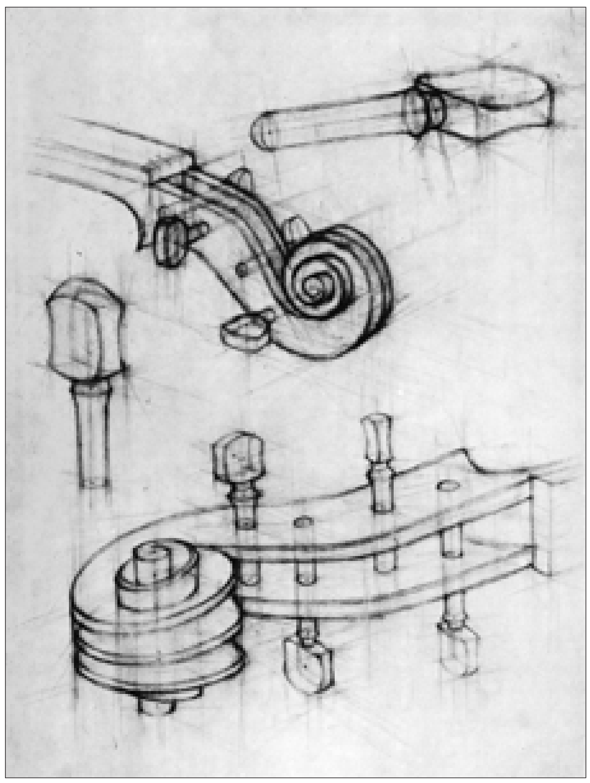


Figure 3-51. Student work (School of Design, Basel, Switzerland). This beautiful transparent construction study of a well-worn boot shows careful and sensitive analysis of the boot's general structure as well as the relationship of detail to larger, simpler structures.



Figures 3-52 Student work. Deborah Augustine. Common household objects are readily available and provide a good resource for exploring transparent construction with varying degrees of complexity. As your understanding increases, you can explore more complicated forms in greater detail.





Figures 3-53 and 3-54 (student works—School of Design, Basel, Switzerland). Complex forms that range from the mundane to the beautiful can be explored with the help of transparent construction techniques. Notice the use of points or dark marks that assist with identifying key points of the delicately drawn cubic structures that guide the formation of ellipses, curves, and other shapes. Both of these studies required patience and careful analysis due to their complexity.

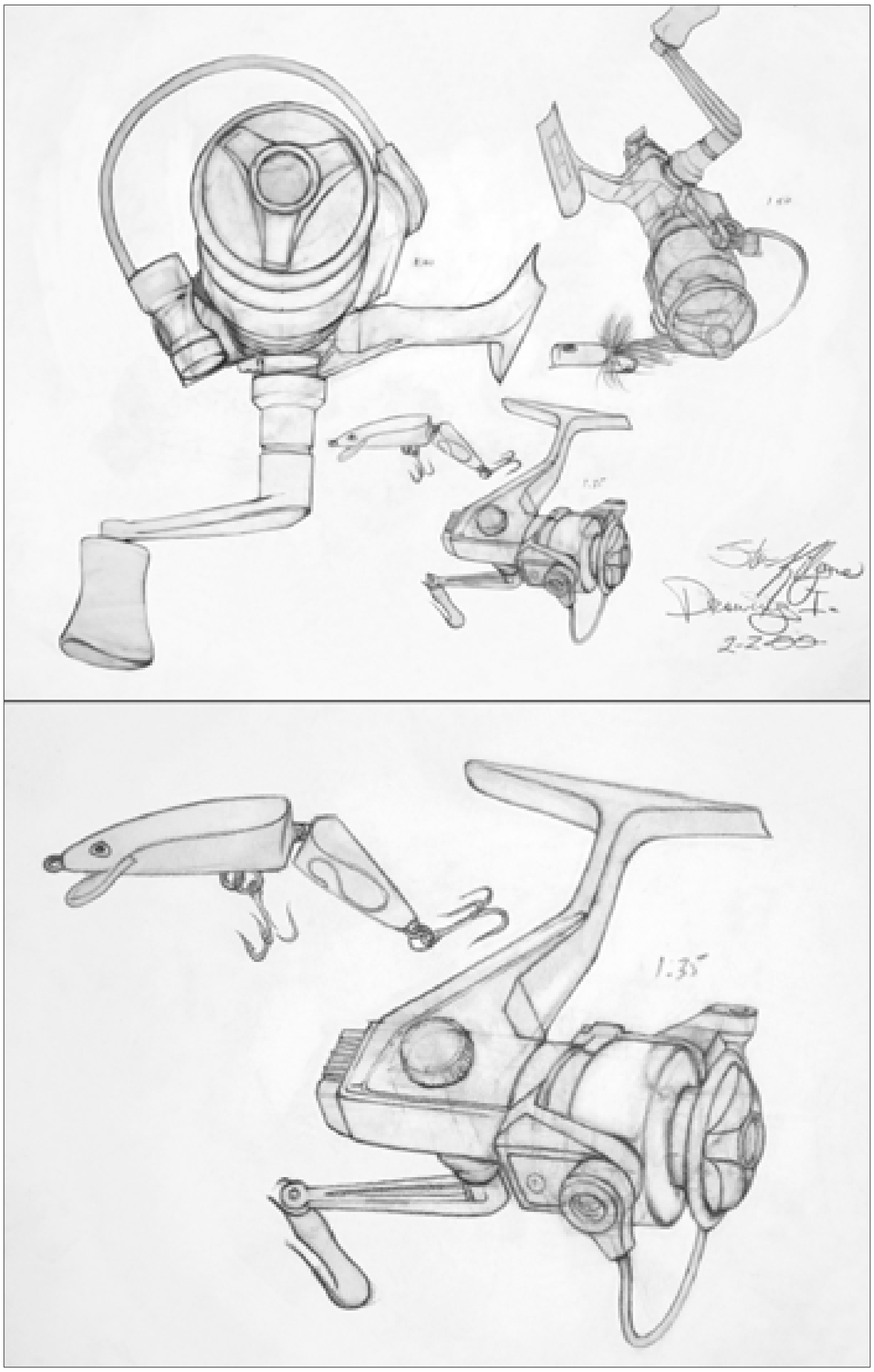


Figure 3-55. Student work. Steve Kilgore. The upper drawing shows three different views of the reel of a fishing pole and two fishing lures. The lower drawing shows a portion of the drawing in greater detail. Although construction lines are not evident in this final version of the drawing, transparent construction was used to analyze the different views of the objects.

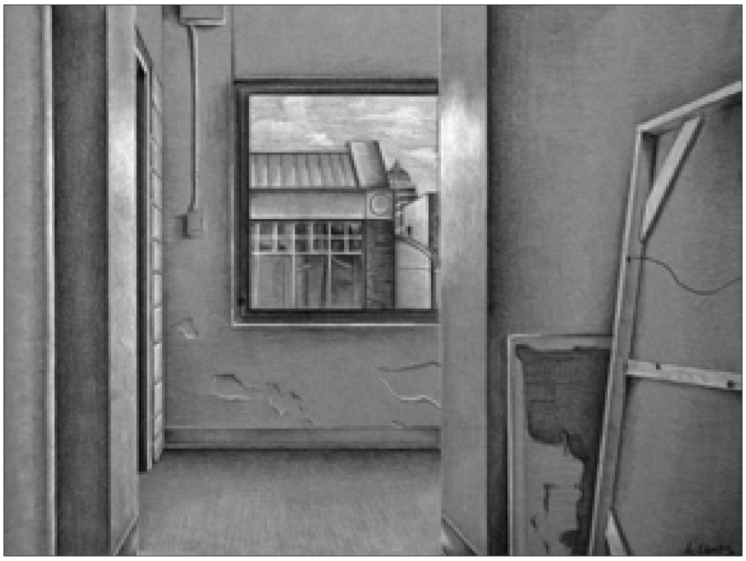


Figure 3-56. Student work. Anna Mae Kamps (Instructor: Devin DuMond). A strong working knowledge of one-point perspective supports a fully developed drawing based on direct observation.

Figure 3-57. Student work. Isaac Smith (Instructor: Patricia Constantine). A strong working knowledge of two-point perspective supports this beautiful drawing of a complex church interior based on direct observation.