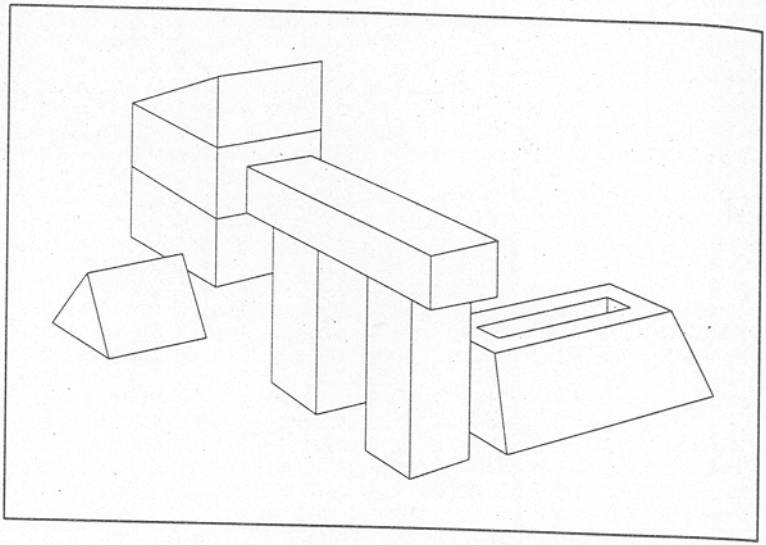


Figure 12.1 Part of drawing analysis is to decide how each line in a drawing should be interpreted.

the drawing into objects. Along the way, you see that some impossible drawings can be detected, because there is no way to interpret all the lines consistently.

There Are Only Four Ways to Label a Line in the Three-Faced-Vertex World

Consider a world populated by crack-free polyhedra with lighting arranged to eliminate all shadows. The lines in drawings of this world represent various naturally occurring edge types. A simple partitioning of these lines is shown in figure 12.2.

All lines are divided into boundary lines and interior lines. **Boundary lines** occur where one object face hides the other. The two regions in the

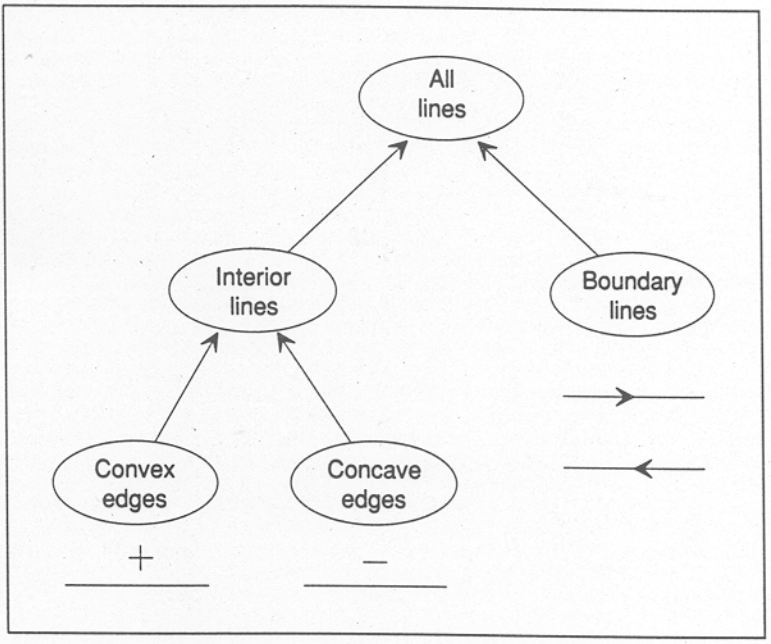


Figure 12.2 Drawings consist of boundary lines and interior lines. The interior lines may be concave or convex.

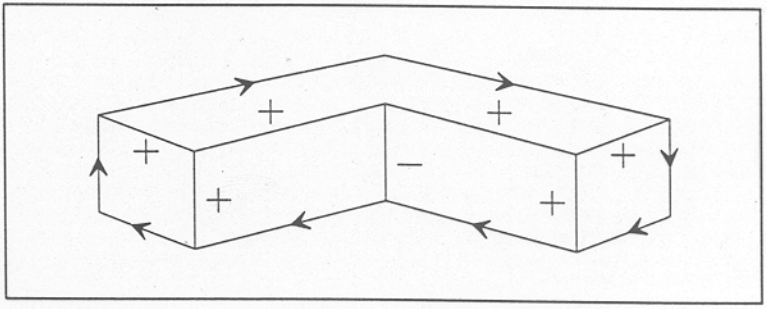


Figure 12.3 An L–shaped solid illustrates the three basic line interpretations: convex lines, marked with plus labels; concave lines, marked with minus labels; and boundary lines, marked with boundary labels.

Combinations of line labels surrounding junctions are called **junction labels**. Natural constraints severely limit the number of junction labels

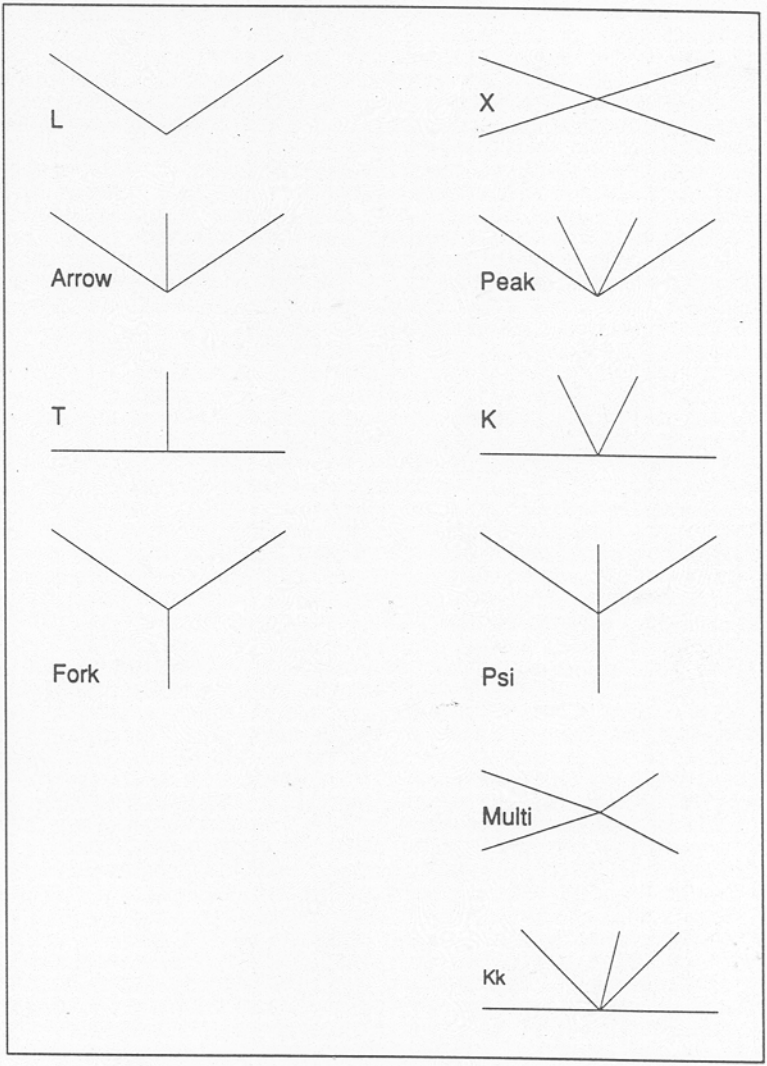


Figure 12.4 The common junctions. Those on the right are excluded if vertexes are all three-faced vertexes and there are no shadows or cracks.

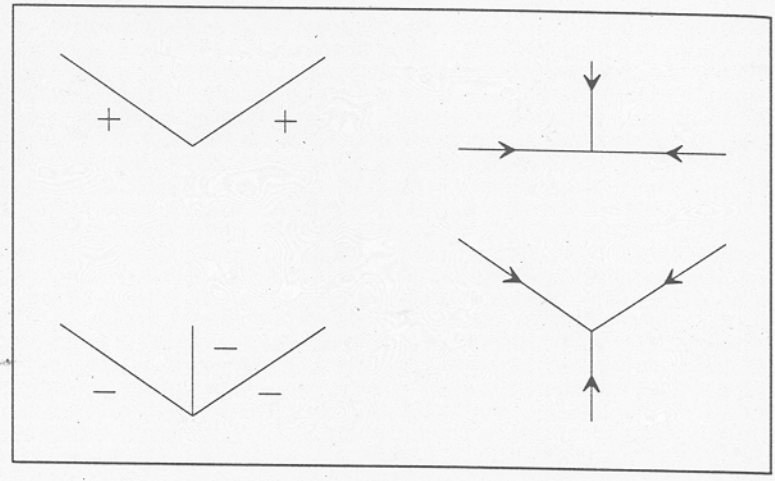


Figure 12.7 Some junction labels not found in drawings of polyhedra with three-faced vertexes.

tion labels of figure 12.7 in drawings of real polyhedral objects, given our

Figure 12.12 If three octants are filled, the remaining five viewing octants each supply a junction label. There are three unique Ls, one Fork, and one Arrow.

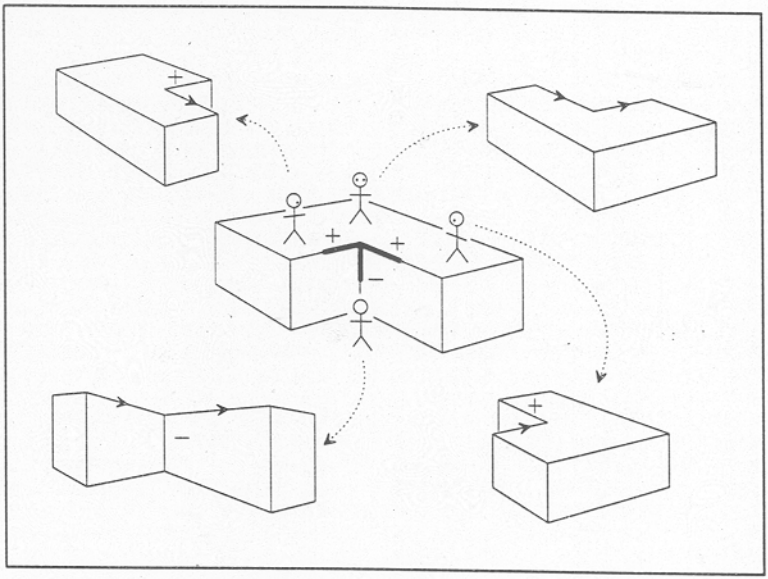
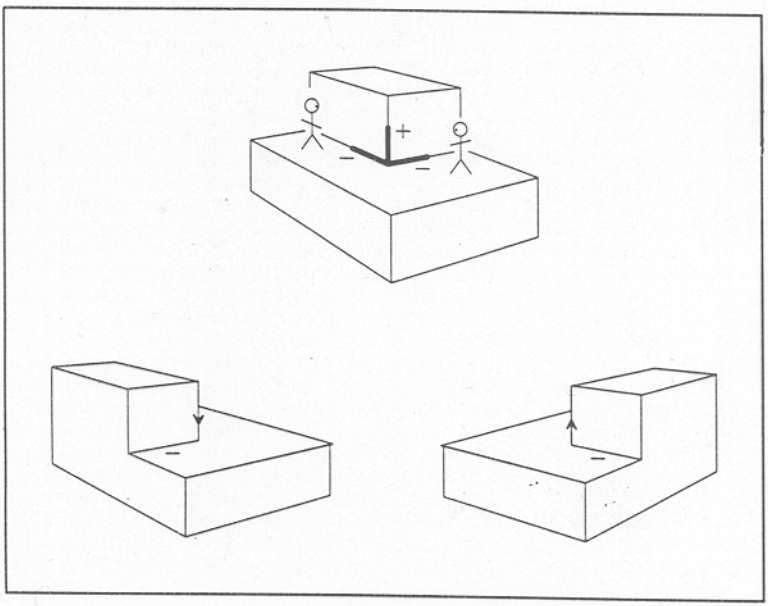


Figure 12.13 If five octants are filled, the three viewing octants supply two Ls and one Arrow.



Finding Correct Labels Is Part of Line-Drawing Analysis

Now let us examine examples showing how the junction catalog can be used. At first, assume that each object is suspended in space. Consequently, each

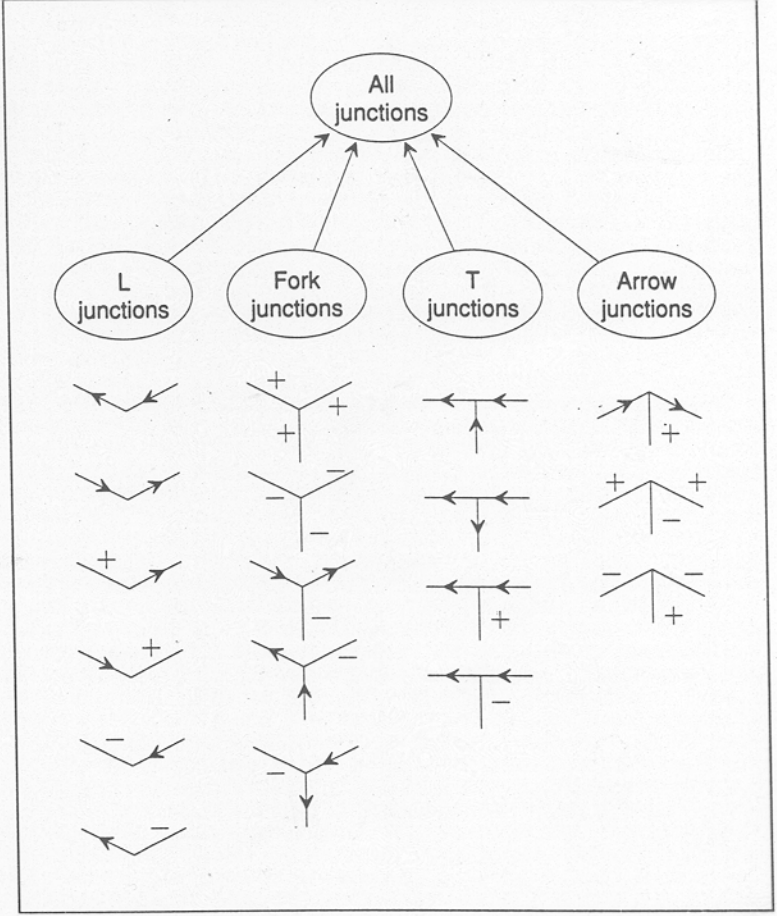
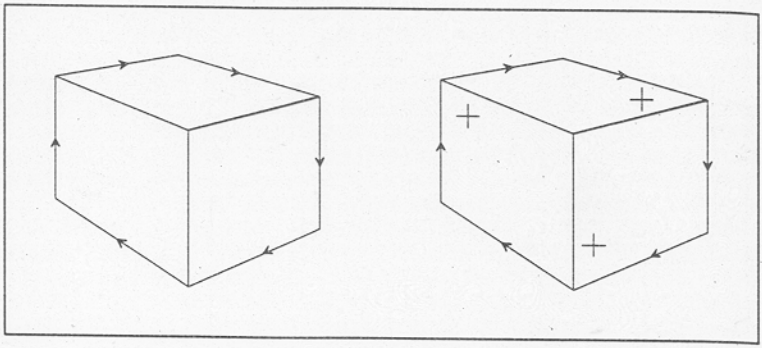


Figure 12.14 Eighteen junction configurations are possible. Were it not for natural constraints, there would be 208.

e 12.15 Labeling begins
cing boundary labels
g clockwise on the border
drawing. Next, it is
convenient to label the
of the Arrow junctions
barbs lie on the border.
example, a consistent
g of all lines is possible,
rse.



move still further, you must return to the junction catalog to pick up the other two Arrow junction labels. These other two Arrow junction label
force all of the remaining

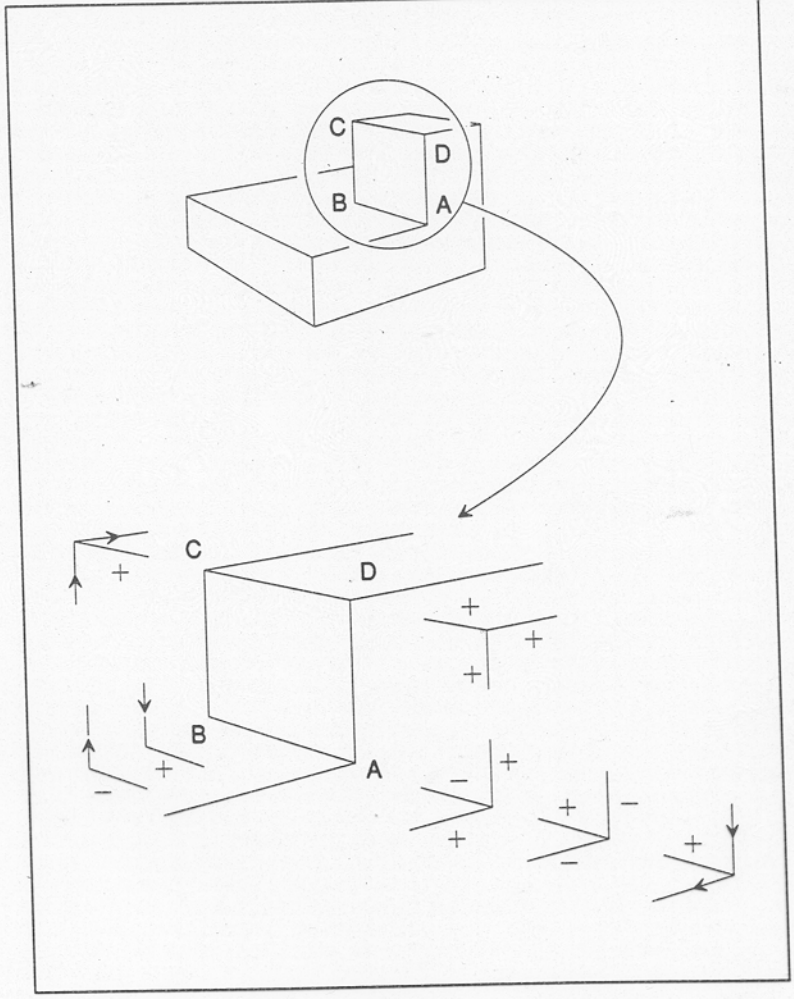


Figure 12.20 An example illustrating constraint propagation in drawings. Junction A is visited first, followed by B, C, and D. The Arrows placed at A limit the choices for Ls at B, which in turn limit the choices for Arrows at C. At C, automatic neighbor reexamination has an effect, eliminating all but one label at B and A. Finally, the C boundary label limits the Fork choices at D to the one shown.

already were label piles at all junctions in the illustration, a pile reduction at junction C could initiate a propagation series that would travel all the

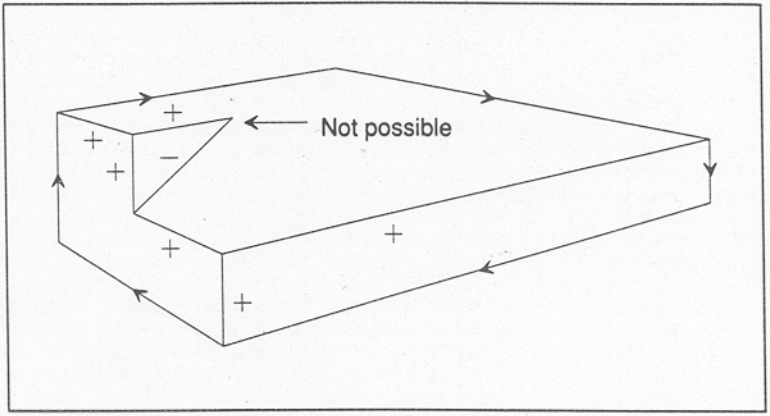


Figure 12.18 An impossible object. The indicated junction is not among the legal ones.

Waltz's Procedure Propagates Label Constraints through Junctions

Now you are ready to learn about **Waltz's procedure**, a powerful procedure for propagating symbolic constraints. To see how Waltz's procedure works, first consider the drawing-labeling problem abstractly, in figure 12.19, without getting into the details of the actual labels. Think of keeping piles of label possibilities for each junction. These piles are created

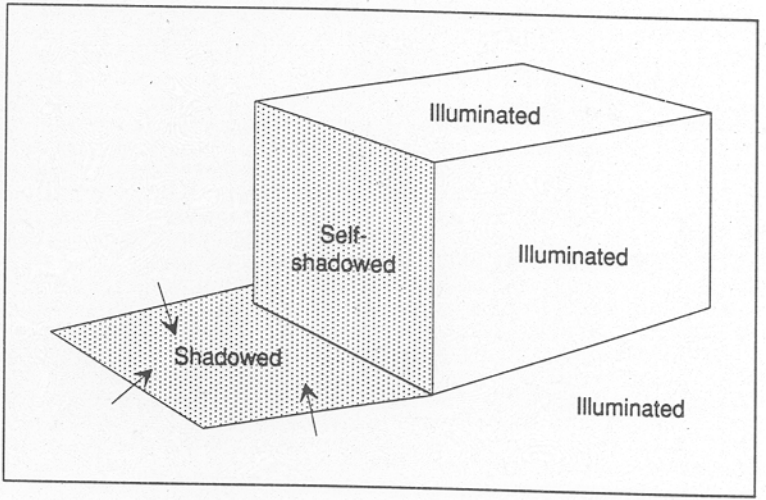


Figure 12.25 Illumination information often provides useful constraint. If there is a single light source, it is convenient to recognize three surface categories: illuminated; shadowed by intervening objects; and self-shadowed by virtue of facing away from the light source.

Figure 12.24 The eleven line interpretations and the corresponding labels.