Modern Movement important experiments with colour were carried out. The De Stijl group in Holland in the early 1920s was one such group. While Mondrian used pure colours and white on canvas, containing them in a black grid of simple rectangles, Rietveld, following similar principles, decorated the internal and external planes of his architecture (Plate 7.1). Other notable modern exponents of colour in the environment include Le Corbusier who used flashes of intense primary colours to contrast with the white geometric frame of his architecture.

The legacy of the dogmatic views of Ruskin and the priggish taste in colour of those who followed abandoned the field of polychromy to the engineer. It was the engineer who embellished and protected with paint the ironwork of bridges, the coachwork of the railway engine and the working parts of industrial and agricultural machinery. Arguably it was not until the building of the Pompidou Centre by Rogers and Piano that a return was made to the more ancient architectural traditions of environmental colouring (Plate 7.2).

The natural colours of traditional settlements constructed from local material delights the eye. The sophisticated and almost pristine colouring of De Stijl gives great intellectual and emotional satisfaction. They are, however, by no means the only ways in which colour can be introduced into the environment. The case being made here is the need for a more catholic and eclectic philosophy of colour in the environment. This is particularly true now when so much of recent urban development is a 'concrete jungle'. Given the current emphasis on sustainability, many local authorities are attempting to humanize the built environment with paint, vegetation and sculpture instead of demolishing the concrete jungle.

THEORY OF COLOUR

Before discussing colour in the environment it is useful to examine the general theory of colour and to define terms used to describe and specify colours. The term colour can be used in two main ways: (i) to describe the hues of the rainbow, the constituent parts into which white light is broken (red, yellow, blue, etc.); or (ii) it can be used in its more popular form and include black, white and grey. The last three 'colours' can be obtained as paints for use in the home in the same way as red, blue or green. It is this populist definition of colour which is used in this text. It is, however, important to realize that the designer's use of colour in the environment differs from that of the painter. While following the same principles of colour harmony the urban designer is working in a field where the quality of light varies from city to city, from season to season, and from morning through to late evening. The painter, in his or her studio, attempts to mix and use colour in a constant daylight condition. The results of his or her work is exhibited in a gallery where optimum lighting conditions prevail. The painter has control over his or her palette and can chose to follow theoretical trains of thought in the abstract. The urban designer works with other actors in urban development, each following individual intentions. The urban designer works on a canvas which is three dimensional, of immense scale and in a constant process of growth and decay. The starting point for the urban designer must of necessity be the environment of the place in which he or she is working. Colour theory for the city, therefore, has to be seen in this greater context and used, where that is possible, for decorating the city by creating harmony where none may exist.

There are three sets of primary colours from which the other colours can be made. With *light* rays, red, green and blue (blue-violet) will form other hues when mixed. Red and green will form yellow: green and blue will form turquoise; red and blue will form magenta. Light primaries are additive so that all three light primaries when combined reform to produce white.

With *pigments*, red, yellow and blue are the primary colours which when combined will

normally form other hues. Pigments tend to be subtractive, that is, red paint absorbs all light except red which is reflected from the surface. No pigments are pure mixtures, therefore, and combinations tend to deepen or subtract more of the light falling on the surface. A combination of all three pigment primaries will form black or deep brown: most light falling on the surface will be absorbed and very little reflected.

In *vision*, however, there are four primaries, red, yellow, green and blue. Each of these colours, perceptually, is quite distinct from each other. Any other colours tend towards one of the primaries. That is, a mix of yellow and green would look either 'greenish' or 'yellowish'. All four colours when spun on a wheel or mixed will form grey.

The three sets of primaries of the artist, the scientist and the psychologist, each produce different colour circles. While each colour circle can be used for deciding colour harmonies, this text, for convenience, will follow the traditional circle of the artist based upon the three primary colours: red, yellow and blue.

Figure 7.1 illustrates the three-primary-colour circle of the artist. It shows the distribution of primary, secondary and tertiary colours together with the division of the colour spectrum in terms of warm and cool hues. Ives, who brought this particular spectrum to perfection suggested that the red should be magenta (*achlor*), the yellow should be clear and clean (*zanth*) and the blue should be turquoise or peacock (*cyan*). These particular primaries when mixed will give a satisfactory spectrum of pure hues (Birren, 1969).

The use of colour harmony in painting or the built environment is founded on an understanding of simultaneous and successive contrast and of the phenomena of visual colour mixtures. Chevreul (1967) described the effect of simultaneous contrast as follows: 'If we look simultaneously upon two stripes of different tones of the same colour, or upon two stripes of the same tone of different colours placed side by side . . . the eye perceives certain modifications which in the first place influence the intensity of the colour, and in the second, the optical composition of the two juxtaposed colours respectively' (Birren, 1969).

Figure 7.2 illustrates simultaneous contrast of brightness. Both greys are identical in brightness but the one seen against black appears lighter than the one seen on the white ground. Light colours will tend to heighten the depth of dark colour and dark colours will tend to make light colours lighter. Where colours of different value or brightness are placed side by side a fluted effect is produced (Figure 7.3). The edges of each tone will tend to be modified in contrary ways. The effect of 'after-image' of contrasting colours is also quite noticeable. Figure 7.4 illustrates this using black and white. The effect of contrast is best demonstrated by staring at a given hue for a short time; when the gaze is transferred to a white wall the appearance or shadow of the opposite hue is stimulated. Referring to the full colour circle (Figure 7.5) the contrasting colours are those that are diametrically opposite on the circle. The after-image of red is blue-green and vice versa; the after-image of yellow is violet and vice versa. Opposite or contrasting colours when used together tend to give brilliance and purity to each other without any change of hue. The red and green used on the Post Modern factory in Nottingham achieves this aim (Plate 7.3). The main colour for the building is mid-red which is heightened by the areas of contrasting mid-green.

Where non-complementary colours are placed side by side they are affected as if tinted by the light of the after-image of the neighbouring colour. When, for example, yellow and orange are placed together the violet after image of the yellow swings the apparent hue of the orange towards red while the blue after-image of the orange will make the yellow appear greenish.

Contrasting effects in value are stronger when light and dark colours are juxtaposed while contrasts in hue are most noticeable when the colours are close in value. However, the size of the