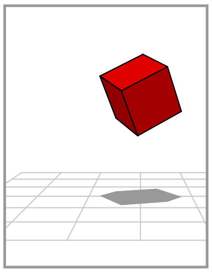
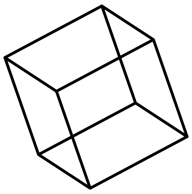


CHAPTER 11

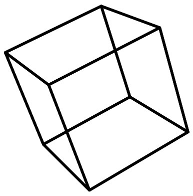
Introduction to drawing in three dimensions

Drawing figures in 3D is considerably more complicated than drawing in 2D, because we want to create the illusion of three dimensions on a two-dimensional page. There are in fact different ways to deal with this problem. I shall illustrate a few ideas by showing a progression of pictures of a cube.

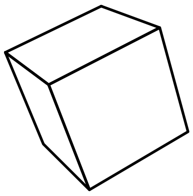
projection:orthogonal:1 frame:drawing:1 The first is a simple **orthogonal projection** of the **frame** of the cube. This just renders the image of the cube projected by parallel lines onto the (x, y) plane.



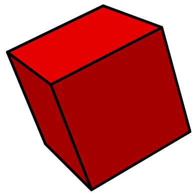
projection:perspective:1 In the next we use **perspective projection**, which in effect renders the image of the cube by intersecting the (x, y) plane with rays from points in space to a fixed location, which plays the role of the eye. This scheme has the virtue that objects further away from the eye look smaller. This provides an illusion of distance.



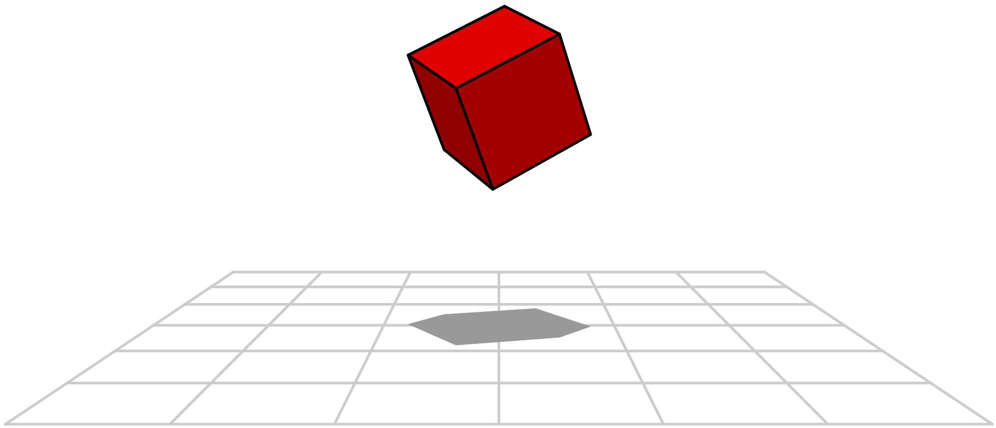
In the third we hide those faces of the cube which the eye lies behind. This adds the illusion of solidity.



shading:1 In the fourth we vary the darkness of the face of the cube according to the degree to which they face towards an imaginary vertical light source. We also get some colour.



shadows:2 And in the fifth we embed the cube into a simple environment, even projecting a shadow from the same imaginary light source that affected brightness. Environment also adds visual cues for depth and orientation.



We shall see in a later chapter that these effects are not too difficult to obtain with a 3D extension of PostScript. In the very next one we shall see the mathematics on which these effects depend.