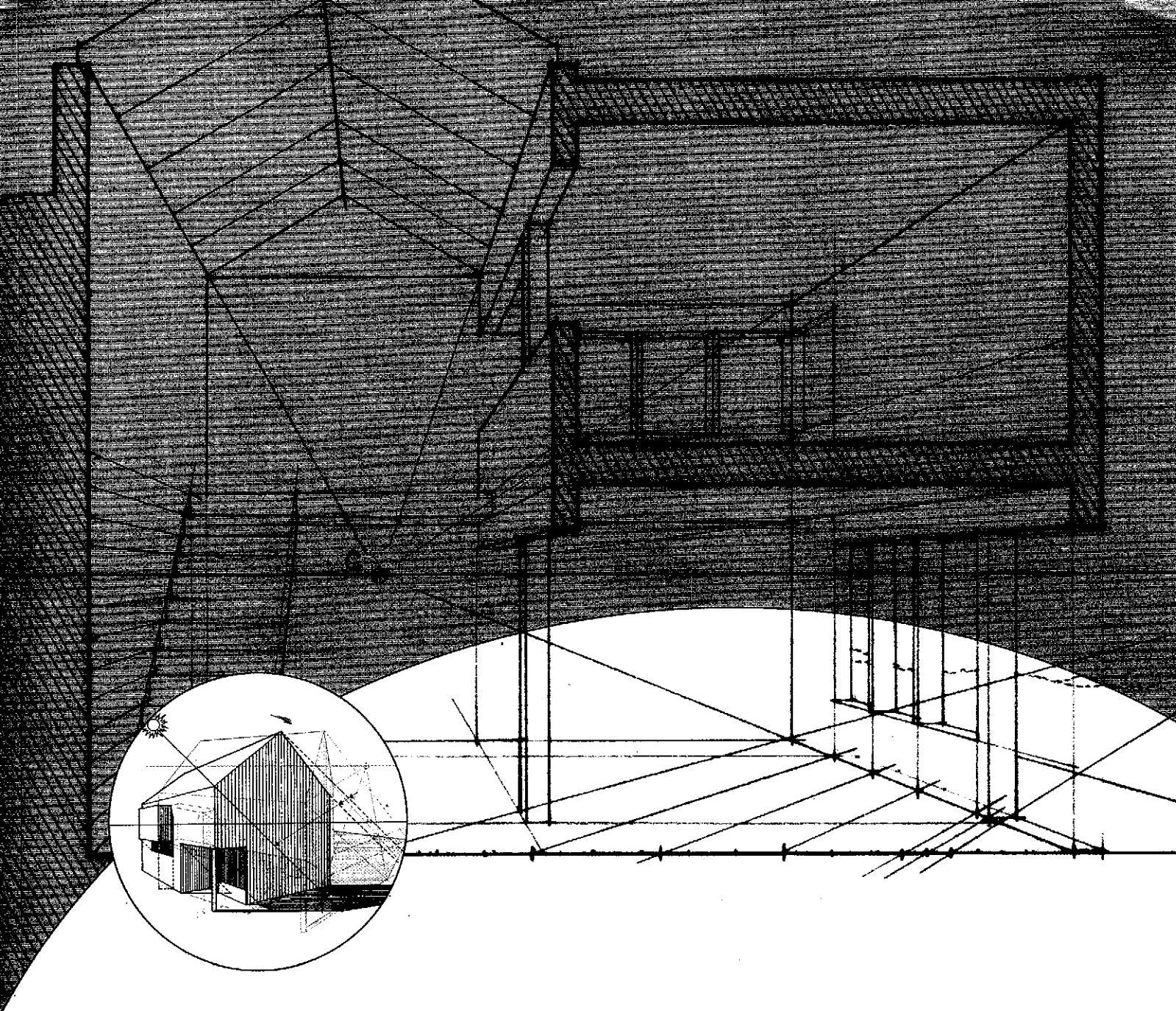
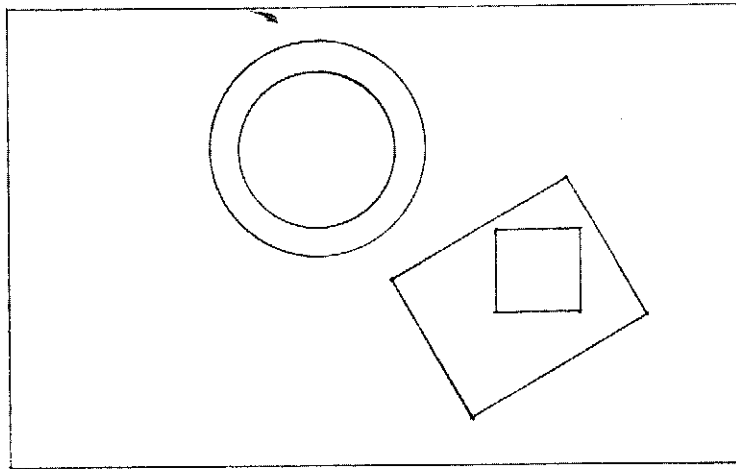
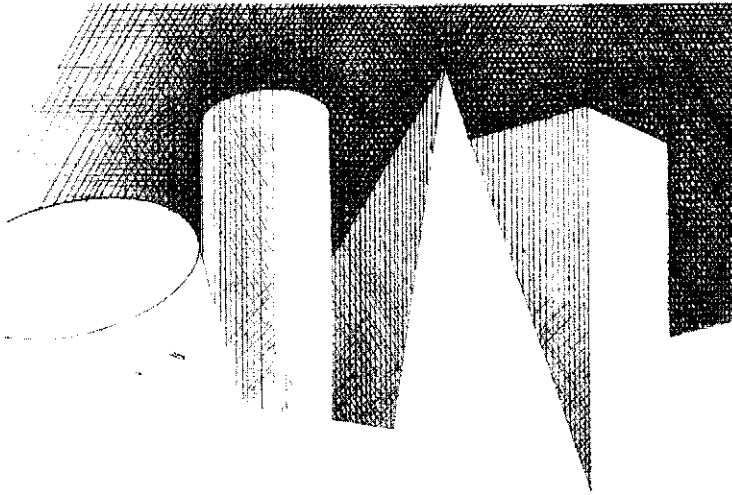




FOURTH EDITION

ARCHITECTURAL GRAPHICS

FRANCIS D.K. CHING

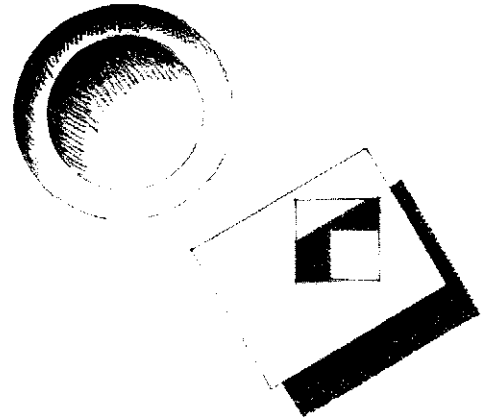


Vision results from the stimulation of nerve cells in the retina of the eye, signaling patterns of light intensity and color. Our visual system processes these patterns of light and dark, and is able to extract specific features of our environment—edges, contours, size, movement, and color. If seeing patterns of light and dark is essential to our perception of objects, then establishing contrasts in value discernible to the eye is the key to the graphic definition of light, form, and space.

Through the interplay of tonal values we are able to:

- Describe how light reveals the form of objects.

- Clarify the arrangements of forms in space.

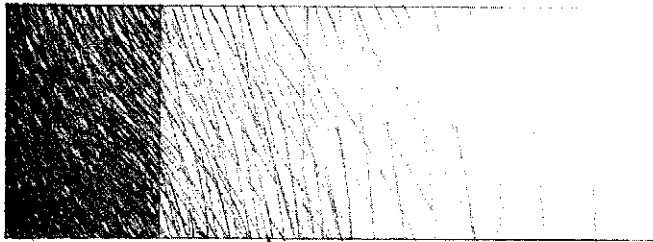
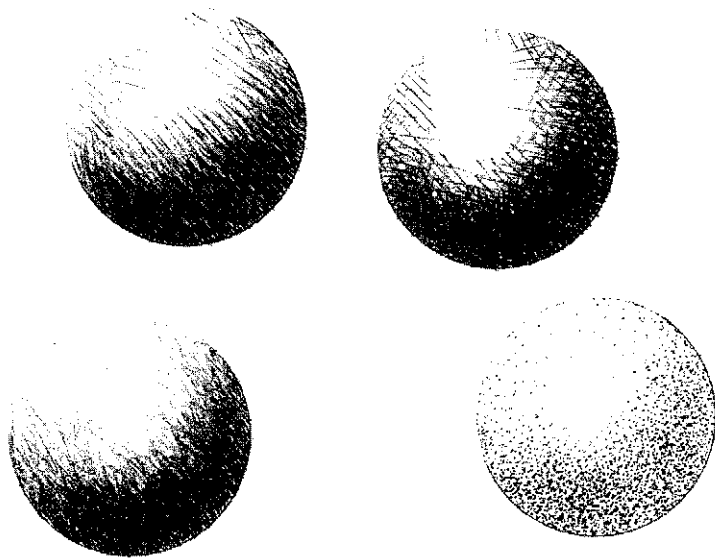


- Depict the color and texture of surfaces.

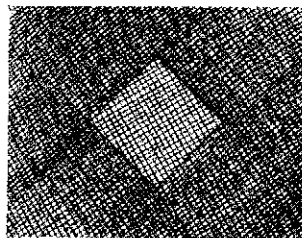
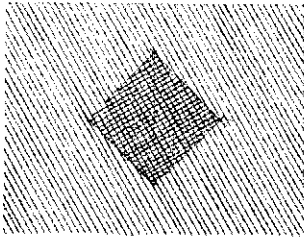
Using the traditional media of pencil and pen-and-ink to make dark marks on a light surface, there are several basic techniques for creating tonal values.

- Hatching
- Crosshatching
- Scribbling
- Stippling

These shading techniques all require a gradual building up or layering of strokes or dots. The visual effect of each technique varies according to the nature of the stroke, the medium, and the texture of the drawing surface. Regardless of the shading technique we use, we must always be fully aware of the tonal value being depicted.



- Because tonal value is expressed primarily through the relative proportion of light to dark areas on the drawing surface, the most important characteristic of these techniques is the spacing and density of the strokes or dots.



- The law of simultaneous contrast states that the stimulation of one tonal value is projected instantaneously on a juxtaposed value. For example, a tonal value superimposed upon a darker tone will appear lighter than the same value set against a lighter tone.

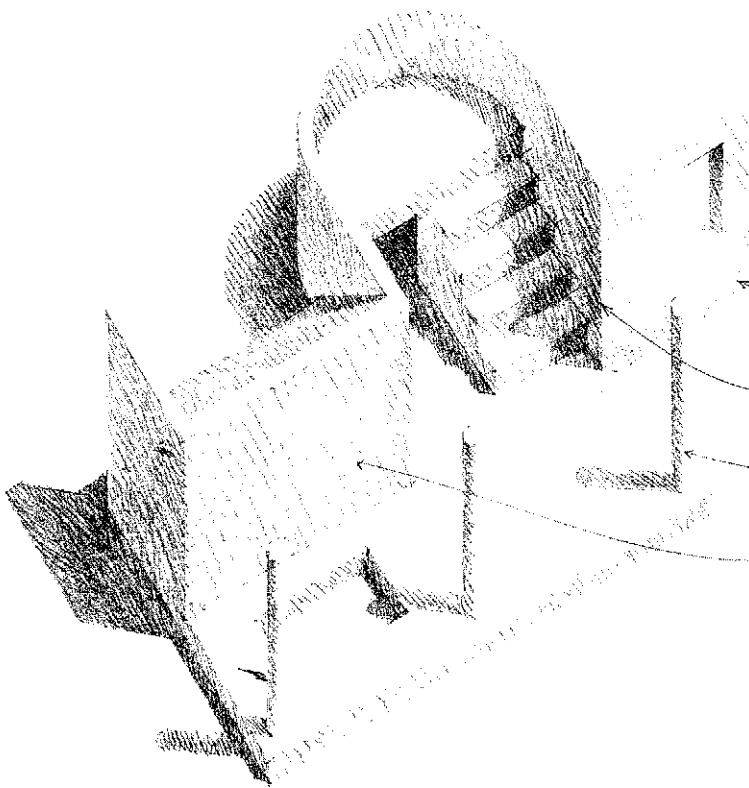


- Secondary characteristics include the visual texture, grain, and direction of the strokes.
- When rendering the darkest values, we should be careful not to lose the white of the paper. Covering the paper surface entirely can cause a drawing to lose depth and vitality.

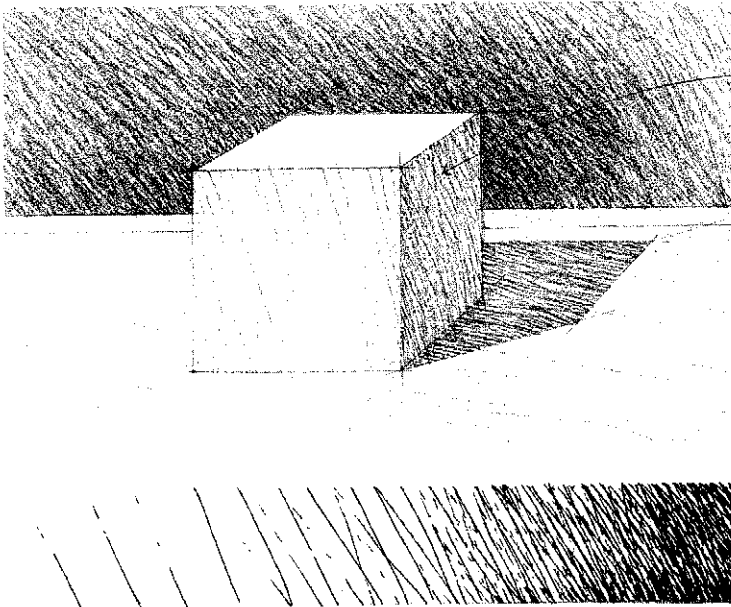
Digital Tonal Values

Paint and drawing programs usually permit colors and tonal values to be selected from a menu or palette. Image-processing software further allows the creation and application of visual textures, some of which mimic the traditional techniques outlined on the following pages.

Hatching consists of a series of more or less parallel lines. The strokes may be long or short, mechanically ruled or drawn freehand, and executed with either a pen or a pencil on smooth or rough paper. When spaced close enough together, the lines lose their individuality and merge to form a tonal value. We therefore rely primarily on the spacing and density of lines to control the lightness or darkness of a value. While thickening the linear strokes can serve to deepen the darkest values, using too thick of a line can result in an unintentional coarseness and heaviness of texture.

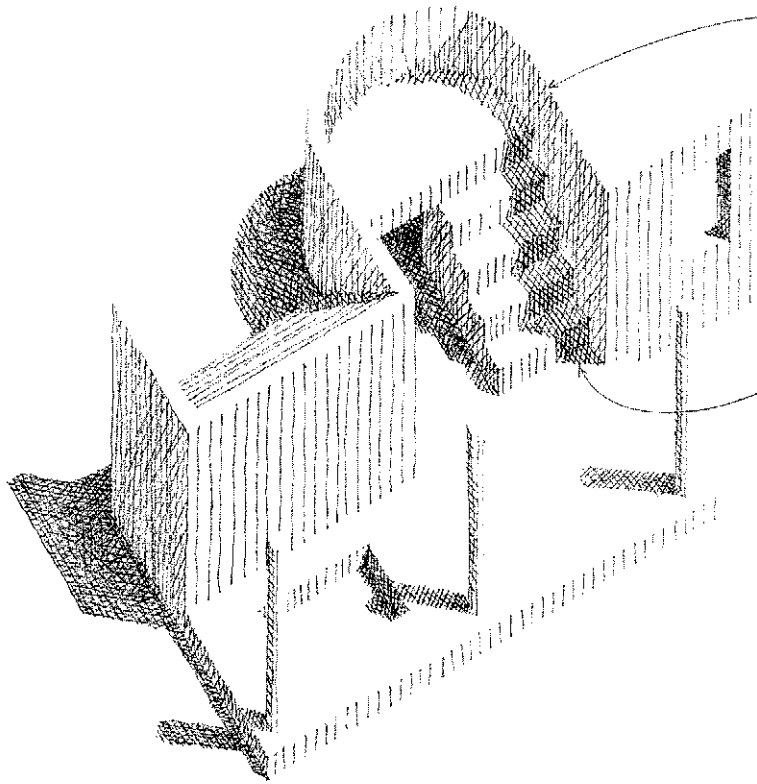


- The most flexible freehand technique for hatching utilizes relatively short diagonal strokes.
- To define a precise edge, fix the beginning of each stroke with slight pressure.
- Feather the ends of the strokes to depict curved surfaces, a texture gradient, or subtleties of light and shade.
- When extending a tonal value over a large area, avoid the effect of banding by softening the edges and overlapping each set of strokes in a random manner.
- By applying additional layers of diagonal strokes at only slightly different angles to the preceding sets, we can build up the density, and therefore the tonal value, of an area. Maintaining the diagonal direction of the strokes in this manner avoids confusion with the underlying drawing and unifies the various tonal areas of a drawing composition.

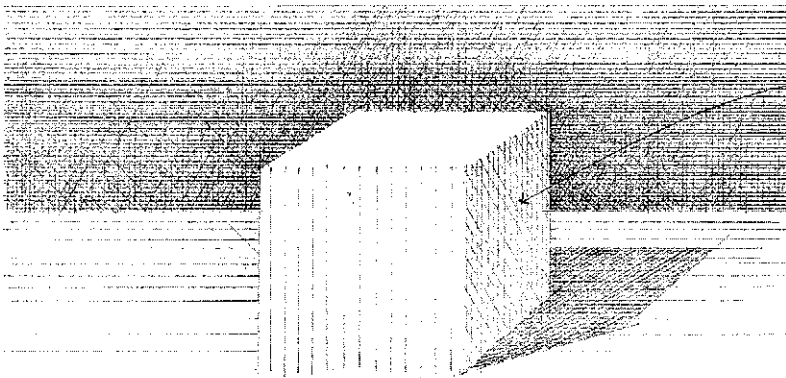


- The direction of hatching can also follow the contours of a form and emphasize the orientation of its surfaces. Remember that direction alone, however, has no impact on tonal value. With texture and contour, the series of lines can also convey material characteristics, such as the grain of wood, the marbling of stone, or the weave of fabric.
- Do not attempt to produce a range of values by varying the grade of lead. Be careful not to use too dense a grade of lead or press so hard that the pencil point embosses the drawing surface.
- Unlike a pencil line, the tonal value of an ink line remains constant. You can only control the spacing and density of the hatching.

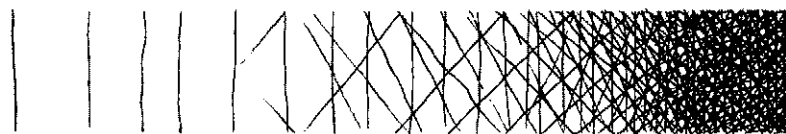
Crosshatching utilizes two or more series of parallel lines to create tonal values. As with hatching, the strokes may be long or short, mechanically ruled or drawn freehand, and executed with either a pen or a pencil on smooth or rough paper.



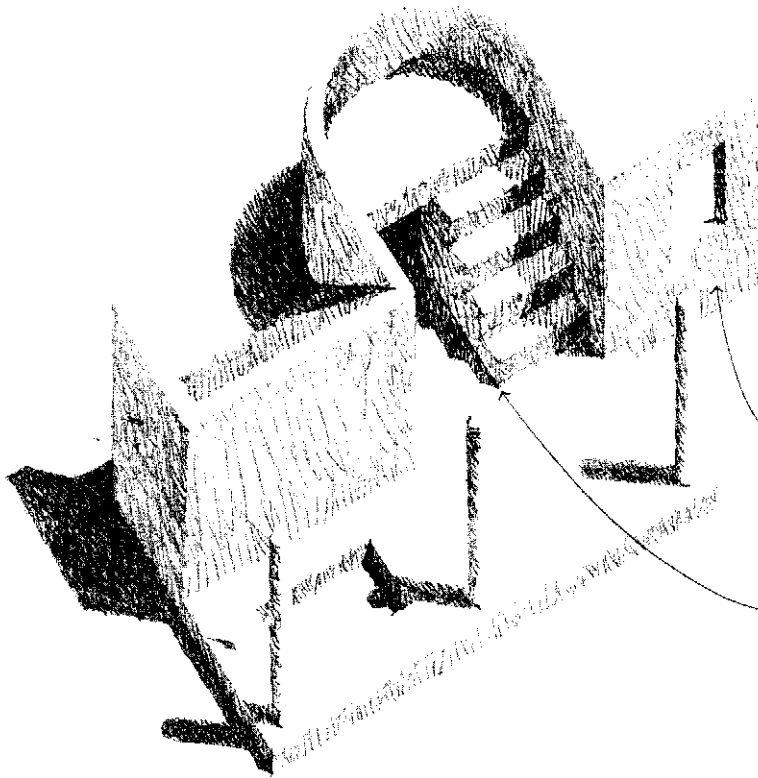
- The simplest crosshatching consists of two intersecting sets of parallel lines.
- While the resulting weave may be appropriate for describing certain textures and materials, the pattern can also produce a stiff, sterile, and mechanical feeling, especially when the lines are ruled and widely spaced.
- Using three or more sets or layers of hatching provides more flexibility in generating a greater range of tonal values and surface textures. The multidirectional nature of the hatching also makes it easier to describe the orientation and curvature of surfaces.



- In practice, hatching and crosshatching are often combined into a single technique. While simple hatching creates the lighter range of values in a drawing, crosshatching renders the darker range.

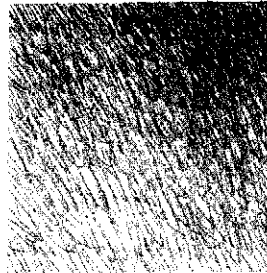
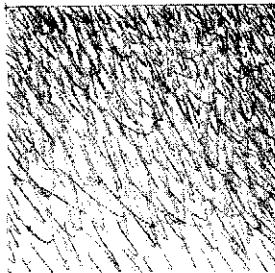


Scribbling is a shading technique that involves drawing a network of random, multidirectional lines. The freehand nature of scribbling gives us great flexibility in describing tonal values and textures. We can vary the shape, density, and direction of the strokes to achieve a wide range of tonal values, textures, and visual expression.



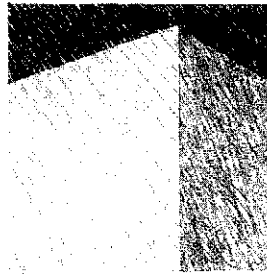
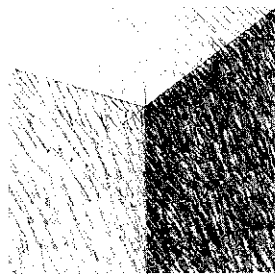
The strokes may be broken or continuous, relatively straight or curvilinear, jagged or softly undulating.

By interweaving the strokes, we create a more cohesive structure of tonal value.

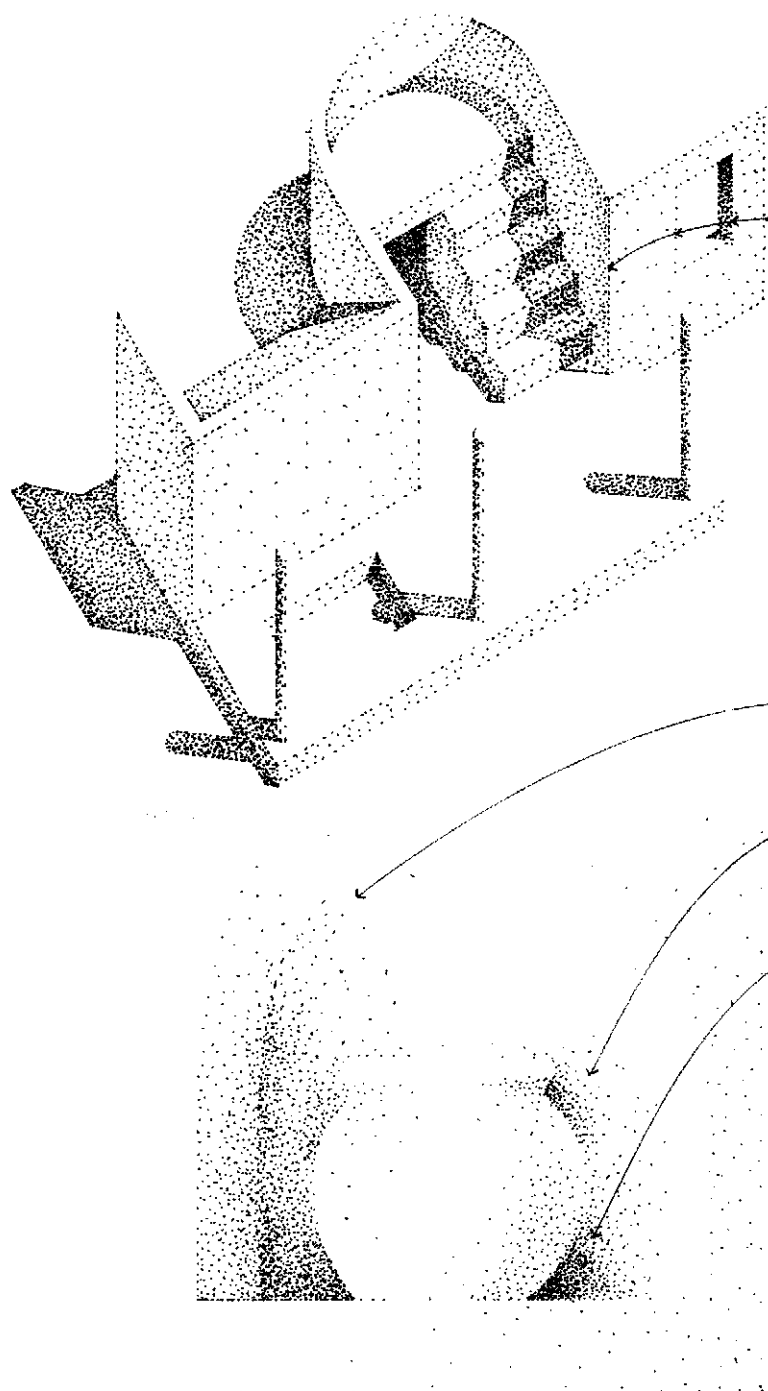


By maintaining a dominant direction, we produce a grain that unifies the various areas and shades of value.

As with hatching, we have to pay attention to both the scale and density of the strokes, and be aware of the qualities of surface texture, pattern, and material they convey.



Stippling is a technique for shading by means of very fine dots. Applying stippling is a slow and time-consuming procedure that requires the utmost patience and care in controlling the size and spacing of the dots. The best results occur when using a fine-tipped ink pen on a smooth drawing surface.

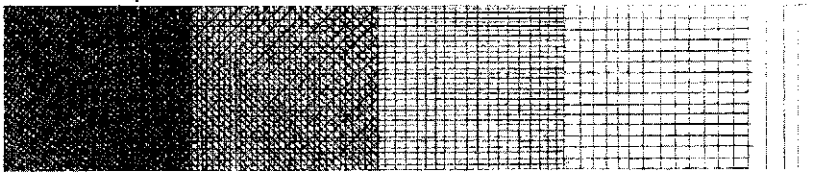


- We use stippling to establish tonal values in pure-tone drawings—drawings that rely on value alone to define edges and contours. The procedure involves applying stippling over faintly drawn shapes of the areas to be toned.
- Because there are no object lines to describe contour and shape in a pure-tone drawing, we must rely on a series of dots to profile spatial edges and define the contours of forms. We use tightly spaced dots to define sharp, distinct edges, and a looser spacing of dots to imply softer, more rounded contours.
- We first cover all shaded areas with an even spacing of dots to create the lightest value.
- Then we establish the next value step with additional stippling.
- We continue to add stippling in a methodical manner until the darkest tonal values are established.
- Resist the temptation to deepen a value by enlarging the dots. If the scale of the dots is too large for the toned area, too coarse a texture will result.

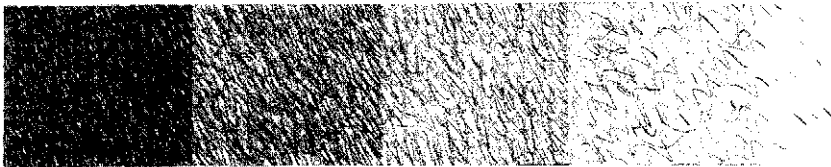
White represents the lightest possible value and black the darkest. In between exists an intermediate range of grays. A familiar form of this range is represented by a value or gray scale having ten equal gradations from white to black. It is worthwhile to practice producing both a stepped series and a graduated scale of tonal values using a variety of media and techniques.



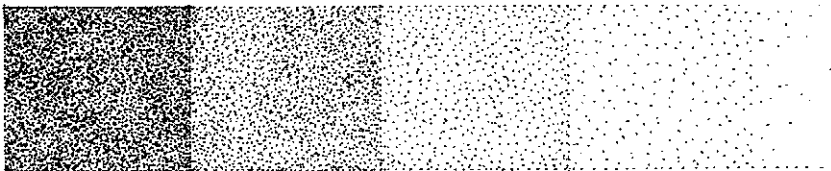
Hatching



Cross-hatching



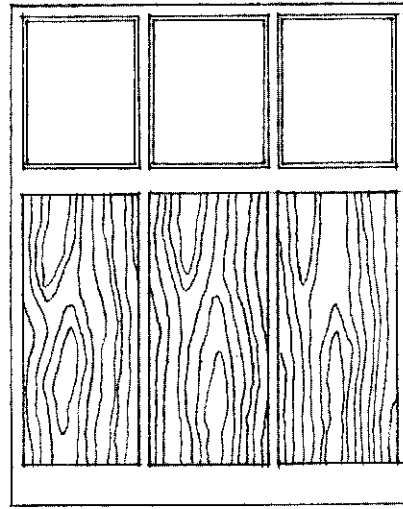
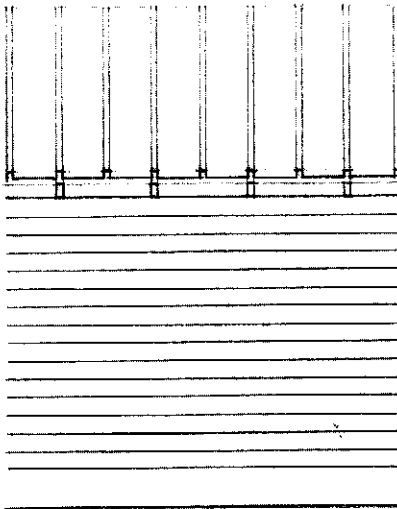
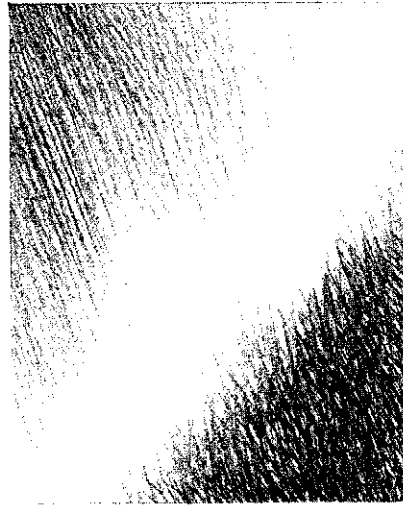
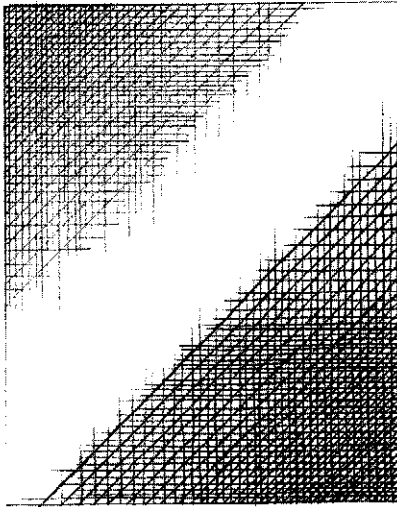
Scribble



Stippling

- Note that a series of dots rather than a line defines the edge of the field.
- It is also possible to execute a gray scale on a tinted or colored surface, using a black pencil to define values darker than the tone of the surface and a white pencil to establish the lighter values.

We use the term “texture” most often to describe the relative smoothness or roughness of a surface. It can also describe the characteristic surface qualities of familiar materials, as the hewn appearance of stone, the grain of wood, and the weave of a fabric. This is tactile texture that can be felt by touch.



Our senses of sight and touch are closely intertwined. As our eyes read the visual texture of a surface, we often respond to its apparent tactile quality without actually touching it. We base these physical reactions on the textural qualities of similar materials we have experienced in the past.

- Whenever we use hatching or stippling to create a tonal value, we simultaneously create visual texture.

- Likewise, as soon as we begin to describe the nature of a material with lines, we simultaneously create a tonal value.

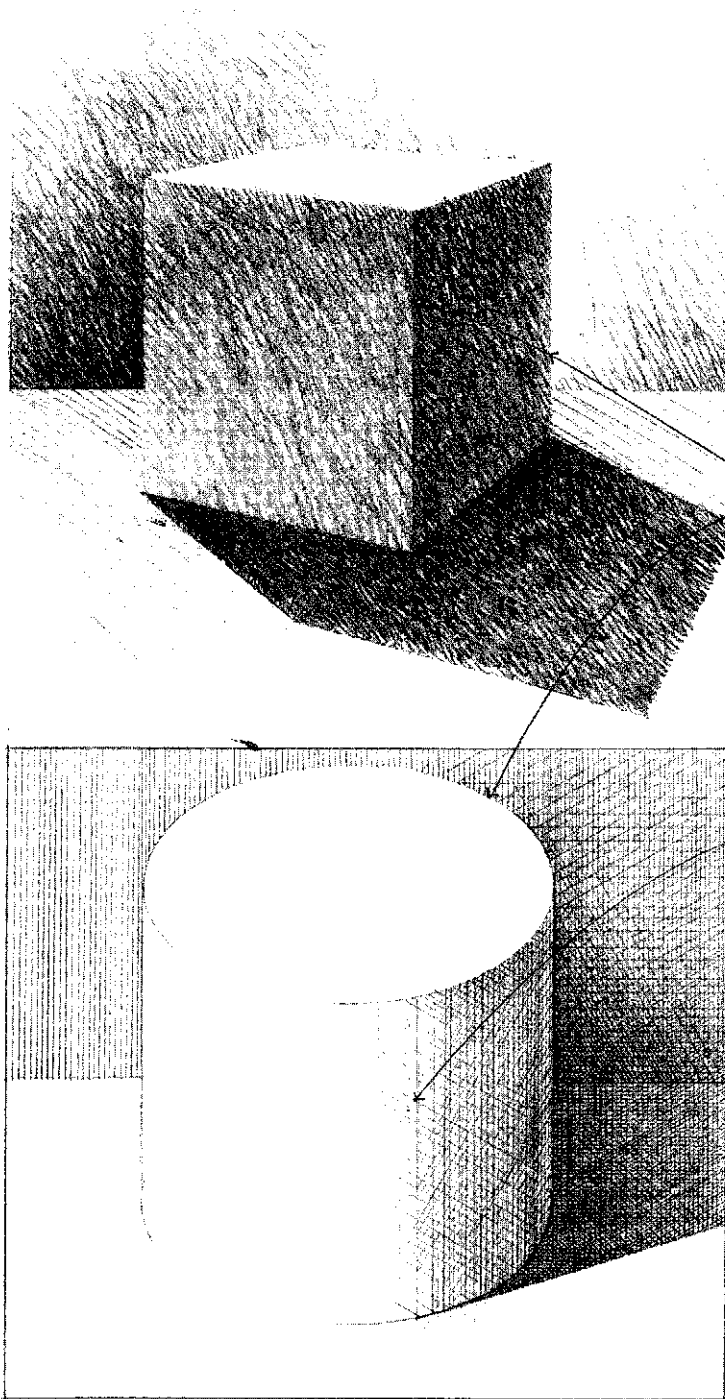
- We should always be aware of this relationship between tonal value and texture, whether smooth or rough, hard or soft, polished or dull. In most cases, tonal value is more critical than texture to the representation of light, shade, and the way they model forms in space.

"Modeling" refers to the technique of rendering the illusion of volume, solidity, and depth on a two-dimensional surface by means of shading. Shading with tonal values extends a simple drawing of contours into the three-dimensional realm of forms arranged in space.

Since the definition of edges gives rise to shape recognition, we look to edges to discover the configuration of the surfaces of a three-dimensional form. We must therefore be careful how we define the nature of the edge or boundary wherever two shapes of contrasting values meet. The skillful manipulation of tonal edges is critical to defining the nature and solidity of a surface or object.

• Hard edges delineate sharp, angular breaks in form or describe contours that are separated from the background by some intervening space. We define hard edges with an abrupt and incisive shift in tonal value.

• Soft edges describe indistinct or vague background shapes, gently curving surfaces and rounded forms, and areas of low contrast. We create soft edges with a gradual change in tonal value or diffuse tonal contrast.

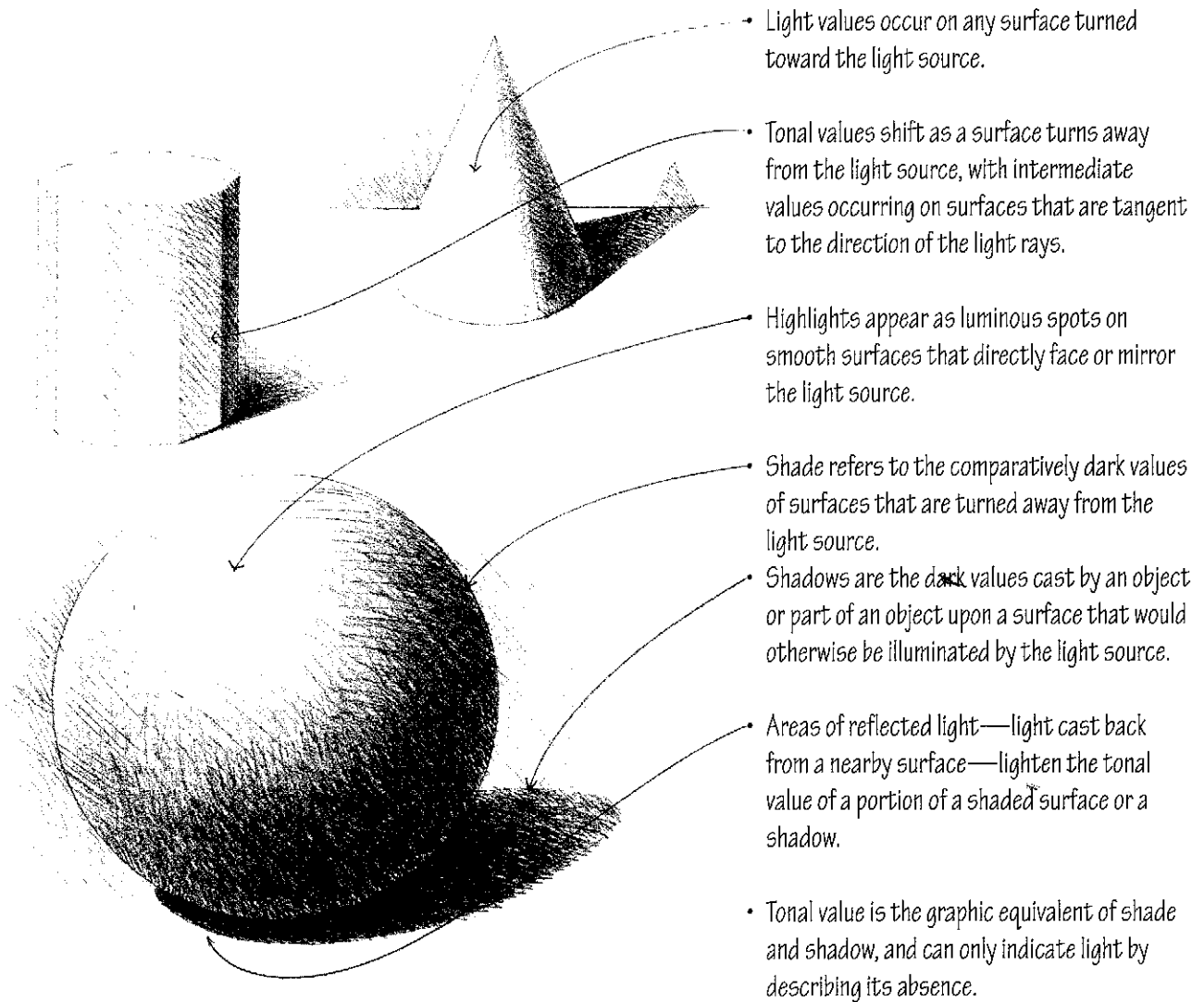


Digital Modeling

It is relatively easy to create three-dimensional digital models, and to apply complex algorithms for lighting and applying textures and materials to the surfaces of the models. At times, the photorealistic capabilities of graphics software can be distracting, leaving nothing to the viewer's imagination.

While tonal values can imply depth on a flat drawing surface, we turn to light to more vividly describe the three-dimensional qualities of forms and spaces in our environment. Light is the radiant energy that illuminates our world and enables us to see three-dimensional forms in space. We do not actually see light but rather the effects of light. The way light falls on and is reflected from a surface creates areas of light, shade, and shadow, which give us perceptual clues to the surface's three-dimensional qualities.

The light-and-dark patterns we see emanate from the interaction of light with the objects and surfaces around us. Within these patterns of light and dark shapes, we can recognize the following elements:

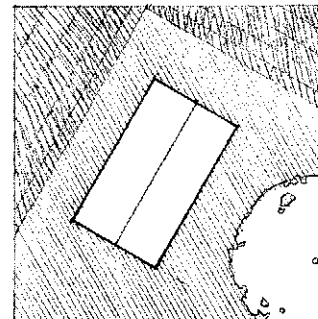
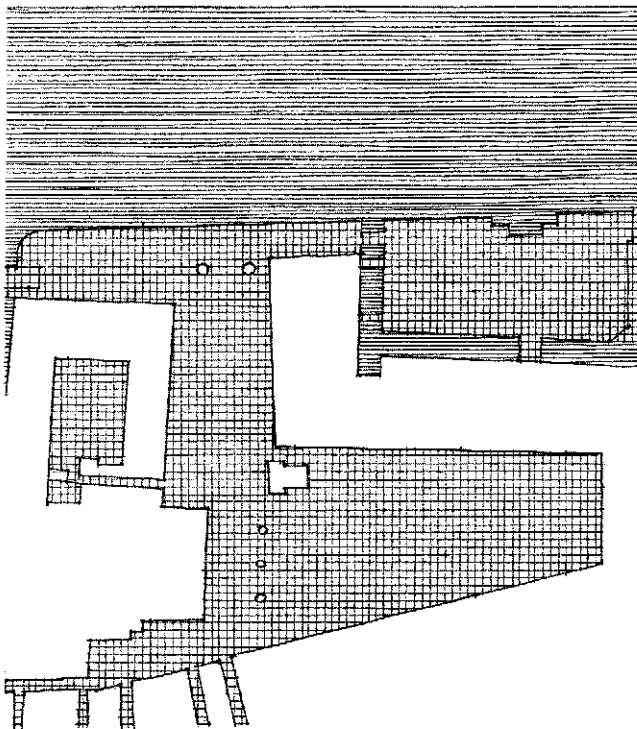
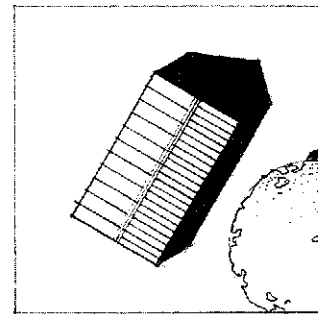
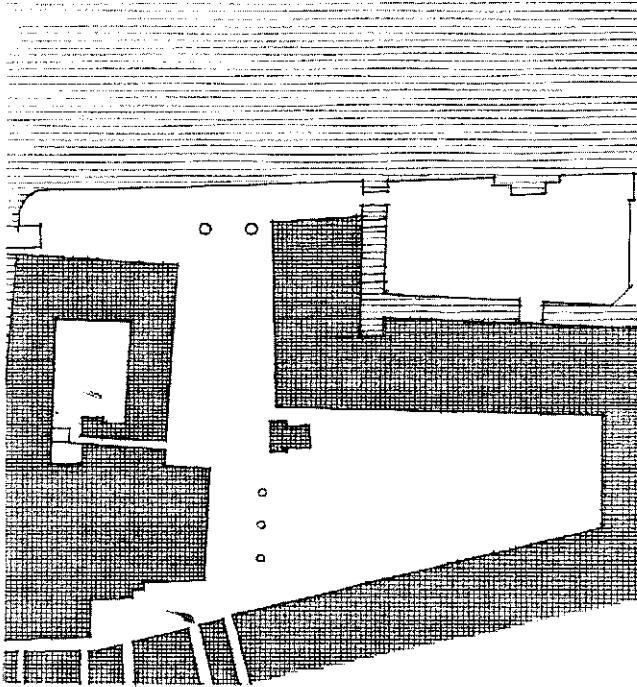


Digital Lighting

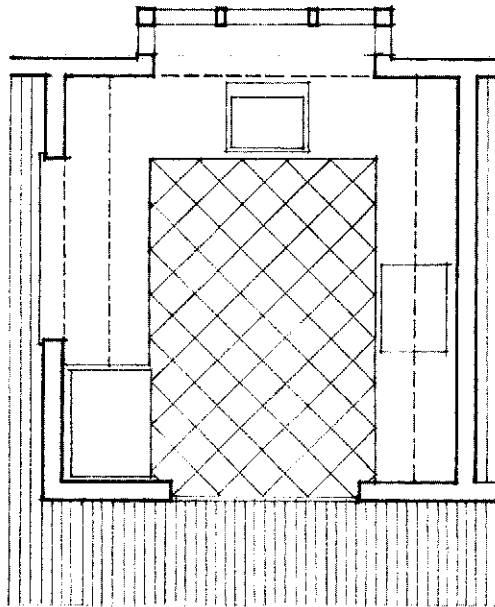
Modeling and rendering software enable us to specify the orientation of the sun in order to study the solar responsiveness of a design. We can also designate the number and type of light sources to simulate the lighting within a space. These simulations, however, are often only approximations of the effects of point sources and their energy distribution profiles. Judgment of the end result, therefore, whether produced by hand or the computer, remains the responsibility of the illustrator.

The drawings on this and the following seven pages illustrate how we can use tonal values to enhance spatial depth and focus attention in various types of architectural drawing.

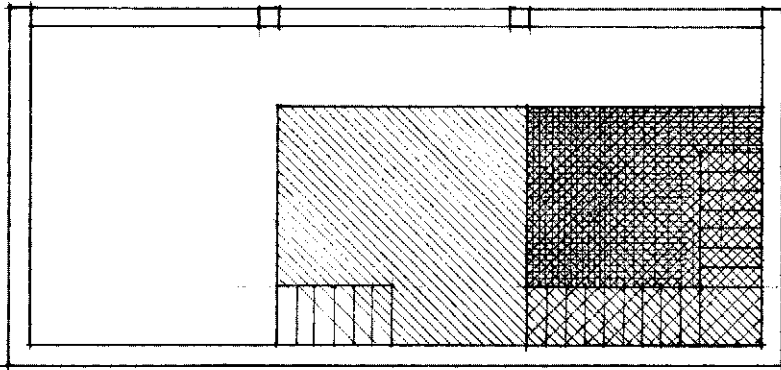
- We use tonal values in site plan drawings to define the relationship between the form of a building and its spatial context. These two drawings of the Piazza San Marco in Venice illustrate how the tonal contrast can be achieved either by rendering the building as a dark figure against a light background or by reversing the figure-ground relationship and rendering the tonal values of the site.
- See also the site plans illustrated on page 53.



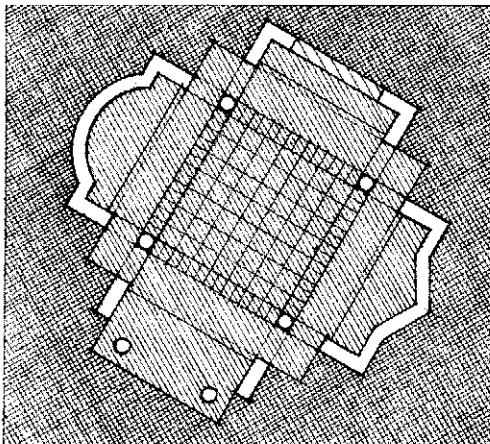
The principal use of tonal values in floor plans is to emphasize the shape and arrangement of cut elements.



- Rendering the floor surface in a plan drawing with a material pattern will give that plane both a textural and a tonal value. These values can effectively isolate and provide a base for elements that are situated above the floor plane.

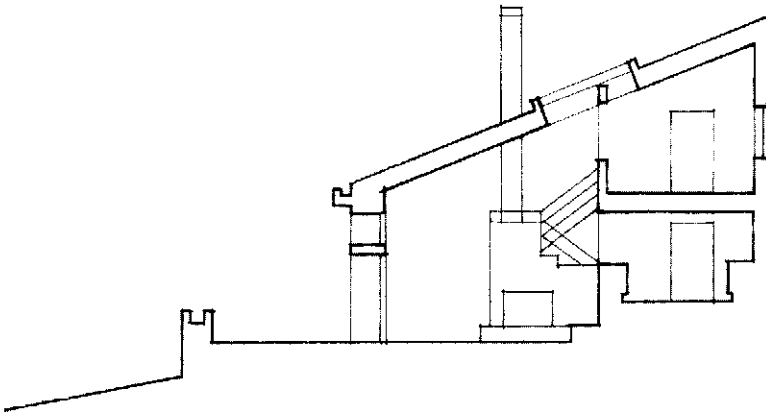


- When a plan drawing has several floor levels within its field, varying the intensity of the tonal values can help convey the relative depth of the floor planes below the plan cut. The lower the floor plane, the darker its value.

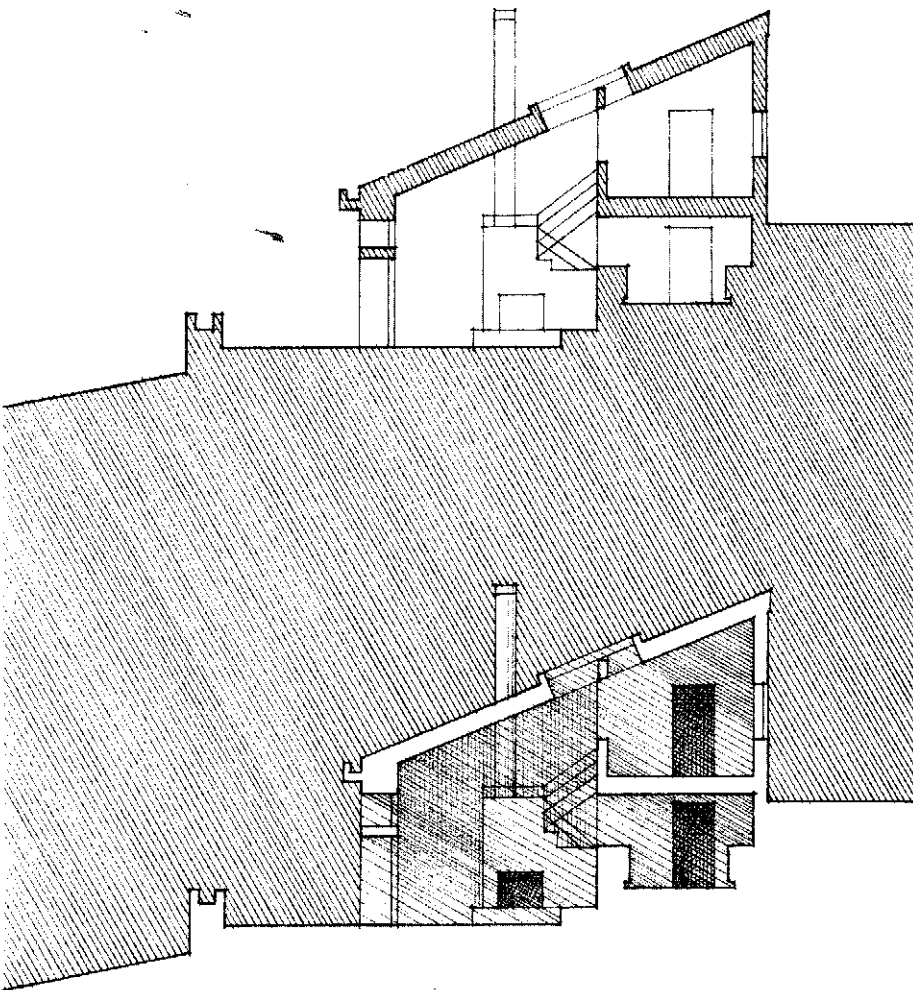


- If the space defined in a plan drawing is given a tonal value along with the surrounding field, the cut elements can be left white or be given a very light value. Be sure, however, that there is sufficient contrast to emphasize the dominance of the cut elements. If necessary, outline the cut elements with a heavy line weight.

We use tonal values in section drawings to establish contrast between the cut elements and what is seen in elevation beyond the plane of the cut.



- The top drawing uses a heavy line weight to outline the cut elements.



- The center drawing projects the cut elements forward with a dark value.
- The bottom drawing reverses the value system and renders the cut elements as light figures against a dark field.
- Note that in the latter two cases, the relationship of the building to the supporting ground mass is clearly indicated by the manner in which the ground is given a value similar to that of the cut elements of the building.

We use contrasting tonal values in elevation drawings to define layers of spatial depth. The most important distinctions to establish are between the cut through the ground plane in front of the building elevation and the building itself, and between the building elevation and its background.



- First, contrasting values for the foreground and background are established.
- Elements are projected forward by having their tonal contrasts defined more sharply and by having their materials, textures, and details drawn more distinctly.
- Areas are pushed into the background by diminishing contrast and detail.
- See pages 145–48 for using shade and shadows to clarify the relative depth of projections and recesses within the massing of a building.