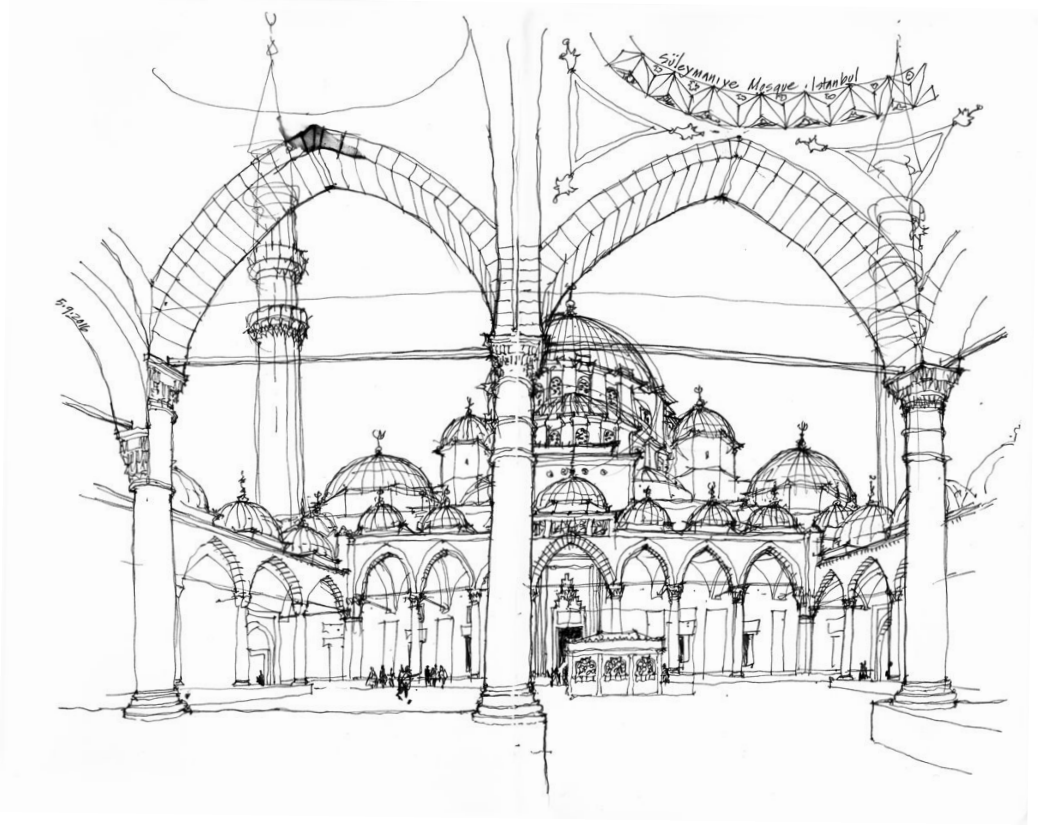
FRANCIS D. K. CHING
WITH STEVEN P. JUROSZEK

DESIGN DRAWING

THIRD EDITION



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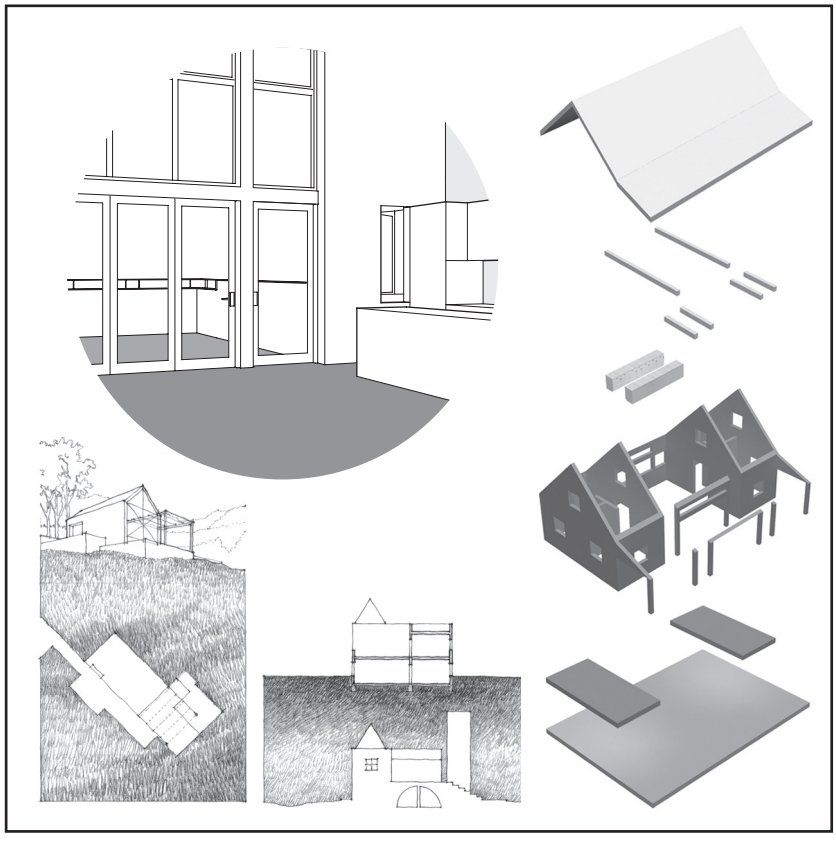

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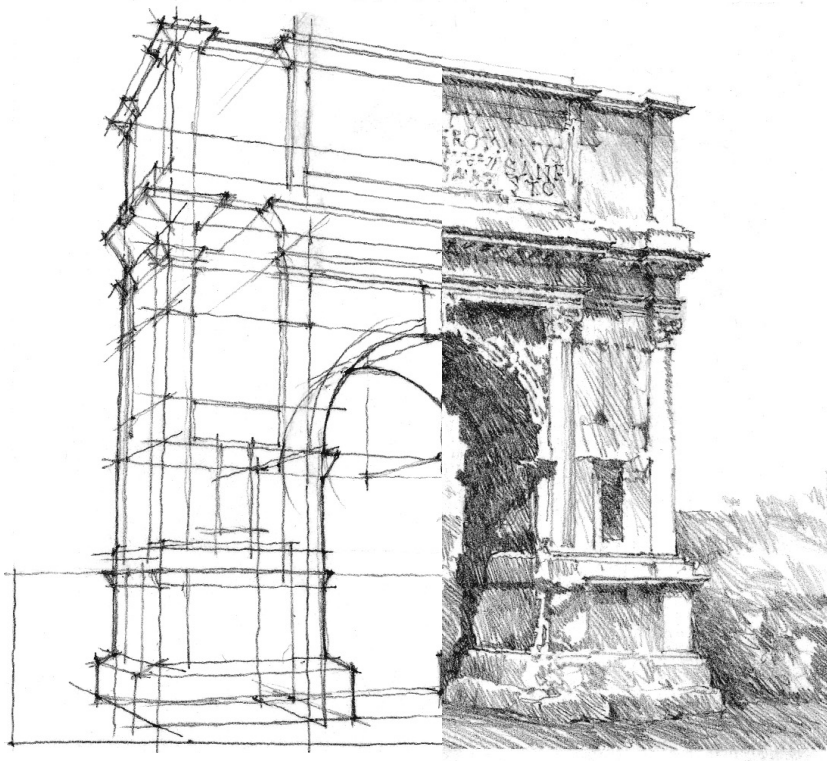
PREFACE TO THE THIRD EDITION



This is a comprehensive drawing manual for students of architecture, interior design, and related design disciplines. Drawing guides typically range from beginning texts on how to draw certain subjects, such as landscapes or the human figure, to more advanced treatises on drawing as art. Some focus on a specific medium, such as pencil or pen-and-ink; others dwell on a particular technique, such as perspective drawing. Further, the discussion is often limited to learning how to draw from observation. This book is based on the premise that drawing is central to the design process. It therefore focuses on drawing as a medium for visualizing and communicating design ideas.

The work begins with an introduction to the drawing process, which involves seeing, imagining, and representing. The remaining content is divided into three parts. *Part 1: Drawing from Observation* introduces the graphic elements that constitute the vocabulary of drawing—line, shape, tone, form, and space. This largely remains the province of freehand drawing because we can best learn to see, understand, and represent these elements through direct examination.

Part 2: Drawing Systems describes the formal systems for representing three-dimensional objects and space, which constitute the language of design drawing. Regardless of the drawing medium or technique we use, each system represents a uniquely different way of seeing and describing the visible world that we experience directly, or a future world that we imagine in design.

Part 3: Drawing from the Imagination addresses issues that arise as we think in a speculative manner to stimulate the design process, develop our design ideas through drawing, and plan how to present our design proposals in the best possible light. It is in this arena where digital drawing and modeling tools have made major advances, both in academia and the profession.

Accompanying each section are a series of short exercises for developing skills and suggestions for longer projects that test the understanding and application of concepts. Like any discipline, drawing takes perseverance and regular exercise to develop mastery and fluency. The information in this manual cannot be received passively but must be learned by actively participating in the process of drawing.

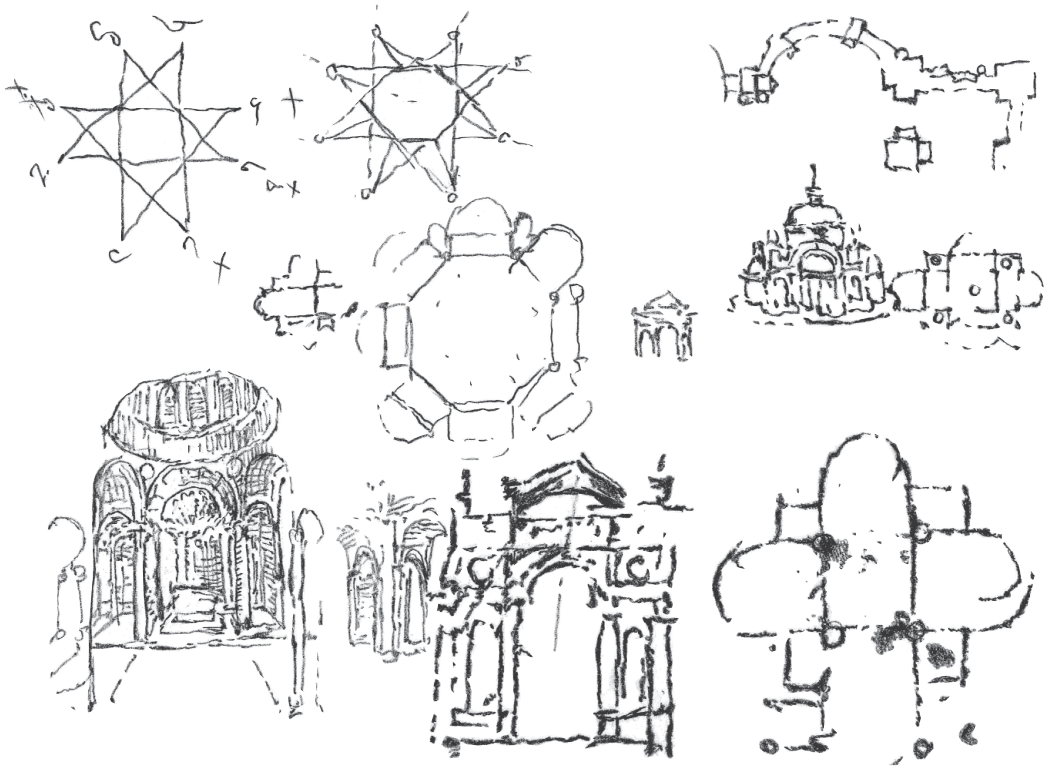
The emphasis remains on drawing by hand, which is the most direct and intuitive means we have to express our visual thoughts and perceptions. Through the tactile nature of drawing in direct response to our visual thoughts and perceptions, we develop an understanding of spatial concepts and the critical ability to think and visualize in three dimensions.

Nevertheless, we cannot ignore the advances in computer technology that have significantly altered the process of architectural drawing and design. Current graphics software ranges from 2D drawing programs to 3D surface and solid modelers that aid in the design and representation of buildings, from small houses to large and complex structures. It is therefore important to acknowledge the unique opportunities and challenges digital tools offer in the production of architectural graphics. While the second edition augmented the material in the first edition with discussions and examples of digital graphic techniques where appropriate to the task at hand, this third edition goes further and provides more examples of strictly digital as well as hybrid processes of producing drawings in the design process.

Whether a drawing is executed by hand or developed with the aid of a computer, the standards and judgments governing the effective communication of design ideas in architecture remain the same, just as the rules of spelling, grammar and punctuation for the written language remain applicable, whether jotted by hand traditionally, typed on a manual or electric typewriter, or entered by keyboard into a word processor.

Introduction

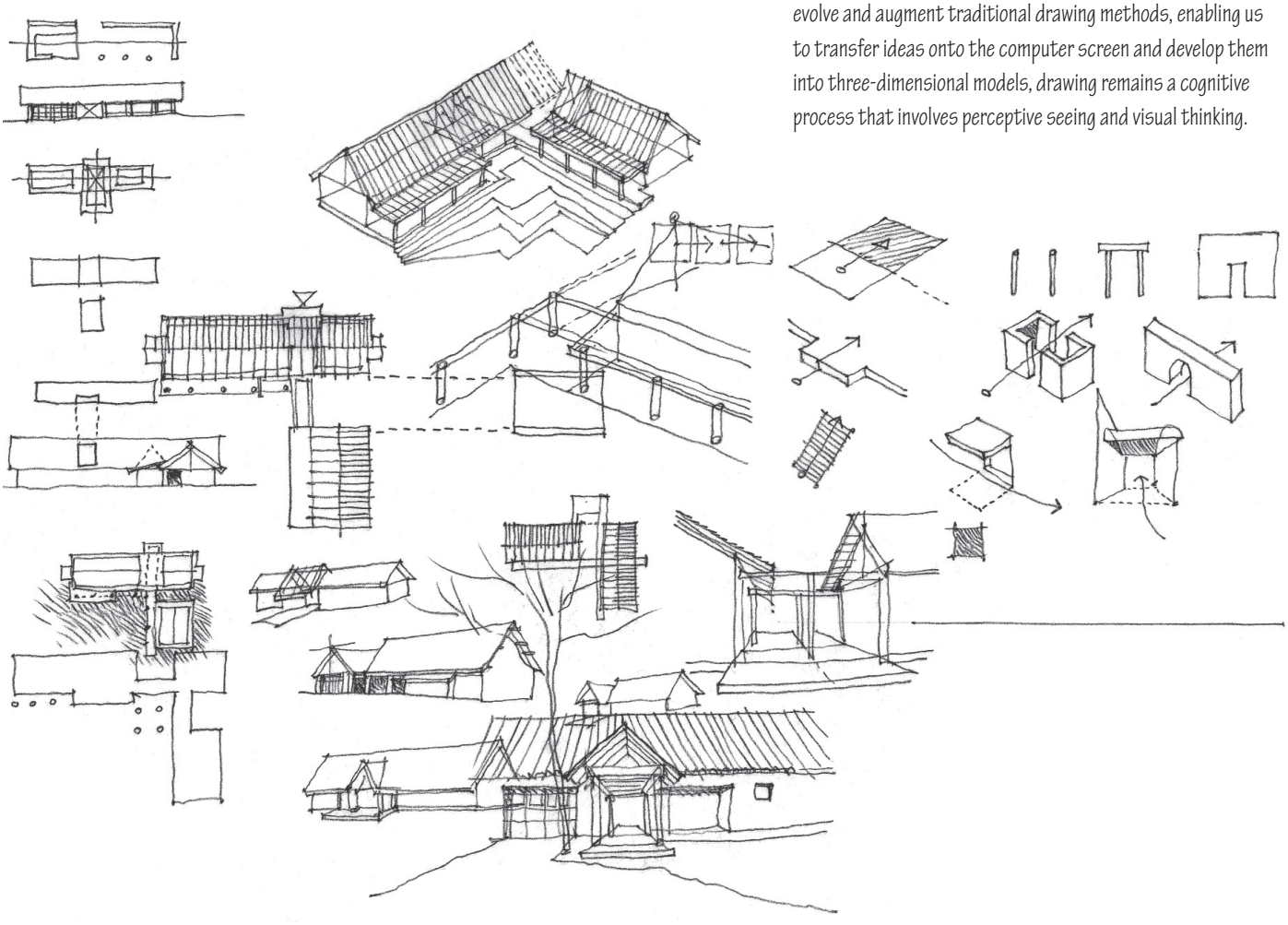
Drawing is the process or technique of representing something—an object, scene, or idea—by making lines on a surface. This definition implies that delineation is different from painting and the coloring of surfaces. While drawing is generally linear in nature, it may include other pictorial elements, such as dots and brush strokes, which can also be interpreted as lines. Whatever form a drawing takes, it is the principal means by which we organize and express our visual thoughts and perceptions. We therefore regard drawing not only as artistic expression but also as a practical tool for formulating and working through design problems.



DESIGN DRAWING

The term *design drawing* brings to mind the presentation drawings used to persuade the viewer of the merits of a design proposal. Also familiar are the construction or working drawings that provide graphic instructions for producing or building a project. But designers use both the process and products of drawing in other ways as well. In design, the role of drawing expands to include recording what exists, working out ideas, and speculating about and planning for the future. Throughout the design process, we use drawing to develop an idea from concept to proposal to constructed reality.

To learn how to draw and to use drawing effectively as a design instrument, it is necessary to acquire certain fundamental skills, such as inscribing lines and laying down tonal values. Over time and with enough practice, anyone can learn these techniques. Skillful technique is of little value, however, unless accompanied by understanding of the perceptual principles on which these techniques are based. Even as digital drawing tools evolve and augment traditional drawing methods, enabling us to transfer ideas onto the computer screen and develop them into three-dimensional models, drawing remains a cognitive process that involves perceptive seeing and visual thinking.



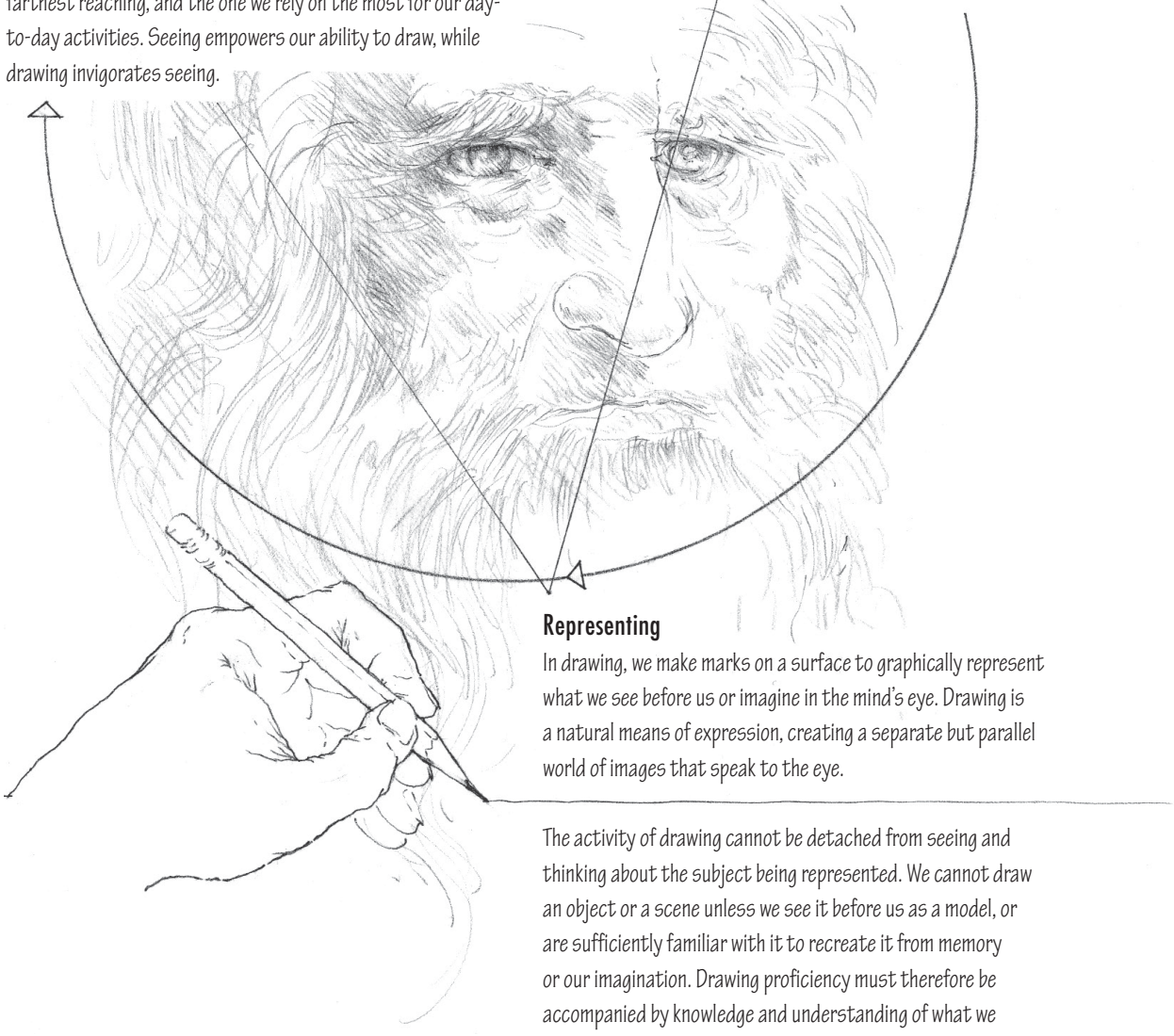
At the heart of all drawing is an interactive process of seeing, imagining, and representing images. Seeing creates the images of external reality we perceive with our eyes open, which give rise to our discovery of the world. With our eyes closed, the mind's eye presents images of an inner reality—visual memories of past events or projections of an imagined future. And then there are the images we create on paper, drawings that we use to express and communicate our thoughts and perceptions.

Seeing

Vision is the primary sensory channel through which we make contact with our world. It is our best-developed sense, the farthest reaching, and the one we rely on the most for our day-to-day activities. Seeing empowers our ability to draw, while drawing invigorates seeing.

Imagining

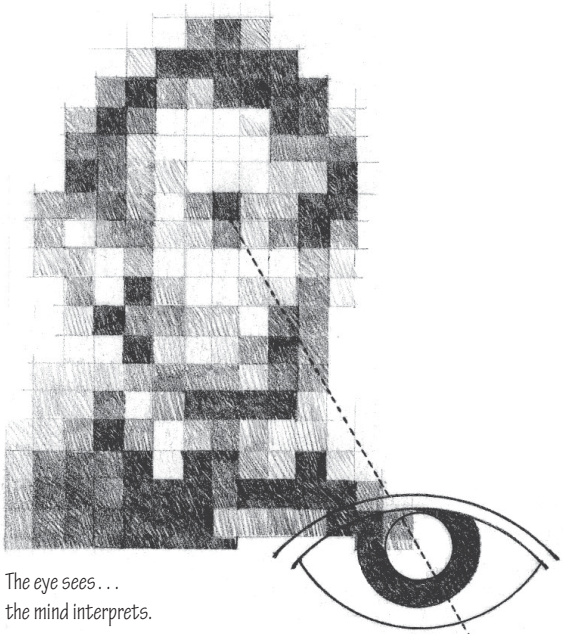
The visual data received by the eye is processed, manipulated, and filtered by the mind in its active search for structure and meaning. The mind's eye creates the images we see, and these are the images we attempt to represent in drawing. Drawing is therefore more than a manual skill; it involves visual thought that stimulates the imagination, while imagining provides impetus for drawing.



Representing

In drawing, we make marks on a surface to graphically represent what we see before us or imagine in the mind's eye. Drawing is a natural means of expression, creating a separate but parallel world of images that speak to the eye.

The activity of drawing cannot be detached from seeing and thinking about the subject being represented. We cannot draw an object or a scene unless we see it before us as a model, or are sufficiently familiar with it to recreate it from memory or our imagination. Drawing proficiency must therefore be accompanied by knowledge and understanding of what we endeavor to represent in graphic form.



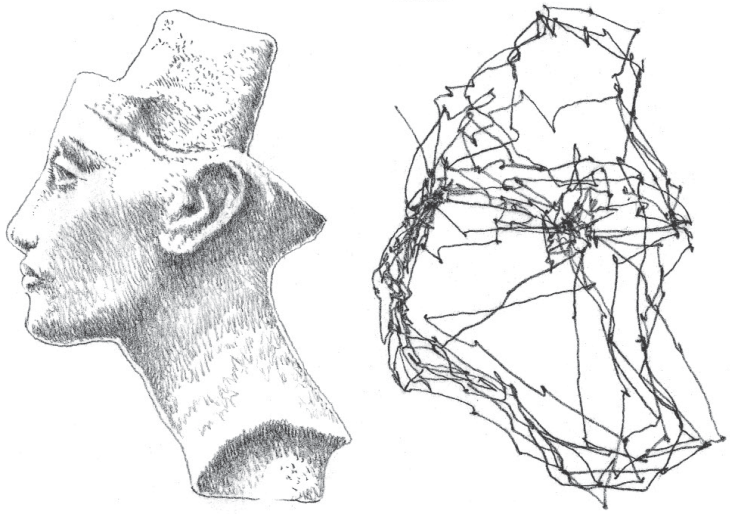
The eye sees . . .
the mind interprets.

The act of seeing is a dynamic and creative process. It is capable of delivering a stable, three-dimensional perception of the moving, changing images that make up our visual world. There are three phases in the swift and sophisticated processing that results in the images we see:

- Reception: our eyes receive energy input in the form of light—either its source or its reflection from illuminated surfaces. The optics of the eye form an upside-down image of incoming light rays on the retina, a collection of nerve cells that are an extension of the brain. These photosensitive cells convert electromagnetic energy into electrochemical signals and provide a point-by-point assessment of the intensity of light received.

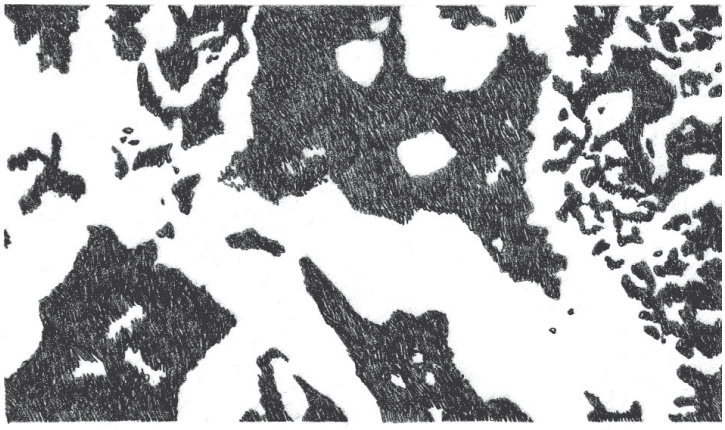
- Extraction: the mind extracts basic visual features from this input. The input—basically a pattern of lights and darks—is further processed by other nerve cells in the retina and moves down the optic nerve. After an intermediate stop it arrives at the visual cortex of the brain, which has cells that extract specific features of visual input: the location and orientation of edges, movement, size, and color.

- Inference: on the basis of these extracted features, we make inferences about our world. Only a very small area of the retina is capable of distinguishing fine detail. Our eyes must therefore continuously scan an object and its environment to see it in its entirety. When we look at something, what we see is actually constructed from a rapid succession of interconnected retinal images. We are able to perceive a stable image even while our eyes are scanning. Our visual system thus does more than passively and mechanically record the physical features of a visual stimulus; it actively transforms sensory impressions of light into meaningful forms.



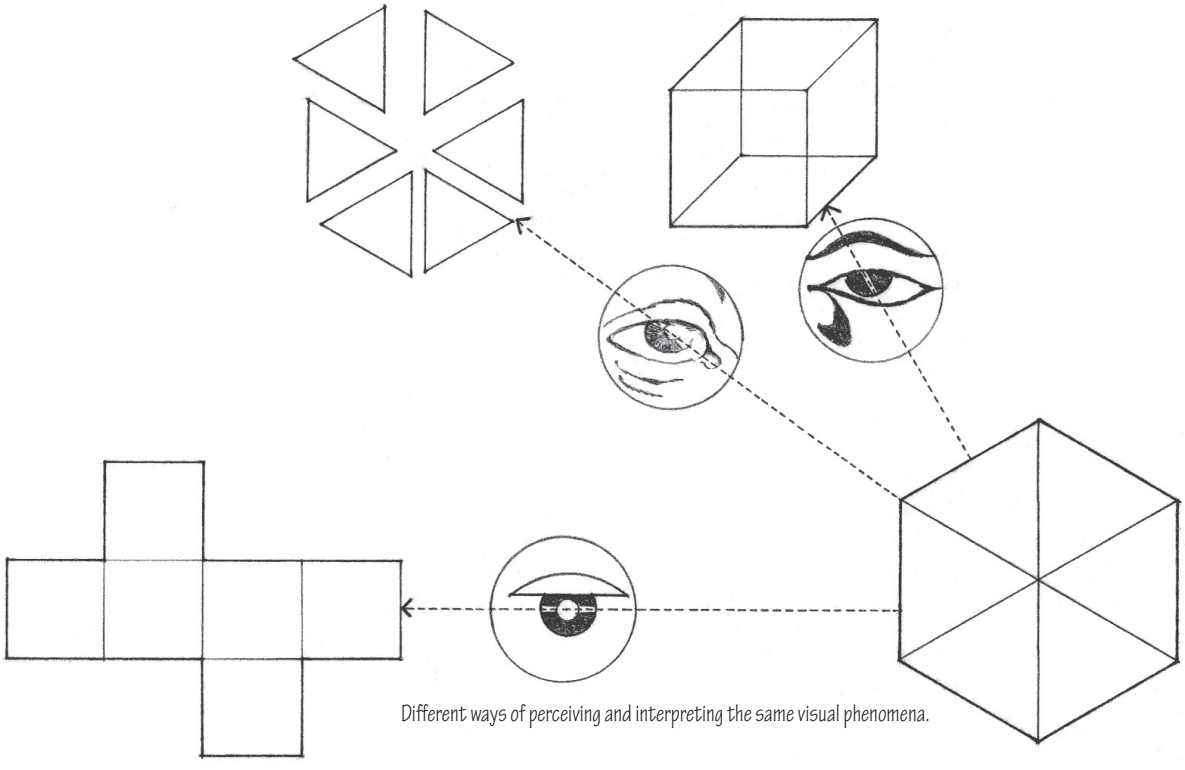
Bust of Queen Nefertiti
The pattern of eye movement of a person viewing a figure, from research by Alfred L. Yarbus of the Institute for Problems of Information Transmission in Moscow.

Seeing is a vigorous, pattern-seeking process. The mind's eye uses the input extracted from the retinal image as the basis for making educated guesses about what we encounter. Inference is easy for the mind. The mind's eye actively seeks those features that fit our image of the world. It looks for closure—for meaning and understanding in the patterns it receives. We are able to form images from the barest scaffolding of visual data, filling out the images if necessary with information that is not really there. For example, we may not understand this incomplete pattern of lights and darks, but once recognized, it cannot not be seen.

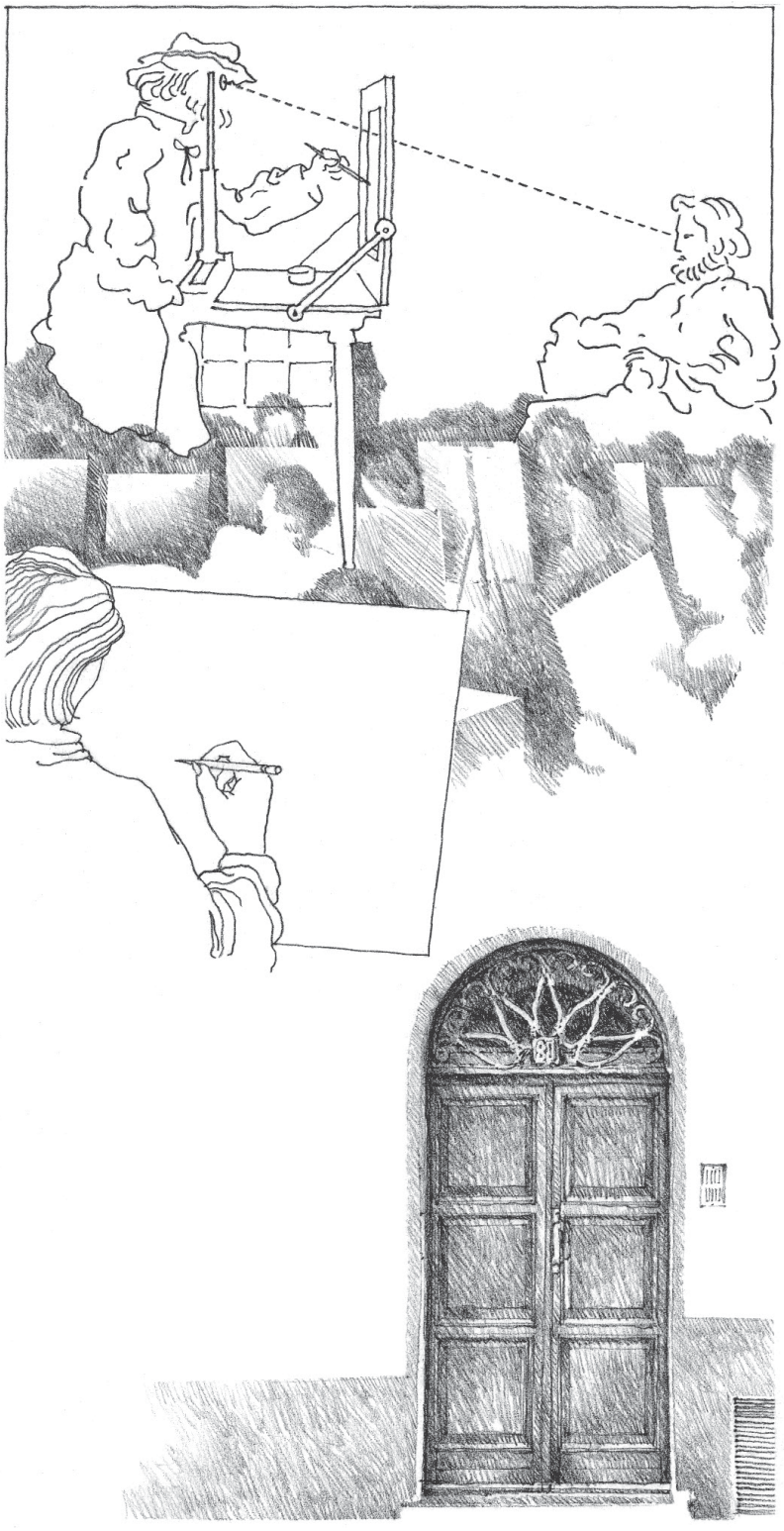


Visual perception thus is a creation of the mind's eye. The eye is blind to what the mind does not see. The picture in our head is not only based on input extracted from the retinal image but is also shaped by our interests and the knowledge and experiences each of us brings to the act of seeing. Our cultural environment also modifies our perceptions and teaches us how to interpret the visual phenomena we experience.

In this illusion designed by psychologist E. G. Boring in 1930, one can see either the profile of a younger woman or the head of an older woman.



Different ways of perceiving and interpreting the same visual phenomena.



Seeing Facilitates Drawing

The drawing of things we see before us, including the careful copying of a master's work, has traditionally been fundamental training for artists and designers. Drawing from observation is the classic method for developing eye-mind-hand coordination. Experiencing and examining the visible world in a direct manner through drawing makes us more conscious of the dynamics of sight. This understanding, in turn, helps us to draw.

Drawing Invigorates Seeing

We normally do not see all that we are capable of seeing. Preconceived notions of what we expect or believe to be out there usually direct our seeing. Through familiarity, we tend to pass over things we confront and use every day without really seeing them. These perceptual prejudices make our life simpler and safer. We do not have to pay full attention to each and every visual stimulus as if seeing it for the first time each day. Instead we can select out only those that provide information pertinent to our momentary needs. This expeditious kind of seeing leads to our common use of stereotypical images and visual clichés.

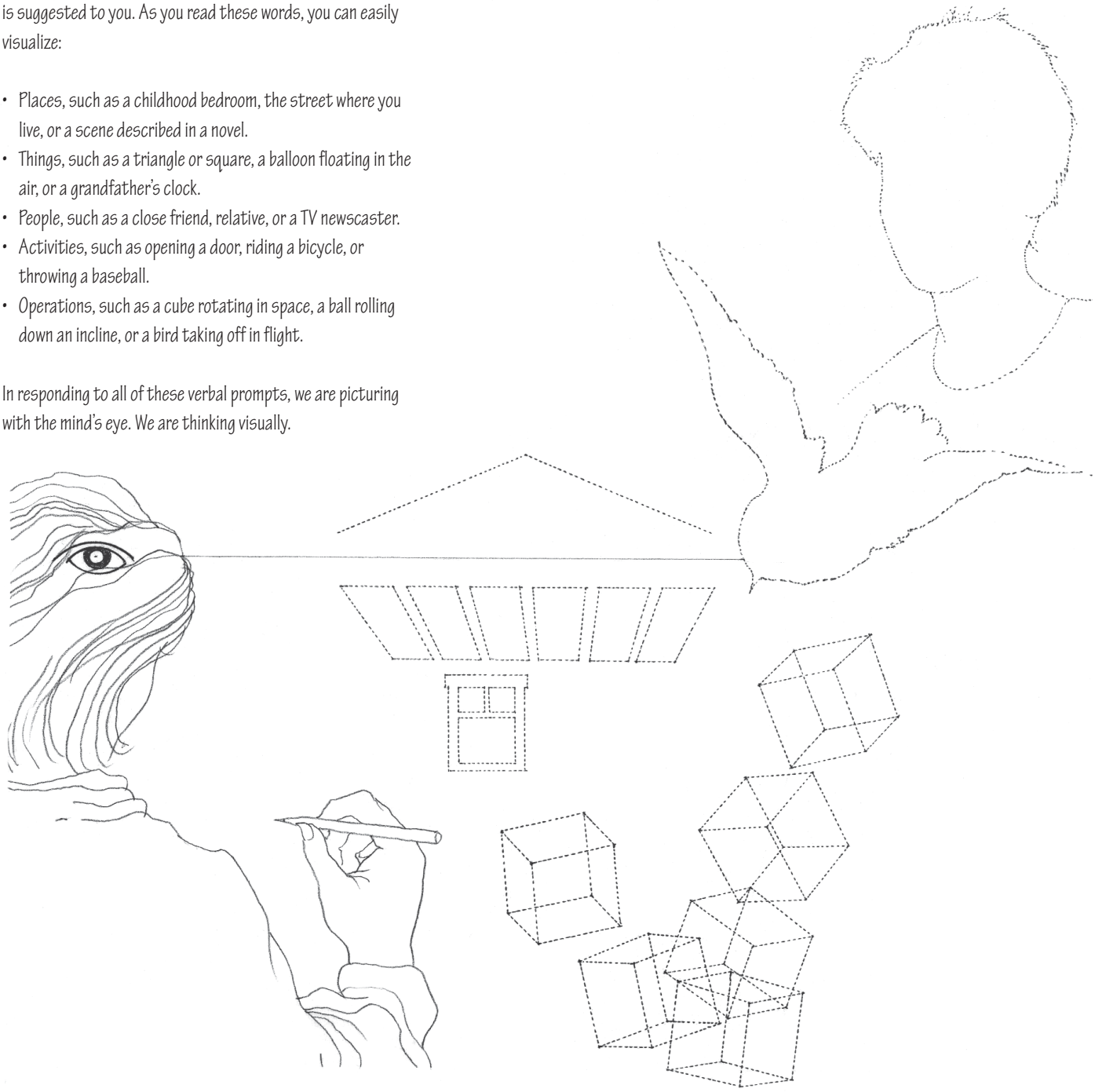
The labeling of visual stereotypes, while necessary to avoid perceptual chaos, can also prevent us from looking anew at what we see as familiar. The visual environment is usually fuller and richer than what we normally perceive at a glance. To make full use of our visual faculty—to see more than symbols—we must learn to see things as if we were going to draw them.

Drawing encourages us to pay attention and to experience the full range of visual phenomena and appreciate the uniqueness of the most ordinary things. In fostering a heightened and critical awareness of the visual environment, drawing also nurtures understanding and improves our visual memory. In drawing from the imagination, we recall past perceptions and draw on these memories.

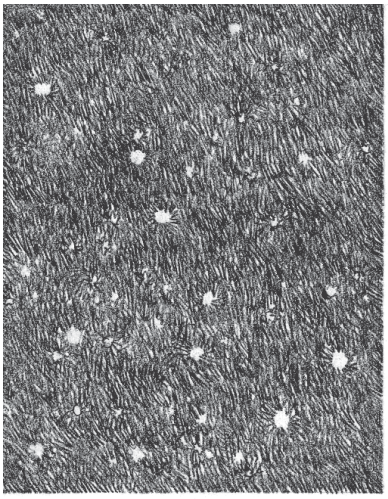
Our perception is not limited to what we can see in the here and now. Images often appear spontaneously in response to a sensory perception—something seen, touched, or smelled. Even without any sort of sensory stimulation, we have the mental faculty of recalling or recreating images. Easily, almost effortlessly, you can imagine something as soon as it is suggested to you. As you read these words, you can easily visualize:

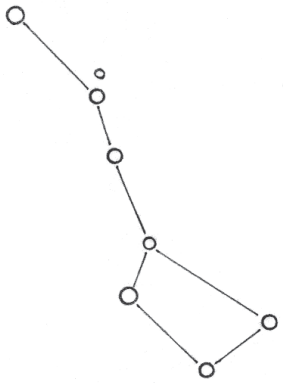
- Places, such as a childhood bedroom, the street where you live, or a scene described in a novel.
- Things, such as a triangle or square, a balloon floating in the air, or a grandfather's clock.
- People, such as a close friend, relative, or a TV newscaster.
- Activities, such as opening a door, riding a bicycle, or throwing a baseball.
- Operations, such as a cube rotating in space, a ball rolling down an incline, or a bird taking off in flight.

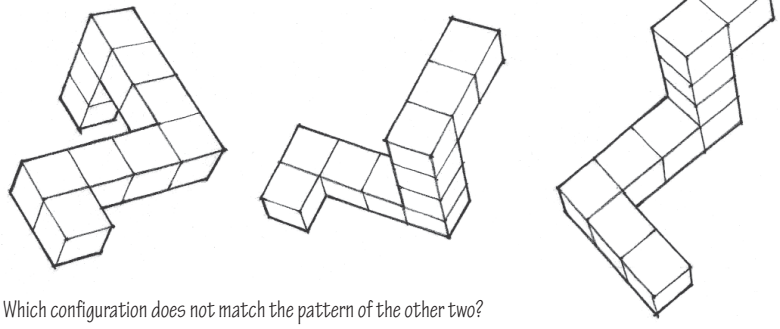
In responding to all of these verbal prompts, we are picturing with the mind's eye. We are thinking visually.



VISUAL THINKING



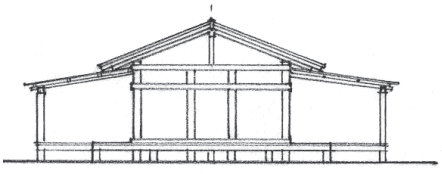




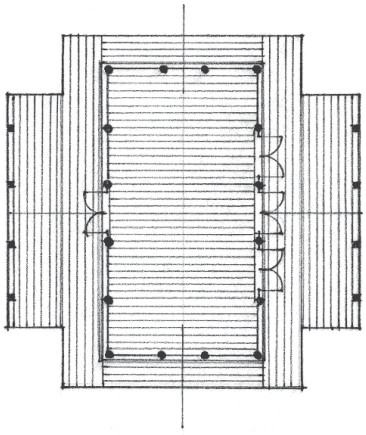
Which configuration does not match the pattern of the other two?

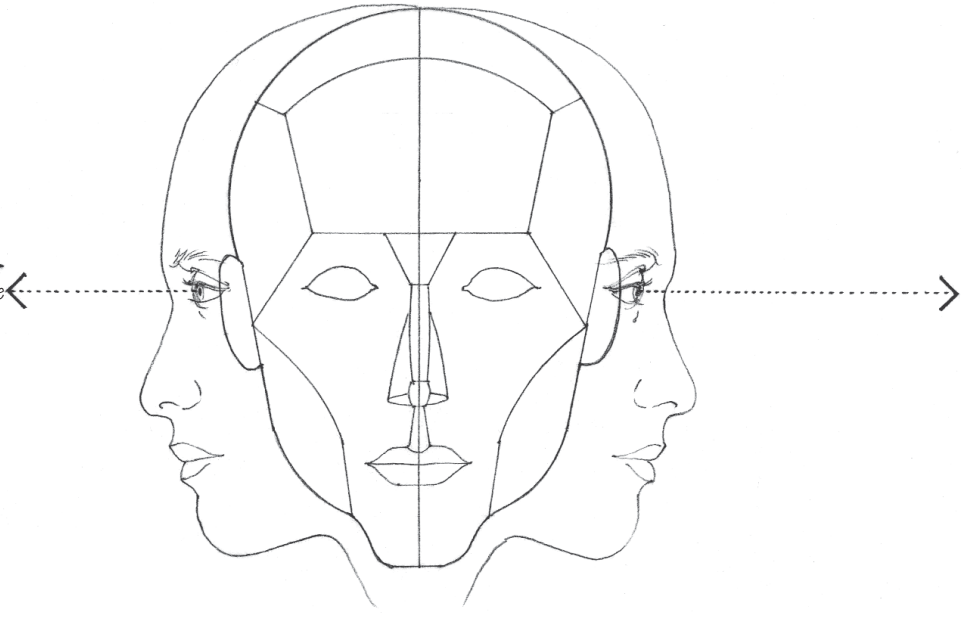
Visual thinking—thinking in images—pervades all human activity. It is an essential part of everyday life. We think in visual terms when we drive down a street looking for an address, set the table for a dinner party, or contemplate a move in a game of chess. Our thought has visual form when we search for constellations in the night sky, build a cabinet from a set of drawings, or design a building. In each of these activities, we actively seek to match the images we see with the images we hold in the mind's eye.

The images in our head are not limited to what we see in the present. The mind is capable of forming, exploring, and recombining images beyond the normal bounds of time and space. With hindsight we visualize memories of things, places, and events from the past. With foresight, we are also able to look forward in time—to use our imagination to envision a possible future. Imagination therefore enables us to have both a sense of history as well as a plan for the future. It establishes connections—visual bridges—between the past, present, and future.



Remembering the past: an 8th-century Japanese structure



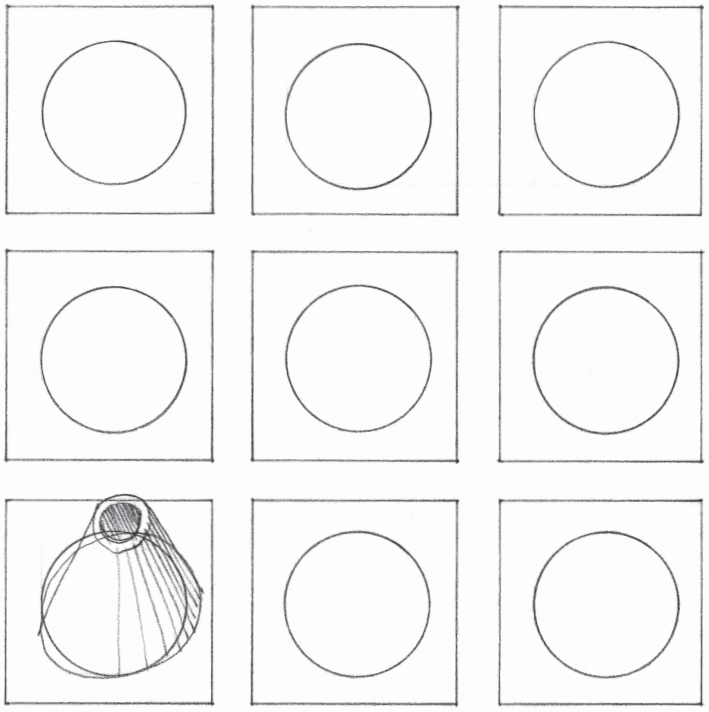


Imagination Inspires Drawing

The images we conjure up in the mind's eye are often hazy, brief, and all too elusive. Even if vivid and clear, they can come to mind and just as suddenly disappear. Unless captured in a drawing, they can easily be lost in awareness and replaced by others in the stream of consciousness. Drawing thus is a natural and necessary extension of visual thought. As the mental picture guides the movement of our eyes and hand on paper, the emerging drawing simultaneously tempers the image in our head. Further thoughts come to mind and are integrated into the process of imagining and drawing.

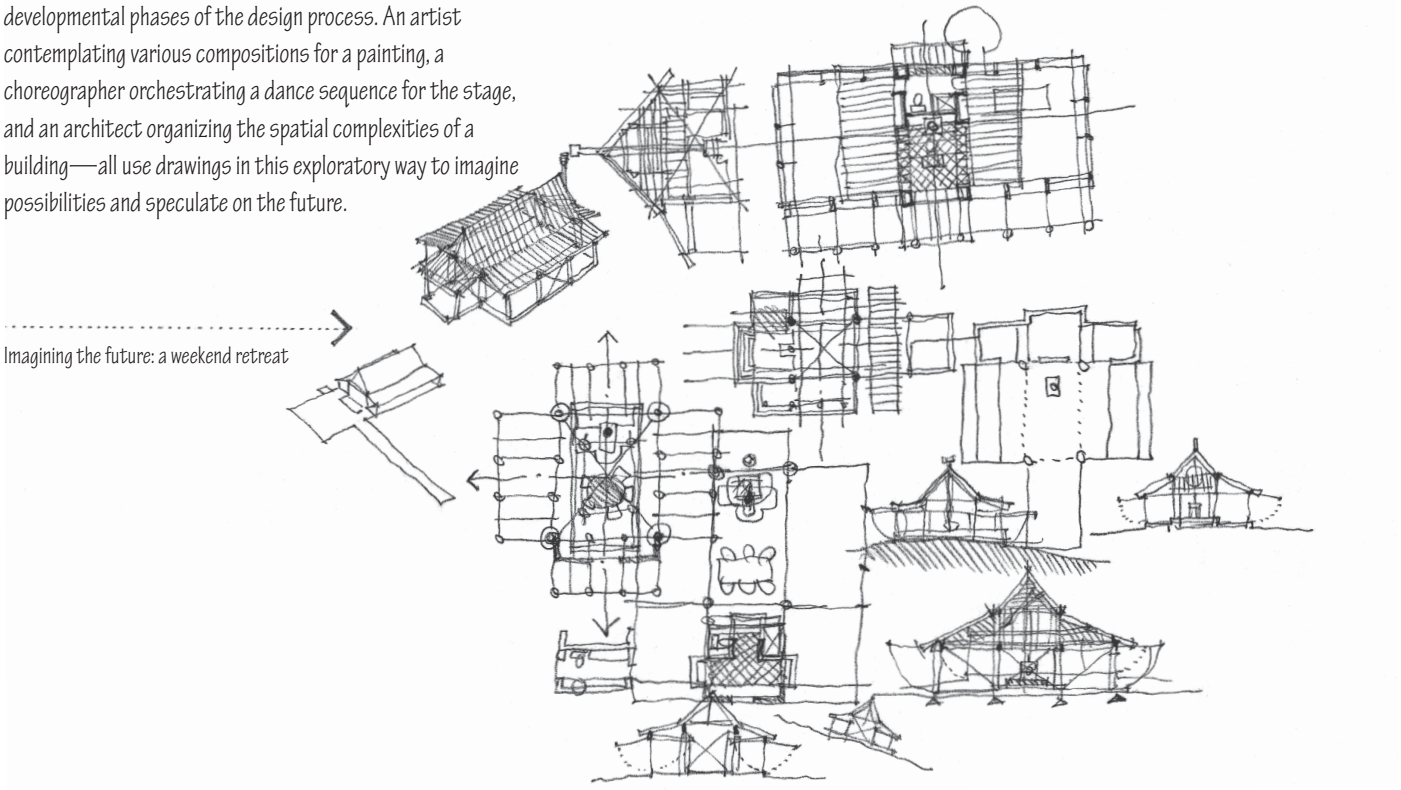
Drawing Stimulates the Imagination

Drawing is a medium that influences thought just as thought directs drawing. Sketching an idea on paper enables us to explore and clarify it in much the same way as we can form and order a thought by putting it into words. Making thoughts concrete and visible enables us to act on them. We can analyze them, see them in a new light, combine them in new ways, and transform them into new ideas. Used in this way, design drawings further stimulate the imagination from which they spring.

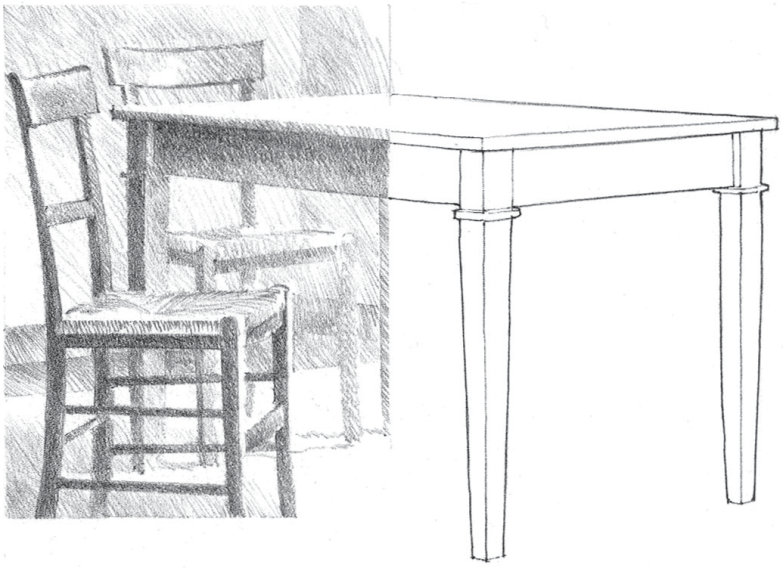


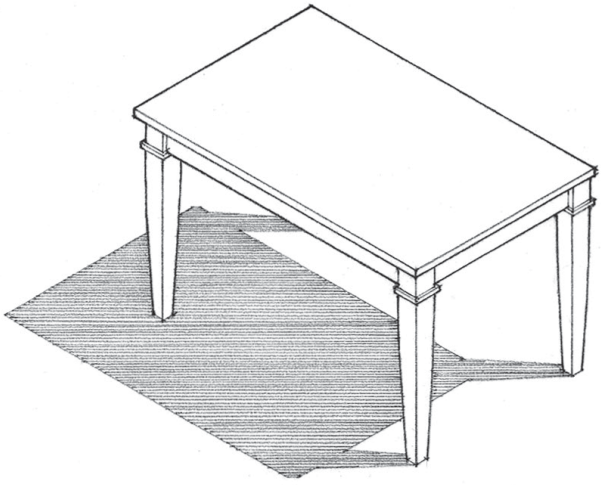
Imagine how you could transform these circles into other things by simply drawing a few lines.

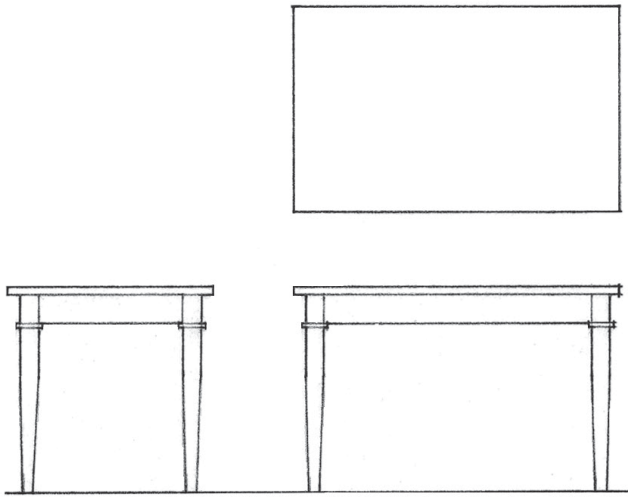
This type of drawing is essential to the initial and developmental phases of the design process. An artist contemplating various compositions for a painting, a choreographer orchestrating a dance sequence for the stage, and an architect organizing the spatial complexities of a building—all use drawings in this exploratory way to imagine possibilities and speculate on the future.



Imagining the future: a weekend retreat







A drawing can never reproduce reality; it can only make visible our perceptions of that outer reality and the inner visions of the mind's eye. In the process of drawing, we create a separate reality, which parallels our experiences.

Our perceptions are holistic, incorporating all the information we possess about the phenomena we experience. A single drawing, however, can only express a limited portion of our experience. In drawing from observation, we direct our attention to particular aspects of our vision and we choose either consciously or unconsciously to ignore others. The choice of medium and technique we elect to use also affects what we are able to convey in a drawing.

We can also draw what we know about a subject, which can be expressed in ways other than how it appears to the eye. In drawing from the imagination, for example, we are not limited to the perceptual views of optical reality. We can draw instead a conceptual view of what the mind sees. Both perceptual and conceptual views are legitimate means of representation. They represent complementary ways of seeing and drawing. The choice of one over the other depends on the purpose of the drawing and what we want to communicate of the subject.

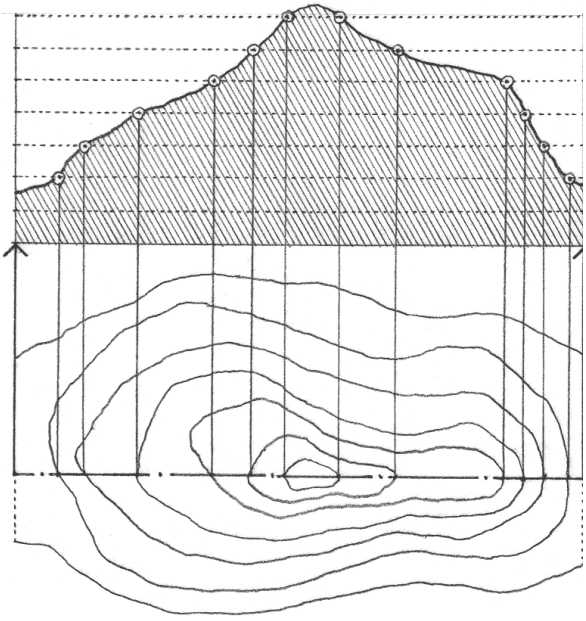
Different ways of representing the same objective reality.

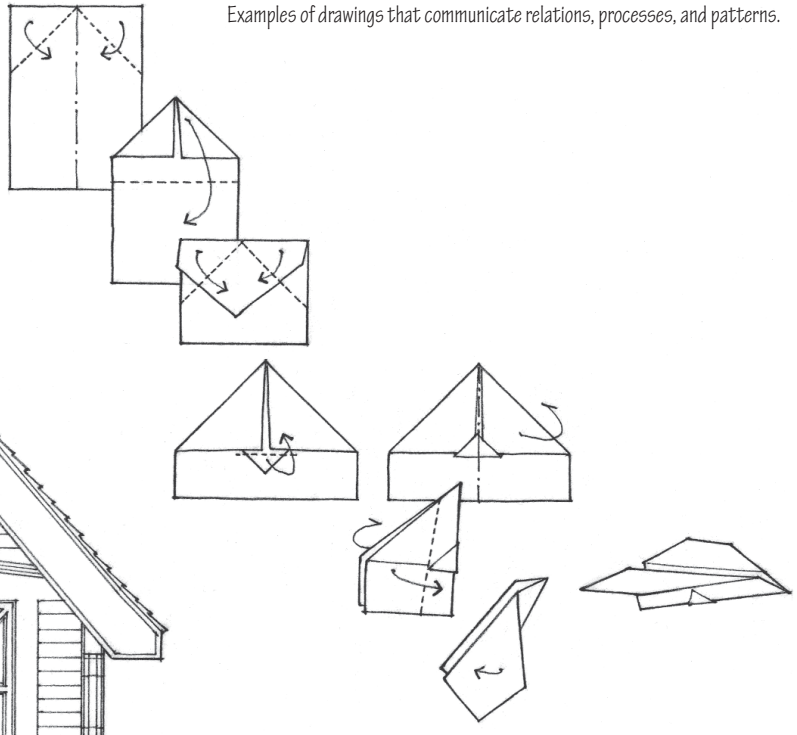
Visual Communication

All drawings communicate to the extent they stimulate an awareness on the part of those who view them. Drawings must catch the eye before they can communicate or instruct. Once they engage the viewer, they should assist their imagination and invite a response.

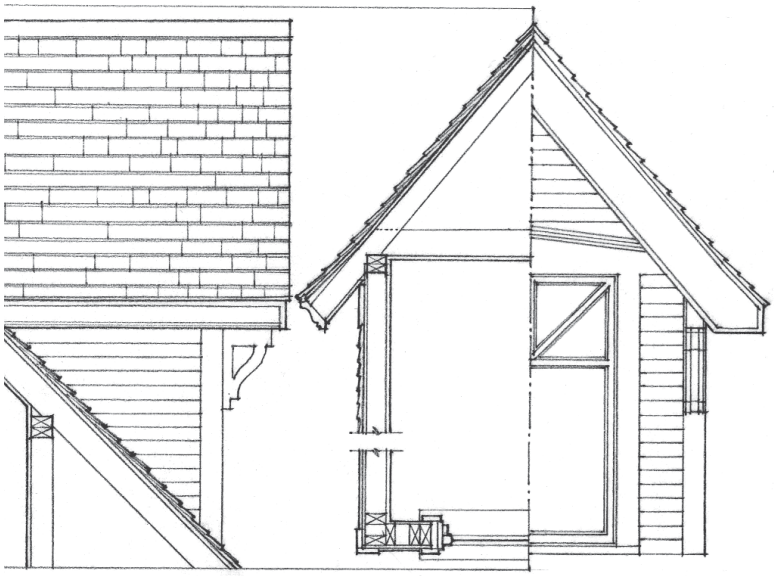
Drawings are by nature information-rich. It would be difficult to adequately describe with words what a drawing is able to reveal at a glance. But just as we each see in a different way, we can each view the same drawing and interpret it differently. Even the most realistic drawing is subject to interpretation. Any drawing we use to communicate visual information should therefore represent things in a way that is comprehensible to others. The more abstract a drawing, the more it must rely on conventions and text to communicate a message or convey information.

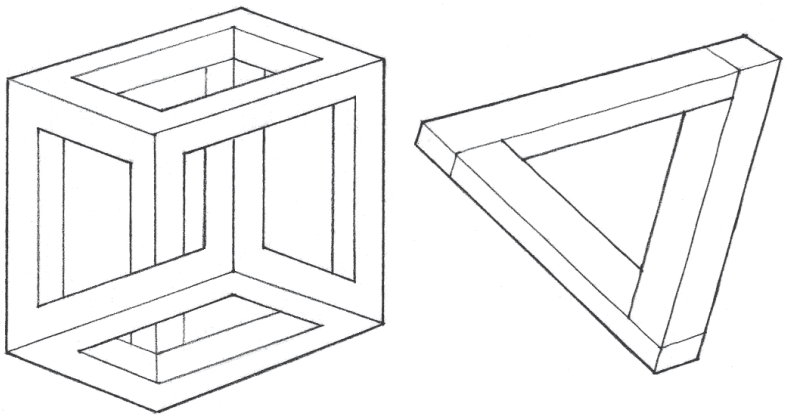
A common form of visual communication is the diagram, a simplified drawing that can illustrate a process or action, clarify a set of relationships, or describe a pattern of change or growth. Another example is the set of presentation drawings that offer a design proposal to others for their review and evaluation. More utilitarian forms of graphic communication include design patterns, working drawings, and technical illustrations. These visual instructions guide others in the construction of a design or the transformation of an idea into reality.



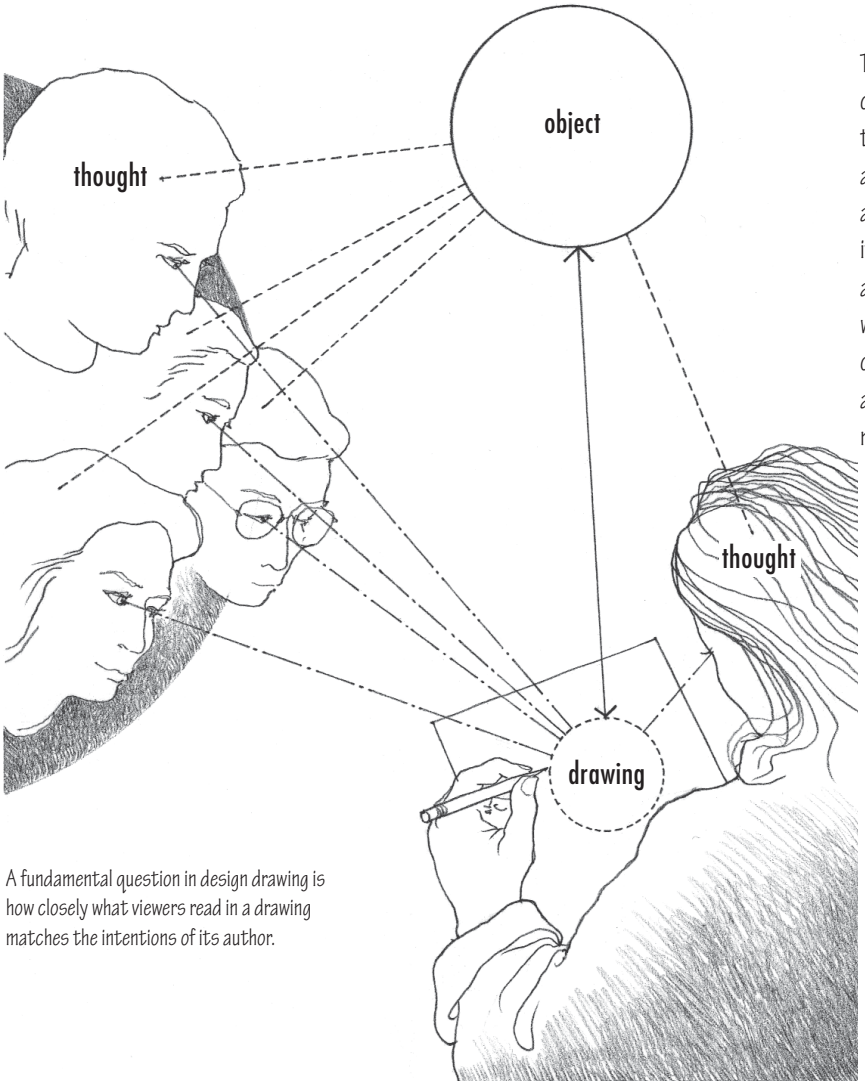


Examples of drawings that communicate relations, processes, and patterns.





What appears to work on paper may not be possible in objective reality.



A fundamental question in design drawing is how closely what viewers read in a drawing matches the intentions of its author.

Reading Drawings

While we are able to read drawings we do not author or that we are incapable of executing, the converse is not true. We cannot construct a drawing unless we are able to decipher the graphic marks we make and understand the way others might see and interpret them. An essential part of learning how to draw is learning to read the drawings we encounter as well as the ones we execute ourselves.

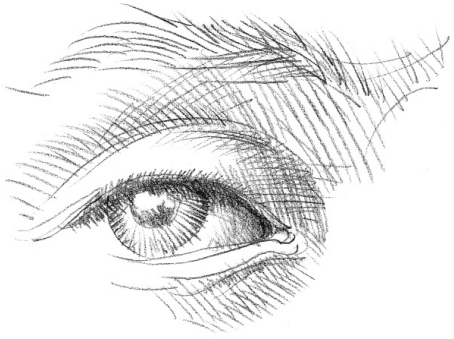
Being able to read a drawing means that we understand the relationship between a subject and how it is represented in a drawing. For example, any drawing, whether generated on a computer screen or created by hand, can be improperly constructed and misconstrue the three-dimensional idea that it represents. We should be able to recognize when a drawing conveys something that is not possible in reality, even though the graphic image may give the opposite impression.

To better critique and improve our own drawings, we should cultivate the habit of reading them the way others might see them. It is easy to convince our eyes that one of our drawings actually stands for what we believe it represents. It is just as easy to see mistakes in another's drawing because we see it with fresh eyes. Looking at a drawing upside down, from a distance, or through a mirror causes us to see it in a new way. The sudden changes of view enable us to see problems our minds predisposed us to ignore. Even small errors that appear to be trivial are of some consequence if they muddy the message or meaning of a drawing.

Drawing from Observation

"Learning to draw is really a matter of learning to see—to see correctly—and that means a good deal more than merely looking with the eye. The sort of 'seeing' I mean is an observation that utilizes as many of the five senses as can reach through the eye at one time."

Kimon Nicolaïdes
The Natural Way to Draw

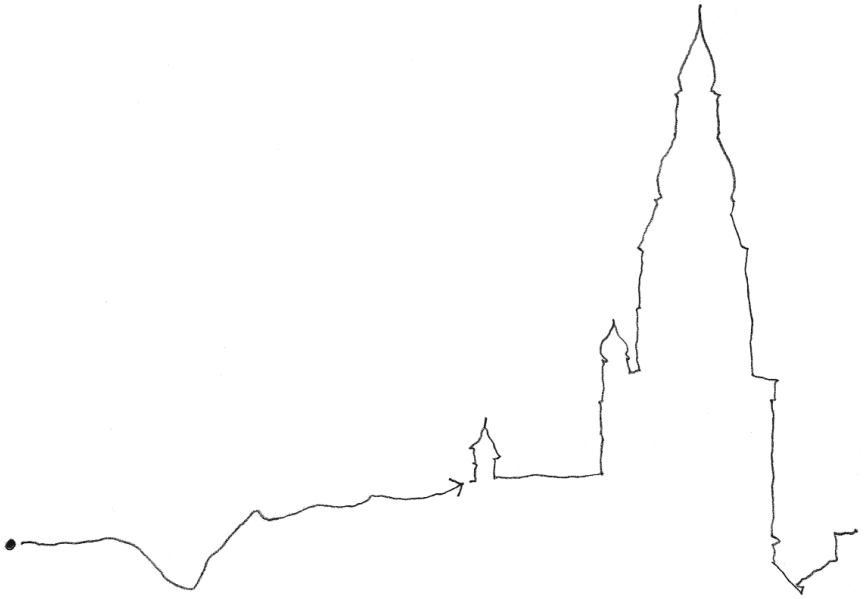


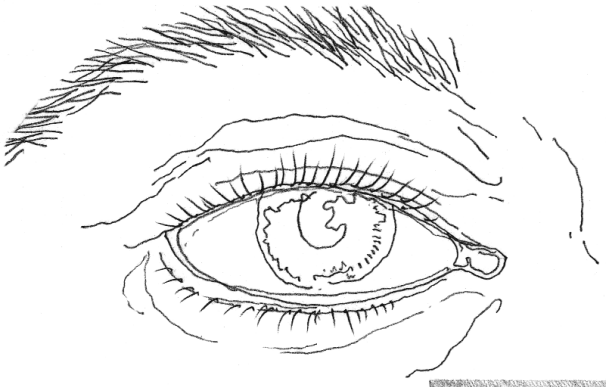
Despite the subjective nature of perception, sight is still the most important sense for gathering information about our world. In the seeing process, we are able to reach out through space and trace the edges of objects, scan surfaces, feel textures, and explore space. The tactile, kinesthetic nature of drawing in direct response to sensory phenomena sharpens our awareness in the present, expands our visual memories of the past, and stimulates the imagination in designing the future.

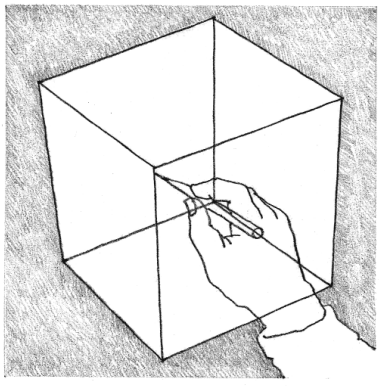
1

Line and Shape

A point has no dimension or scale. When made visible as a dot, the point establishes a position in space. As the dot moves across a surface, it traces the path of a line—the quintessential element of drawing. We rely principally on the line to portray the edges and contours of objects we see in visual space. In delineating these boundaries, the line naturally begins to define shape—the pictorial element that establishes the figures in our visual field and organizes the composition of a drawing.



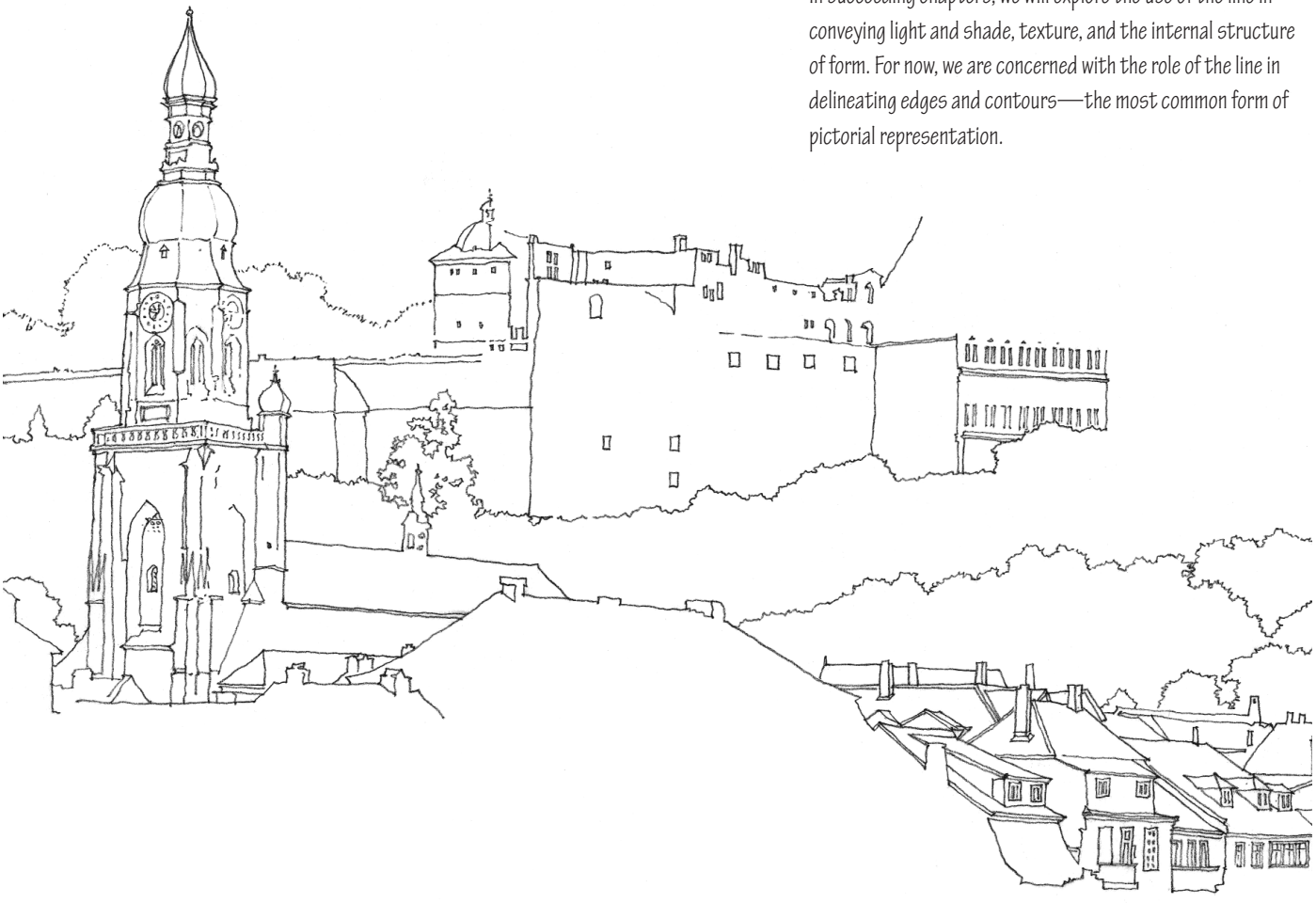




Conceptually, a line is a one-dimensional element having a continuous extent of length but no breadth or thickness. Such a line does not actually exist in the physical world of matter. Whatever we regard as a line is in fact a thin, solid volume, such as a strand of wire; or a very narrow depression, such as a crease; or a discontinuity in color or tonal value, such as where an object meets its shadow. Yet our vision perceives all of these as lines. Just as lines are critical to the way we perceive our world, they are essential in representing our perceptions in a drawing.

In drawing, we pull or drag the point of a tool across a receptive surface to produce a line. As a graphic element, the line is a one-dimensional trace on a two-dimensional surface. Yet, it is the most natural and efficient means we have to circumscribe and describe the three-dimensional form of a subject. We construct these lines as we do in sight in order to recreate a sense of the form's existence in space. And as viewers, we readily associate the drawn lines with the physical boundaries of a form and the edges of parts within it.

In succeeding chapters, we will explore the use of the line in conveying light and shade, texture, and the internal structure of form. For now, we are concerned with the role of the line in delineating edges and contours—the most common form of pictorial representation.



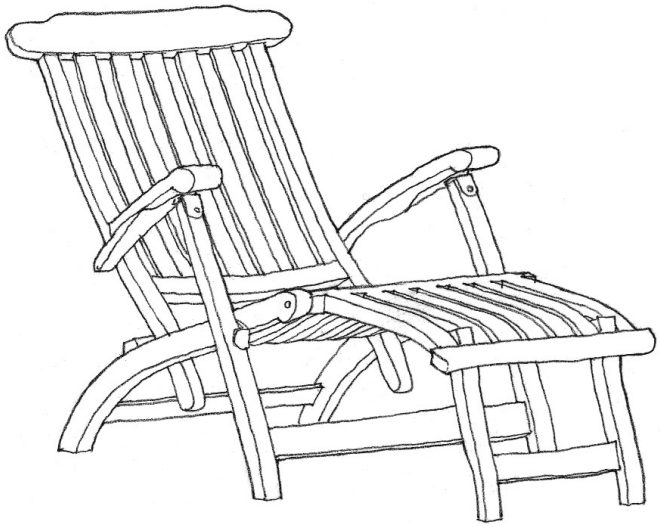
Contours dominate our perception of the visual world. The mind infers the existence of contours from the patterns of light and dark the eyes receive. Our visual system seeks out and creates a cognitive line along the points where two fields of contrasting light or color meet. Some of these edges are clear; others are lost in the background as they change color or tonal value. Still, in its need to identify objects, the mind is able to fabricate a continuous line along each edge. In the seeing process, the mind enhances these edges and sees them as contours.

The most noticeable contours are those that separate one thing from another. These contours give rise to the images of objects we see in visual space. They circumscribe an object and define the outer boundary between the figure and its background. In limiting and defining the edges of things, contours also describe their shape.

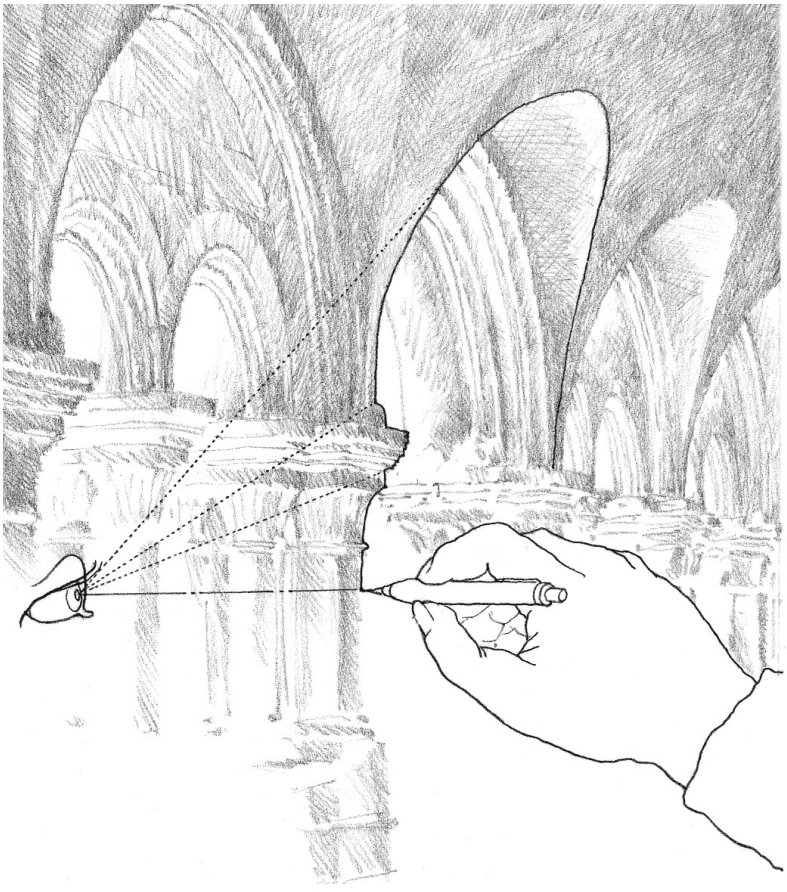
But contours do more than describe the outline of a flat, two-dimensional silhouette.

- Some contours travel inward at folds or breaks in a plane.
- Others are formed by overlapping or projecting parts.
- Still other contours describe the shapes of spaces and shadows within the form.

In both seeing and drawing, we are able to follow these contours as they eloquently describe the three-dimensional nature of forms in space.



CONTOUR DRAWING

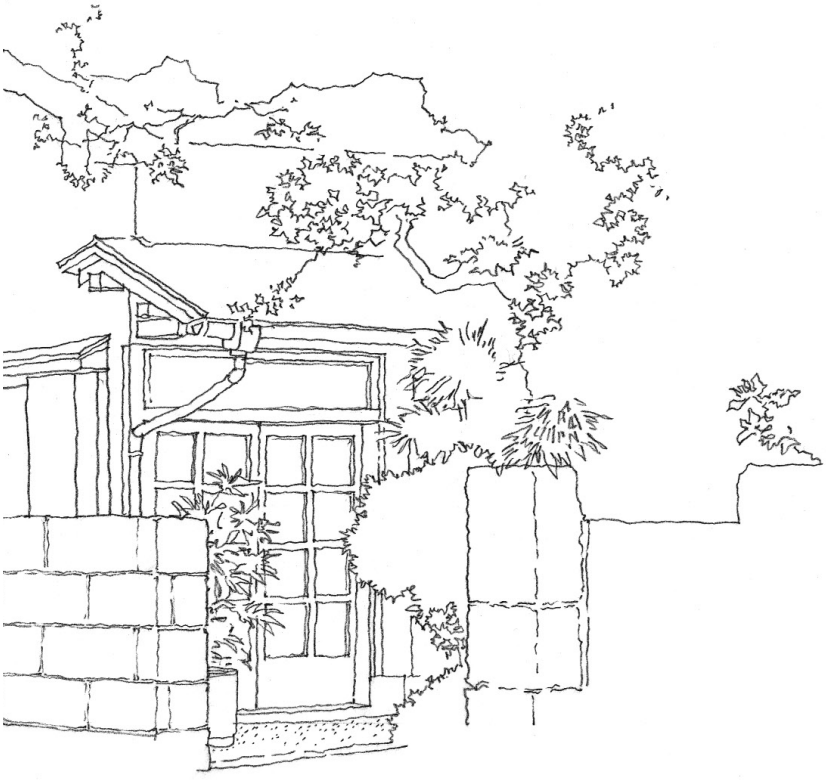


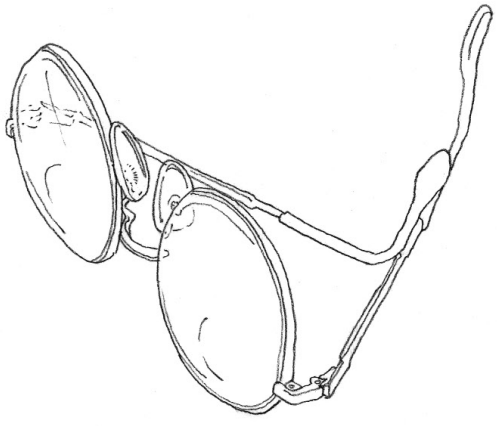
Contour drawing is one approach to drawing from observation. Its primary purpose is to develop visual acuity and sensitivity to qualities of surface and form. The process of contour drawing suppresses the symbolic abstraction we normally use to represent things. Instead, it compels us to pay close attention, look carefully, and to experience a subject with both our visual and tactile senses.

Our goal in contour drawing is to arrive at an accurate correspondence between the eye as it follows the edges of a form and the hand as it draws the lines that represent those edges. As the eye slowly traces the contours of a subject, the hand moves the drawing instrument at the same slow and deliberate pace and responds to every indentation and undulation of form. This is a meticulous and methodical process that involves working from detail to detail, part to part, and form to form.

The process is as much tactile as visual. Imagine the pencil or pen is in actual contact with the subject as you draw. Do not retrace over lines or erase them. Most importantly, draw slowly and deliberately. Avoid the temptation to move the hand faster than the eye can see; move in pace with the eye and examine the shape of each contour you see in the subject without considering or worrying about its identity.

Contour drawing is best done with either a soft, well-sharpened pencil or a fine-tipped pen that is capable of producing a single incisive line. This fosters a feeling of precision that corresponds to the acuity of vision contour drawing promotes.



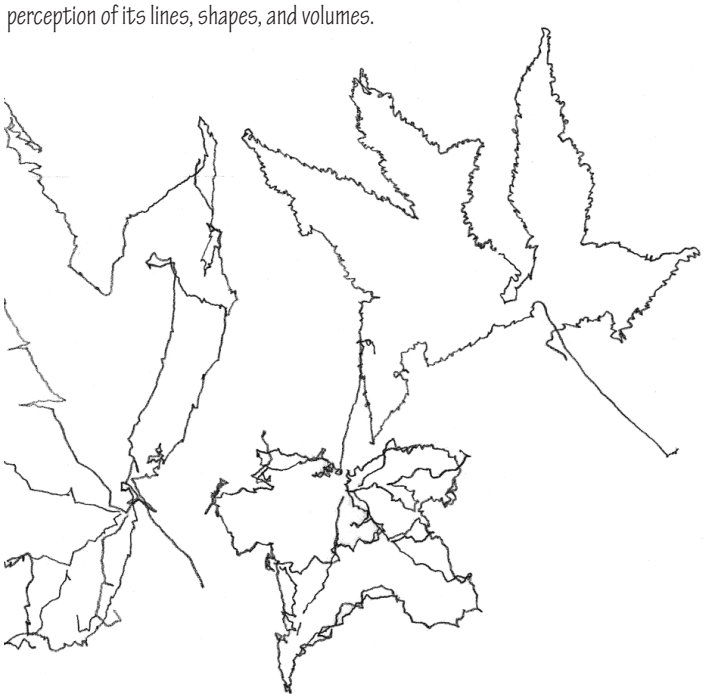


Blind contour drawing involves the drawing of contours while looking only at the subject, not the surface upon which we are drawing or the evolving image. Turn your body away from the paper and concentrate all of your attention on the subject. Your eyes should remain on the subject as the hand attempts to record on paper what you see.

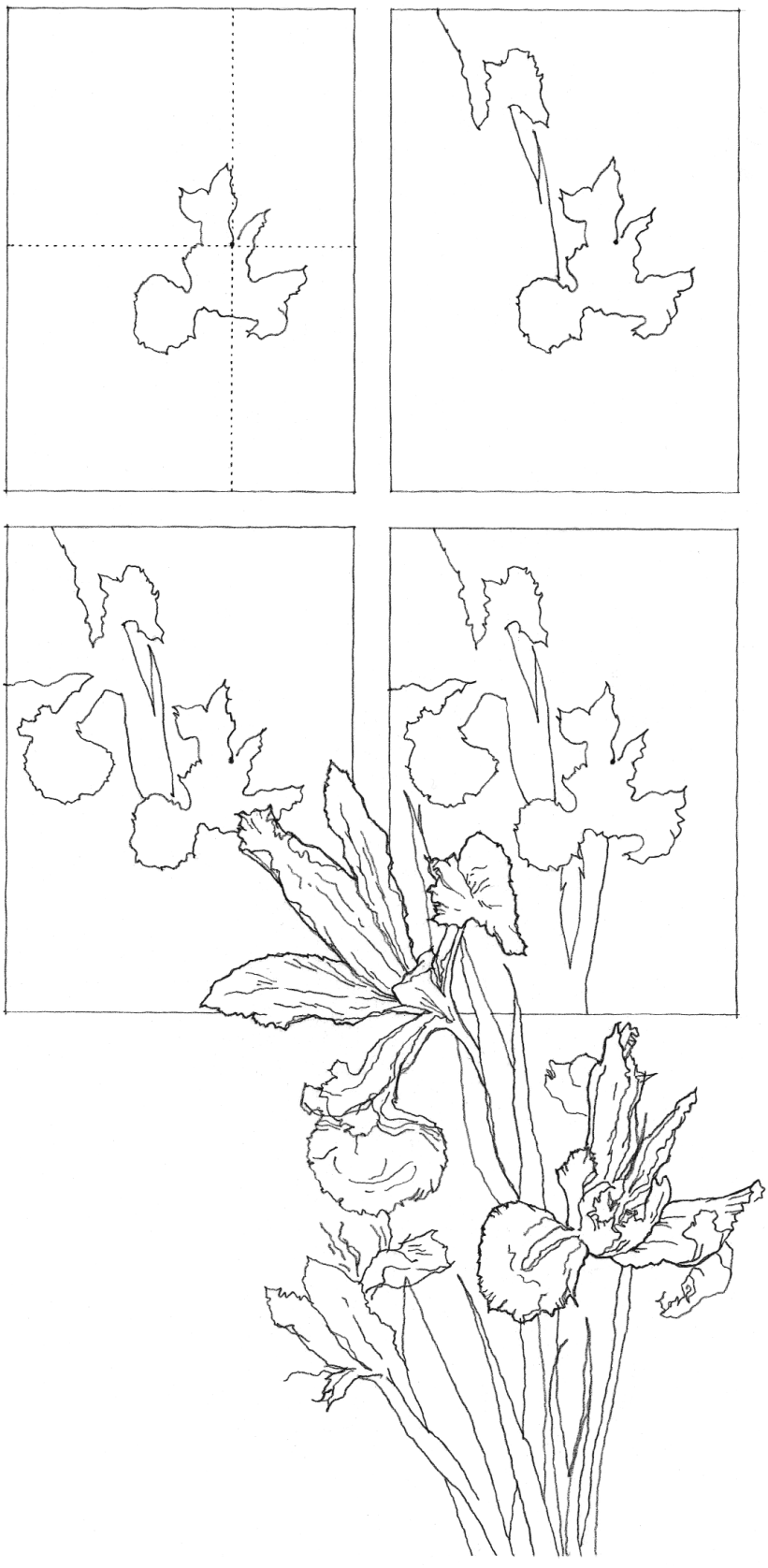
Focus the eye on a clearly defined point along a contour of the subject. Place the tip of the pen or pencil on the paper and imagine it is actually touching the subject at that point. Slowly and painstakingly follow the contour with your eyes, observing every minute shift or bend in the contour. As your eyes move, also move your pen or pencil on the paper at the same deliberate pace, recording each variation in contour that you see.

Continue to draw each edge you see, bit by bit, at a slow, even pace. You may have to stop periodically as you continue to scan the subject, but avoid making these stopping points too conspicuous. Strive to record each contour at the very instant you see each point along the contour. Allow the eye, mind, and hand to respond simultaneously to each and every critically perceived event.

In this mode of drawing, distorted and exaggerated proportions often result. The final drawing is not intended to look like the object but rather to document and express your careful perception of its lines, shapes, and volumes.



MODIFIED CONTOUR DRAWING



In modified contour drawing, we begin as in blind contour drawing. But in order to check relationships of size, length, and angle, we allow ourselves to glance at the emerging drawing at certain intervals.

Begin as in blind contour drawing. Select any convenient point along a contour of the subject. Place the tip of the pen or pencil on the sheet of paper and imagine it is in contact with the same point on the subject. Check the relationship of the contour to an imaginary vertical or horizontal line. As your eyes follow the contour in space, carefully draw the contour line at the same slow and deliberate pace.

Work from contour to contour, along, across, or around the edges and surfaces of a form. Respond to each and every surface modulation with equivalent hand movements. At certain points—breaks in planes or folds across contours—a contour line may disappear around a bend or be interrupted by another contour. At these junctures, look at the drawing and realign your pen or pencil with the previously stated edge to maintain a reasonable degree of accuracy and proportion. With only a glance for realignment, continue to draw, keeping your eyes on the subject.

The more we focus on what we see, the more we will become aware of the details of a form—the thickness of a material, how it turns or bends around a corner, and the manner in which it meets other materials. When confronted with a myriad of details, we must judge the relative significance of each detail and draw only those contours that are absolutely essential to the comprehension and representation of the form. Strive for economy of linework.

Do not worry about the proportions of the whole. With experience and practice, we eventually develop the ability to scan each contour of a subject, hold an image of that line in the mind's eye, visualize it on the drawing surface, and then draw over the projected trace.

While a true contour drawing uses a single line weight, varying the width of a line while drawing enables one to be more expressive. Thickening a line can provide emphasis, create a sense of depth, or imply a shadow. The characteristics of the line used to define a contour can communicate the nature of the form—its materiality, surface texture, and visual weight.