

## MODERN ARCHITECTURAL DESIGN FOR HEALTHY BUILDINGS AND OCCUPANTS

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### Abstract

The author addresses the question of what is a healthy building, and whether the definition normally expressed in terms of occupant well being, has changed over time. He next considers this definition in relation to the relevant physical correlates, and suggests that they support the idea of the light airy building. He then takes the idea of and Air Quality, and investigates how it can be, and perhaps more importantly how it is incorporated into current solutions. He finds that there are two design approaches, namely Climatically Rejecting and Climatically Interactive, and that the use of either can result in solutions of differing orders of technical complexity. Finally, he suggests that some orders of solution are more difficult to operate healthily than others, and indicates possible ways ahead.

### Introduction

In 1961 the World Health Organisation defined Health as "Not merely the absence of disease or infirmity, but a state of complete Physical Mental and Social well-being". A healthy building therefore is surely one that promotes the complete well-being of its occupants.

Modern society spends between 85-90% of its time indoors. A consequence of social changes including increased leisure time, an ageing population, and the influence of television. As a result we now find that the number of health complaints that may be related to the indoor climate, has begun to rise. It is certainly ironic that having spent years cleaning up the pollution in the outside air, we should now need to focus our concern on indoor air quality. For, we have always assumed, perhaps as a result of our long involvement in Public Health and Safety, that our buildings are both safe and healthy.

Traditionally, our buildings have been well and naturally ventilated using large and opening windows. The result has been that a sufficient quantity of "fresh" external air was available to provide oxygen to breathe, and to reduce by dilution any internal concentrations of contaminants to safe limits. However, as a result of the 1974 oil crisis, we began to both seal up the gaps and cracks in our houses and places of work, and to reduce the volume of occupied space (and therefore volume of air) per person, in order to reduce the heat lost by ventilation and so reduce the fuel bill.

Unfortunately, this desire to reduce energy consumption, when approached via the mechanism of reducing the quantity of fresh air available to each person, (so that minimum levels rather than the traditional levels become the norm) particularly when associated with a more sophisticated approach to technology (mechanical ventilation and air conditioning), has led to tighter (lower) ventilation design limits. As a result, the margins of safety which we probably don't fully understand, get reduced, so that acceptable risks tend to become problems. This process is exacerbated by the normal workings of the construction industry, in that it both builds and sells its prototypes so that in the current economic climate it is hard-pressed to reflect on any such side effects.

What has happened to our ventilation levels, has also happened to our standards of daylight. The large openable windows of yester-year, have become sealed for the reasons given above, and reduced in size to control both heat losses and gains. This reduction in quantity and quality of daylight, has been eagerly replaced with up to the minute high efficiency electric lighting.

#### Is Energy Efficiency Safe?

What seems to have been happening, is that the Design Professionals have concentrated quite naturally on the recent and on-going changes to the Building and Fire Safety Regulations. This has resulted in a too narrow concern with efficiency and safety, such that the traditional concept of Health, and the Healthy building has been lost. An attitude that has been perhaps reinforced by the modern concern for the healthy body, based on diet and exercise, almost as an alternative to environment. The approach varies from country to country, but the direction is I think relatively clear.

The issue is that of whether we have created, or are creating, a generation of safe and efficient buildings, but which are unfortunately unhealthy. The temptation to accept that we have, and are, is increasing. Outbreaks of and deaths from Legionnaires Disease continue, and together with the new phenomenon of Building Syndrome it disrupts our air conditioned, sealed building, commercial lives. In housing the scourge of condensation and mould growth has never been greater. The Pundits, are having a field day. Forbid air conditioning, reduce building depth, increase volume of air per person, centrally heat everything etc.

#### Reason must Triumph

Yet for all this, there is much evidence to indicate that we have learnt a great deal over the past years. Certainly in the U.K. we have many excellent examples of well liked, functionally successful, safe, and efficient schools, houses, offices, factories and hospitals. The same is, I am sure, true of many countries. The difficult seems to be that within any building type, the results are random, with no obvious logic, although a great deal of opinion, to explain why some seem to work better and are apparently so much healthier than others.

Moreover, success and failure appears to be related in one way or another to the visual environment and air quality. This should come as no surprise as the eye has more receptors and uses more brain capacity than anything else we do, and more air is filtered through the body than anything else except food. So we are perceiving short term problems through the most sensitive mechanism, and longer term ones through the mechanism that filters more of the surrounding environment than anything else.

The natural tendency is to credit the success or blame to the design professional involved. Indeed this view is reinforced by the typical professional attitude, namely ... Employ me, and it will all be fine... One can criticise designs of a few years ago with impunity, as now our knowledge and solutions are better!!!

The alternative and currently more popular solution is to argue that ... we (the professionals) know how to do it, but the clients will not let us, do not want it, will not pay for it etc. Clients, it is argued, get the buildings they deserve... On the other hand, the randomness of the results, so argue the clients, means that it cannot all be their fault.

### A way forward

The suggestions that I would like to make, perhaps as a theme for this conference are as follows:

a. Health as an issue, as a design parameter in our buildings, has been forgotten. It must be restored as a design and operational matter in its own right. Health hazards and their prevention are not now the preserve of the Architect or Engineer. They are no longer skilled in their solution. New skills or the retraining of old skills are needed.

b. A clearer recognition of differing boundaries, how they may be easily and unwittingly crossed, and the consequences of so doing, is required. Buildings may be climatically Rejective or Interactive. They may have simple or complex spaces. The choice of design solution depends on function, site constraints and the like. The result may vary from a simple naturally ventilated climatically rejecting building, to a complex climatically interactive building. Yet how many realise that in a spatially complex climatically interactive building, the mechanical plant has a fabric protection, as well as a comfort controlling role. The solution to which is of an entirely different order, and with a much lower probability of success.

c. Are our buildings ever properly put to work, or to use another phrase, properly commissioned. I doubt it. Although this deficiency may cause difficulties in a simple climatically rejecting building, in complex buildings it can, and has resulted in death.

d. We have in the U.K. no generally reliable operation and maintenance structure, yet we continue to design and build buildings that rely utterly on the existence of such a structure. The new breed of Facilities Managers are trying hard, but they have a long way to go.

If the situation is unsatisfactory, and it is, then it is in least a part our fault, because we have developed no means of correlating success and/or failure in operation, with design and construction. No means of learning from our successes or failures. No means of establishing a range of partial solutions to copy. No means of establishing which solutions work best in practice. No range of partial solutions, of best buys. Let us now create this opportunity before it is too late.