for each of us, not so when it comes to lighting calculations. A series of notional artificial mathematical sky models have been created from which the sun is totally excluded. The 'daylight factor' at any point inside a building is then calculated as the portion of one of these theoretical hemispheres which can be seen. Since the more advanced of the mathematical models do not define the sky as uniformly bright, the whole process involves highly complex solid geometry. In a misguided attempt to help architects, building scientists have generated a whole series of tools to help them calculate the levels of daylight in buildings. Tables, Waldram diagrams and daylight protractors, together with a whole series of computer programs have been presented as tools for the unfortunate architect. Now these tools all miss the point about design so dramatically as to be worthy of a little further study (Lawson 1982).

First, they all require the geometry of the outside of the building and the inside of the room in question to be defined, and the shape and location of all the windows to be known. They are purely evaluative tools which do nothing to suggest solutions, but merely assess them after they have been designed. Second, they produce apparently very accurate results about a highly variable phenomenon. Of course the level of illumination created by daylight varies from nothing at dawn to a very high level, depending on where you are in the world and the weather, and returns to nothing again at dusk. Thankfully the human eye is capable of working at levels of light 100,000 times brighter than the minimum level at which it can just work efficiently, and we make this adjustment often without even noticing! So the daylight tools indicate a degree of precision which is misleading and unnecessary. Third, the daylight tools are totally divorced from other considerations connected with window design such as heat loss and gain, view and so on as we saw in the previous chapter. Such a lack of integration makes such tools virtually useless to the design. It has been found, not surprisingly, that such tools are not used in practice (Lawson 1975a) but they are still in the curriculum and standard textbooks of many design courses.

The danger of such apparently scientifically respectable techniques is that sooner or later they get used as fixed criteria, and this actually happened in the case of daylighting. Using statistics of the actual levels of illumination expected over the year in the United Kingdom, it was calculated that a 2 per cent daylight factor was desirable in schools. It then became a mandatory requirement that all desks in new schools should receive at least this daylight factor. The whole geometry of the classrooms themselves was thus effectively prescribed and, as a result, a generation of schools were built with

large areas of glazing. The resultant acoustic and visual distraction, glare, draughts, the colossal heat losses and excessive solar gain in summer, which were frequently experienced in these schools, eventually led to the relaxation of this regulation. In many areas, programmes were then put in place to fill in windows to reduce the negative effects of such a disastrous distortion of the design process.

Regulation and criteria

Unfortunately, much of the legislation with which designers must work appears to be based on the pattern illustrated by the daylighting example. Wherever there is the possibility of measuring performance, there is also the opportunity to legislate. It is difficult to legislate for qualities, but easy to define and enforce quantities (Lawson 1975b). It is increasingly difficult for the designer to maintain a sensibly balanced design process in the face of necessarily imbalanced legislation. A dramatic example of this can be found in the design of public sector housing in the United Kingdom.

The British government had commissioned an excellent piece of research completed by a committee chaired by Sir Parker Morris into the needs of the residents of family housing. The committee worked for two years visiting housing schemes, issuing questionnaires, taking evidence from experts and studying the available literature. This was to be a most thorough and reputable study which proved useful in guiding the development of housing design for several decades (Parker Morris, *Homes for Today and Tomorrow* 1961: 594, London House). The final report was in the form of a pamphlet containing over 200 major recommendations. Some of the recommendations were later included as requirements in what became the Mandatory Minimum Standards for public sector housing. It is interesting to see just which of the original Parker Morris recommendations were to become legislative requirements and why. Consider just three of these recommendations made in connection with the design of the kitchen:

1. The relation of the kitchen to the place outside the kitchen where the children are likely to play should be considered.
2. A person working at the sink should be able to see out of the window.
3. Worktops should be provided on both sides of the sink and cooker positions. Kitchen fitments should be arranged to form a work sequence comprising worktop/sink/worktop/cooker/worktop unbroken by a door or any other traffic way.

(Parker Morris 1961)