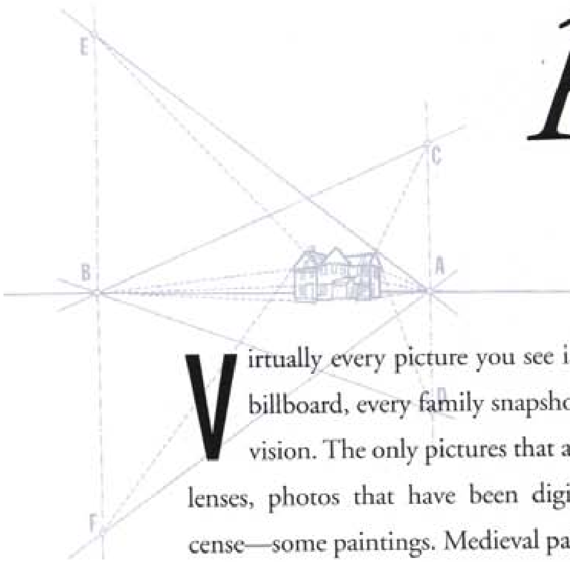
13

how to look at perspective pictures



Virtually every picture you see is in perspective: every photo in a magazine, every billboard, every family snapshot, every scene in every movie, every image on television. The only pictures that are not in perspective are photos made with fish-eye lenses, photos that have been digitally manipulated, and—allowing for artistic license—some paintings. Medieval paintings are not in perspective, and neither are older Japanese and Chinese paintings. But these days it is not easy to find a picture that is not in perspective. Even collages are often just collections of perspective pictures.

Most people in the world grow up seeing perspective pictures, and they seem natural and right to millions of viewers. Given that, it is surprising that very few people know how they work. Try this experiment: make a little freehand sketch of a cube on the margins of this page. (Don't look too much at Figure 13.1. The idea is to see what kind of cube you naturally draw.) Take the edges of your cube, and extend them into space. I tried it and got this result:

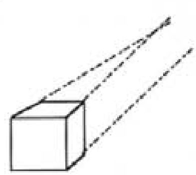
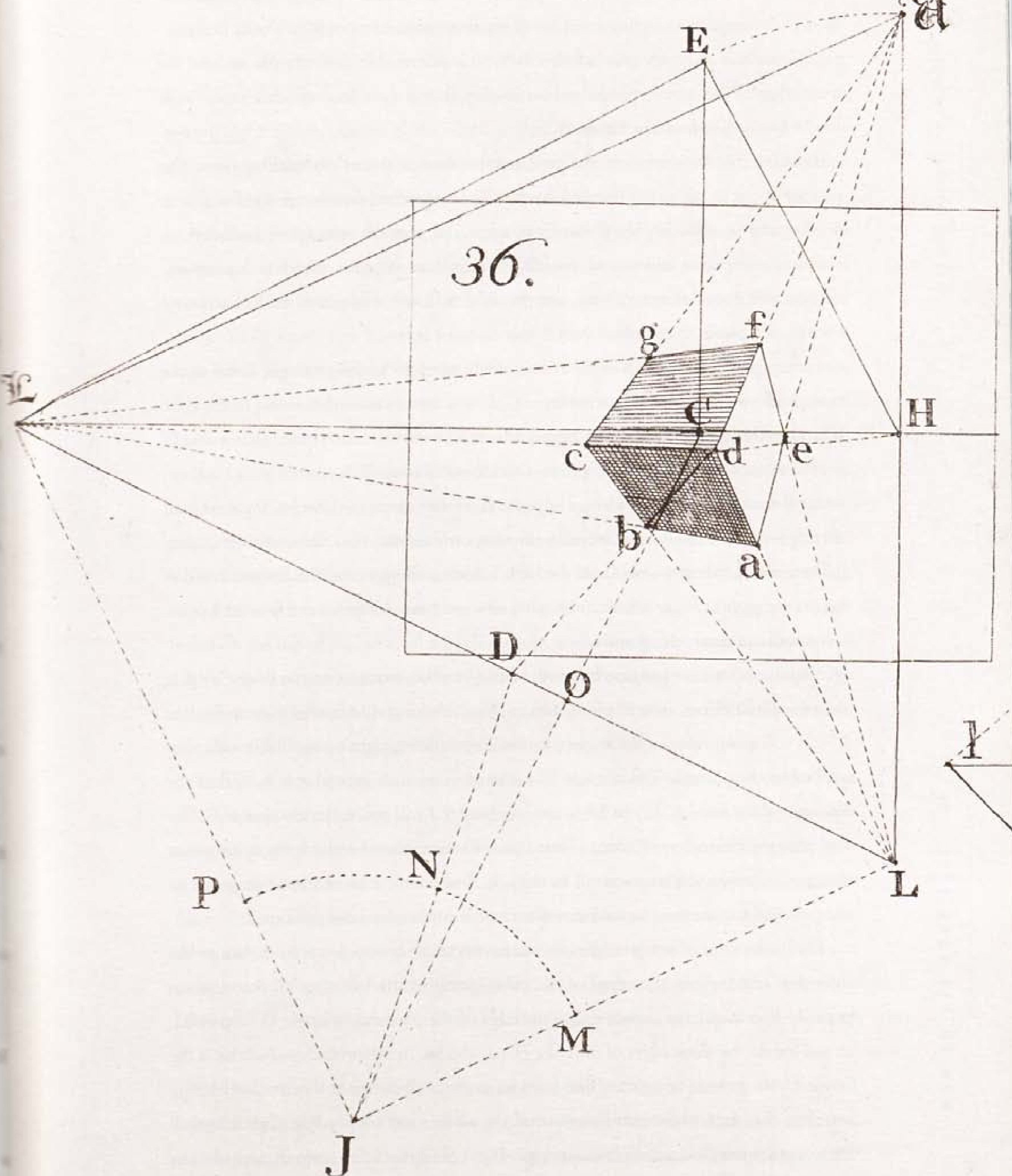


figure 13.1

Perspective picture of a cube. 1755.



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This cube is not in perspective. The laws are very strict, and they say that if lines are parallel to one another in real life—as they are on the real cube I am imagining—then they have to converge to a single point. One of my lines misses the point by a wide margin.

The practice of perspective is full of rules; it is permissible, for example, to have the front edges of the cube be parallel to one another. But all the rules come down to a single one, which is illustrated in Figure 13.1.

Imagine that the surface of the page is a flat floor, and you are standing on it. Say you are about as tall as the line EC, so that if you stretched out flat on the floor, your head would be at E and your feet at C. Imagine, too, that the rectangle is a window, an opening in the floor, and you are looking through it at the cube, which is floating underneath. It does not matter what size the cube is: it could be about six feet across or the size of a planet. Nor does it matter how far away it is.

Picture yourself standing in the center of the window, looking straight down at the cube, with your feet planted on the letter C. If you were to trace the outline of the cube onto the window, you would get exactly the outline that is drawn here. That is one of the miracles of perspective: if you go to a window and trace what you see with a crayon, you will automatically get a picture in perspective that obeys all the rules. If you extend the edges of the cube in all directions, drawing on the floor, they will converge as they do here, on the three points L (at the left), L (normal letter L, at the bottom), and A (at the top right). You're meant to imagine all those lines drawn on the floor and yourself standing there looking at them.

Now the trick is to imagine building a little tentlike structure on the floor. Say that the triangle LEH is a sheet of plexiglass, and that it is hinged to the floor along the line LH. If you stoop down and lift it up, you will be standing right up against it with your eye just at the point E. The triangle LLJ is another such sheet, and it is hinged to the floor along the line LL. If you lift it up, its top edge J will touch the top corner E. The two plexiglass triangles will form a little tent. (There will not be much room for you at that point, unless you step around to the side. But your eye must stay at the point of the pyramid so that you can look down at the cube from the same position.)

This is the kind of setup it takes to explain the single law of perspective. Notice the lines that recede from the edges of the cube, going to the left: they all converge on point L. You might not expect it, but the edge of the plexiglass triangle EL is parallel, in real life, to the three edges of the cube gf, cd, and ba. In other words—and this is the law—if you draw an imaginary line from your eye to the surface that you're drawing on, then the place where that line touches the surface will also be the place where all lines that are parallel to your line converge. If you find that confusing, then you're not alone—it took a century and a half from the time perspective was invented until one person discovered that law, and then it took another century and a half before it was widely known. Even today, most artists and architects who learn perspective don't learn that law. (They tend to let computers do the work for them.)

You can also think of the law this way: if you are drawing this cube and you are not sure where the edges converge, you need only to draw an imaginary line from your eye toward the drawing, parallel to the edges, to find the point where they converge. With the plexiglass triangles swung up into position, then the line from your eye to the point L will locate the point where fe, da, and cb all converge.

In actual perspective drawing it is not efficient to build pop-up triangles, and so draftsmen rotate the triangles until they are flat on the surface, as they are here. The process is called "rabatment," and in the nineteenth century it was basic knowledge for artists. You'll know you have understood this if you see why the angle LJL and the angle LEH are right angles: because they need to have the same orientations as the cube. And you will have mastered it if you see how the person who drew this located the third vanishing point, the one at A, by making the length AH equal the length EH.

You can understand ordinary perspective drawings even without grasping the basic law, by watching where lines converge. Points like L and A are called vanishing points. Notice that lines df and cg are in the same plane, and so are lines dc and fg—they are all in the top face of the cube. It turns out that any lines that are drawn on the top face of the cube will converge somewhere along the line LA. If I were to draw a checkerboard on the top of the cube, all the lines would go to L or A; but more interestingly, if I draw any two parallel lines on the top face, they will converge to a point on LA. For that reason the line is called a vanishing line. Every plane has its vanishing line, and all sets of parallel lines in a plane will vanish somewhere on the vanishing line.

This is all very abstract, the way most books on perspective tend to be. Here is a more realistic example (Fig. 13.2). Practically any building can be used to demonstrate perspective; all you need to do is to stand still and visualize how the lines go. First look at the right-hand side of the house and imagine all the horizontal lines—the line of the floor of the porch, the top of the porch, the sills and lintels and sashes of all the windows, and the cornice on top. If they were all extended into space, they would meet in a single vanishing point, which I have labeled A in Figure 13.3. (Most often, vanishing points will be far away from the objects, and so I have made a smaller-scale drawing to go with the large one.)

Then do the same for all the horizontal lines on the front of the house—the front line of the porch floor, the front of the porch roof, the windows and cornice, and, over on the left, the basement windows, the trim line, and all the horizontal lines of the wood siding. All those lines converge farther away, at point B. (When you're doing this

figure 13.2

A house. Chicago, winter 1998.

outdoors, as opposed to drawing the lines on a photograph, it helps to hold up a pencil to gauge where the lines are going.) A straight, horizontal line between points A and B is the horizon line. If you are looking more or less straight across at the building, the vertical lines will still look vertical, as they do here. If you look up at a skyscraper, you will have to add a third vanishing point up in the sky.

Notice, too, that *all* horizontal lines that are parallel to the ones on the front of the house will converge on point B, including the lines on the chimney and even on the house in the right background. As long as the houses are parallel to one another, their vanishing points will coincide. And the same goes for all houses on any street parallel to this one, even if they are miles away out of sight.

That is the simple part. Perspective becomes more interesting when you think about other planes. The visible part of roof on the right part of the house also forms a plane. Some lines in that plane are horizontal and parallel to the lines on the front walls of the house, and so they will also vanish at point B. But what about lines that slope straight

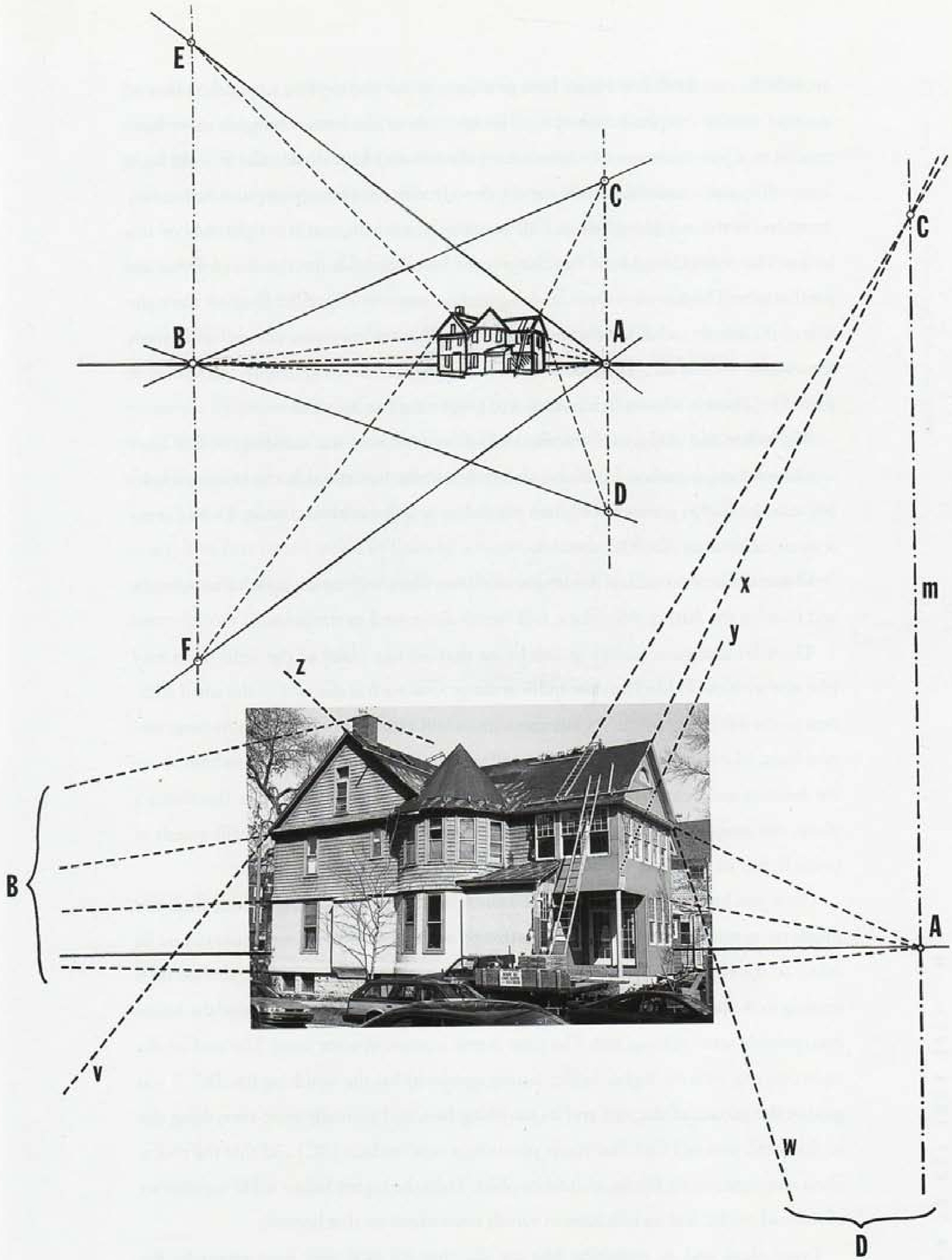

figure 13.3

Diagrams of the vanishing points and lines.

up, like the one labeled x? Here's how to reason it: the sloping line x is in the plane of the roof *and* in the plane formed by the right side of the house. Imagine more lines parallel to x but drawn on the right side of the house; I have drawn one at y. All such lines will vanish somewhere up in the air, directly above the vanishing point A. Line m, therefore, is the vanishing line for all possible parallel lines in the right side of the house. The point C is *also* the vanishing point for all possible lines in the roof that are parallel to x. The line m is the vanishing line for any sets of parallel lines on the right side of the house; and similarly, any parallel lines that are drawn on the roof will vanish somewhere on line BC. The two sides of the upper ladder will probably also vanish at point C. (There is a lower ladder, too, and I will return to it in a moment.)

The other side of the roof was not visible from where I was standing, but its lines would tend *down* toward vanishing points below the horizon. Line w is an example. Because the roof is symmetrical, lines parallel to w will vanish at a point D that is exactly as far beneath A as C is above A.

Over on the other side of the house, roof lines like z will vanish upward to point E; and lines on the farther side, like v, will vanish downward to the point F.

There are also some planes in this house that are like plane of the right-hand roof (the one with the ladder) but not quite as steep. One such is the roof of the small addition to the left of the porch. Its horizontal lines will vanish at point B, but its most vertical lines, like the right-hand cornice, will vanish on the line DAC, somewhere above the horizon and below the point C. And then there's the lower ladder: it also forms a plane, the steepest one of all. Its horizontal lines—the ladder's rungs—will vanish at point B, but its sides will vanish very high, somewhere up above point C.

Once you have studied a house and found the principal vanishing points, then you might try to visualize the vanishing *lines* that go with them. If you turn Figure 13.3 on its side—so the right side is up—the line m makes a perfect horizon, and the dashed lines leading to A and C are like railroad tracks. The windows on the right side of the house even provide some railroad ties. The same is true in more obscure cases. The roof on the right (the one with the higher ladder resting against it) has the vanishing line BC. If you picture the surface of the roof and its vanishing line, and mentally erase everything else in the scene, you will find that you're picturing a new horizon (BC) and that the roof is like a rectangle resting flat on an infinite plain. Then the higher ladder is like another set of railroad tracks, and its rails have to vanish somewhere on that horizon.

Every plane and its vanishing line are like this; it's as if they were originally flat planes (or plains) and were tilted up into position. You can even visualize vanishing lines for planes that are out of sight, like the line BD for the far side of the right-hand roof. I have drawn in several others on the small diagram. After a while, you'll be able to look at the large photo and picture vanishing lines all around the house. And most important, the planes aren't separate: they all fit together like one of those folding paper toys that flex back and forth, revealing numbers or fortunes.

Perspective is dry—no doubt about it—but once you understand these principles, you will start to see things in a very different way. The visible sides and roofs of every house will become parts of infinite, invisible planes; and all the planes will intersect in vanishing lines. Every ordinary house will reveal itself as part of a larger structure, and you will be able to picture and sense the planes and points that define the structure. It's an interesting feeling; perspective is very exact and rational but it divides the world into geometric shapes so complex and unmoving that it can be claustrophobic and exhausting. Of all the kinds of seeing in this book, this is the one that gives me the least pleasure. I have thought about perspective for over a decade and I no longer want to see the lines. There is pleasure in the learning and in the first discoveries of how the planes interact. The first time I stood in front of a house and imagined all the lines in place, I was astonished. But perspective is also unremitting and it makes the world clearer and more obvious than I like it to be.