

2 INTRODUCTION

We spend most of our lives in buildings and our experiences in them are important. These experiences are to a large extent formed by the prevailing physical conditions and therefore our physical surroundings are of special concern to us as building designers.

The design of our physical environment involves a number of different disciplines and each of these has its own literature and traditions of study. As an example, consider the range of expertise involved in the design of a heating system - just one small part of a building.

Experimental psychologists will determine the factors that influence a person's thermal comfort and they will investigate the variability of people's responses to those factors. This information is used to choose the comfort criteria that will be applied to various aspects of a design.

Physiologists explore the biological processes that maintain a healthy body temperature. This information may be used to choose effective ways of achieving a comfortable thermal environment.

Physicists determine a whole host of thermal properties, such as the emissivity of surfaces and the heat output from radiators.

Engineers design a heating system that will keep occupants comfortable in a building where circumstances are unique to that particular scheme.

Architects need to accommodate the heating system in their designs, and provide occupant comfort without compromising other design objectives.

The engineering and architectural tasks are slightly different from the others because a designer's final output is that of synthesis i.e. putting parts together to make a whole. The other disciplines' final output derives from analysis i.e. identifying the elements that make up the whole, or from experiment. This does not mean that those other disciplines never undertake design, they do. Experiments need to be meticulously designed if they are to provide unambiguous results.

The opposite is also true. Although a designer's final output is one of synthesis, before that can be accomplished, there needs to be much analysis. Often this is first needed in order to establish basic design criteria and their relative priorities. Designers must then establish a suitable framework of criteria that can be used to assess a design. Without such a framework, designers are unable to assess their work and hence unable develop and improve their designs.

Many different professions contribute to making the built environment and no one profession has exclusive involvement in any one particular area of expertise. The more each member of the design team appreciates the outlook of other team members, the less painful is the whole construction process. This does not mean that everyone is able to do the other's job, nor that everyone in the team will always be able to have their own way. But that even though each member of the team brings a different focus to the project, they all wish for the final building to be the best overall compromise possible. Confucius is reported to have said two thousand five hundred years ago,

'Men who differ in their principles cannot help each other in their plans'.

2.1 Building for a purpose

Buildings are built for a variety of purposes that will vary in importance for different design projects. One task of the designer is to decide on what really is important for a particular project. This may not be easy; not only will the priorities assigned to various purposes change between projects, but also, no two designers will hold exactly the same opinion about what is important for one particular project.

2.1.1 A means of providing shelter

Because humankind has had the ability to construct shelters it has spread over the majority of the globe. Shelters of one kind or another have protected people from the extremes of a biting arctic wind to the searing rays of a tropical sun.

It is instructive to examine the shelters of indigenous peoples. These display an admirable aptness of construction, developed through trial and error over generations. Designers intending to build in a climate with which they are unfamiliar would be reckless if they ignored the lessons to be learnt from such buildings.

Some of the lessons to be learnt from traditional constructions are:

The needs of humans in particular environments

Those climate variables that are really important

Ways in which comfort can be achieved

The availability of materials for construction

The idea that what has gone before is a part of design i.e. the importance of precedence

2.1.2 Easing the task of living

Although a simple shelter may enable someone to survive, it does not necessarily enable a person to be comfortable. It might well be asked if comfort is that important. Well, I believe it is. You might well not be in danger of dying from hypothermia in a cold room, but you might not feel comfortable enough to read a book or be able to perform a task needing some dexterity. A noisy room might not damage your hearing, but still it might be too noisy to conduct a conversation with a friend. Generally, people perform difficult tasks better if they are not distracted by discomfort. Therefore, if people are to make the most of their abilities they need reasonably comfortable surroundings.

One important area of study is to explore the range of conditions that people find comfortable. Anybody undertaking this sort of study soon appreciates the extent to which people's preferences differ. Any single condition is unlikely to satisfy everyone and designers must choose to design for a particular group of people.

Comfort is not a simple physiological response. Autonomous physiological processes are to a large part responsible for our experience of comfort, but overlain on them are complex emotional and psychological effects. These can be difficult to predict and therefore not easily taken into account by the designer. Because they are not always easy to define, it does not mean that they are factors that can be ignored. This can be difficult to sometimes accept. A problem cannot be ignored just because it is either difficult to define or does not have an exact or '*perfect*' solution.

2.1.3 Experiences for the senses

Understanding the ways in which physical stimuli influence our sensations unlocks the potential of using design to create particular experiences. It may be that we are able to heighten the response to some stimuli by contrasting them with different sensations, or ensure that users are unaware that their environment has changed because of the subtlety with which it has been achieved. Skilful manipulation of the environment requires astute observation and experience over some years. The general principles are quite simple but they are not easily applied to predictable effect.

Constant change and continuous stimulation can provide a stimulating environment, but one which quickly palls. Where people are exposed to a particular environment for a long time then a subtle approach may provide a more lasting satisfaction.

The foregoing does not necessarily only refer to the internal environment within a building, or even a building. It applies as much to the manipulation of the spaces around buildings. Perhaps, even to experience in general.

2.1.4 A statement from the client

Buildings can be expensive and their costs increase with size, complexity, the use of exclusive materials and the employment of craftsmen. Clients who build on an extravagant scale are announcing to the world something about themselves. A corporate client might wish to convey another sort of message, for example their concern for the environment. In such cases it may well be that the client will insist that the building be designed to be energy efficient or that the design utilises reclaimed materials, thus confirming their 'Green' credentials.

2.1.5 Expression of culture

Buildings are structures imposed upon the natural world by humans. As such they are a visible expression of our relationship with the environment. I might see buildings as symbols of a mastery of people over the natural world. Buildings perceived in this light can become a language that says something about both the people who built the buildings and myself as the interpreter. This identification of a building with an expression of cultural values can become so close that the building itself may even be seen as embodying those cultural values.

This may apply not only to buildings as a whole, but to particular building forms, styles or even details. A particular style may be so associated with a particular function that it acts as a cue and therefore evokes a common emotional response throughout a people of one culture.

The last two aspects will be covered in other courses and this unit will concentrate upon how to achieve the first three purposes of buildings:

- to give **shelter**
- to ensure **comfort**
- to provide an **experience**.

Initially the course will be concentrated upon providing an overview of the subject and introducing some of the theoretical foundations of Building Environmental Design. Some of the concepts introduced may seem rather abstract at first, but they will appear less so as they are applied to your studio projects.

2.2 An imperative of design

The Earth's climate appears to be changing. There is no doubt that the Earth's temperature has been rising at an unprecedented rate over the last 100 years. Whether this is man made or not is open to debate, but the opinion of the majority of scientists is that man's activities are a major cause of the observed increase in global temperatures.

Let us recognise that the Western world has raised the standard of living for most of its people by the exploitation of the Earth's natural resources. One of the most important factors that has helped us to increase our standard of living has been the application of mechanical and electrical power. This has enabled us to increase both our productivity and our mobility. Unfortunately, this mostly has been achieved by the burning of fossil fuels such as coal and oil which has resulted in the release of trillions of tonnes of Carbon Dioxide into the atmosphere. Carbon Dioxide is known to be a 'Green House' gas that absorbs radiation emitted from the earth's surface and then re-emits some of it back to earth. This reduces the heat lost to outer space which means that more heat is retained on earth.

These effects are real and are not challenged. There is less agreement on the eventual consequences for the Earth's climate.

However, if the world's population were to emit per person the same quantity of Carbon Dioxide as each person in developed countries, then the increased concentrations of Carbon Dioxide would result in substantially more heat being retained by the earth.

At the very least, it might seem prudent to limit the emissions of Carbon Dioxide.

Because buildings account for a significant part of the energy used in the European Union, if emissions of carbon dioxide are to be reduced then the energy used by buildings must be reduced. As a means of achieving this objective the European Union enacted on the 5th January 2003 the Directive on the Energy Performance of Buildings.

As a means of fulfilling this Directive the Government of the UK has introduced a number of measures, one of which is to introduce new Building Regulations that specify the characteristics that various types of building must achieve.

Of particular interest to the designers of environmental conditions are:

- Part E - Resistance to sound,
- Part F - Ventilation,
- Part L - Conservation of fuel and power.

It is important to recognise that the total energy used through the lifetime of a building comprises:

- Energy used in construction - sometimes called embodied energy,
- Energy used to refurbish and maintain a building,
- Energy used to run the building, its heat and light and electrical power,
- Energy used to dispose of the building at the end of its useful life.

Not only does it need to be recognised that construction materials require energy to be extracted, refined, transported to site and incorporated into the building, but also that they might be of limited availability with only a finite amount accessible. Therefore, designers need to consider whether or not their buildings contribute to a sustainable society.