FLEXIBILITY IN BUILDING DESIGN

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Introduction

A range of social, architectural, engineering and environmental considerations all conspire together to influence buildings in ways which are unpredictable and unforeseen. The spaces they contain, their systems of control, the nature of building enclosures and the events that take place inside them are all closely interconnected; it is difficult to disentangle one element from another. For instance, internal divisions on a floor may influence air flow from above and temperature control at the perimeter, create barriers to communication between people, and have a fundamental impact on the use of adjoining spaces. All these problems can be solved but the in-built 'flexibility' that results may be difficult to operate, expensive to maintain and remain esoteric to those who need to understand it. As a result, the validity of the building and its systems are called into question as its continued use becomes subject to uncertainty and even chaos.

The predicament I have described has been brought about by attitudes and skills developed over the last 50 years or so. Distinct areas of expertise exist which can be applied effectively to the many separate systems of building and organisational design. These embrace technological, mechanical, electrical, behavioural and managerial skills and many others. But the separateness of these disciplines tends to cause building systems to break down at their connections. The full impact of one on another is not always appreciated because, for instance, architects neglect the continuing role of facilities managers, engineers misinterpret the needs of building users, interior designers have no knowledge of an organisation's management thinking. The list of potential disconnections is long. Together, they impede our ability to tackle and control the complexity of building in the Age of Paradox. (Figure 1) More than ever before, it is necessary now to think in terms of complex wholes rather than individual parts. For the future, the traditional barriers between professions may need to be lowered and categories of expertise re-defined; the term 'flexibility' will begin to assume a new meaning.

Analogies with Science

To develop the theme of disconnection further I am delving, first, into the world of scientific discovery. For 300 years scientists have been looking for the simplest pieces possible; they have dissected everything into modules, atoms, nuclei and quarks. But these simple particles, apparently obeying simple rules, sometimes....

"spontaneously organise themselves into complex structures like stars, galaxies, snowflakes and hurricanes - as if they were obeying a hidden yearning for organisation and order."[1] (Figure 2)

As a result, scientists' attention has been diverted away from ultimate particles towards patterns of change and what prompts them to form and

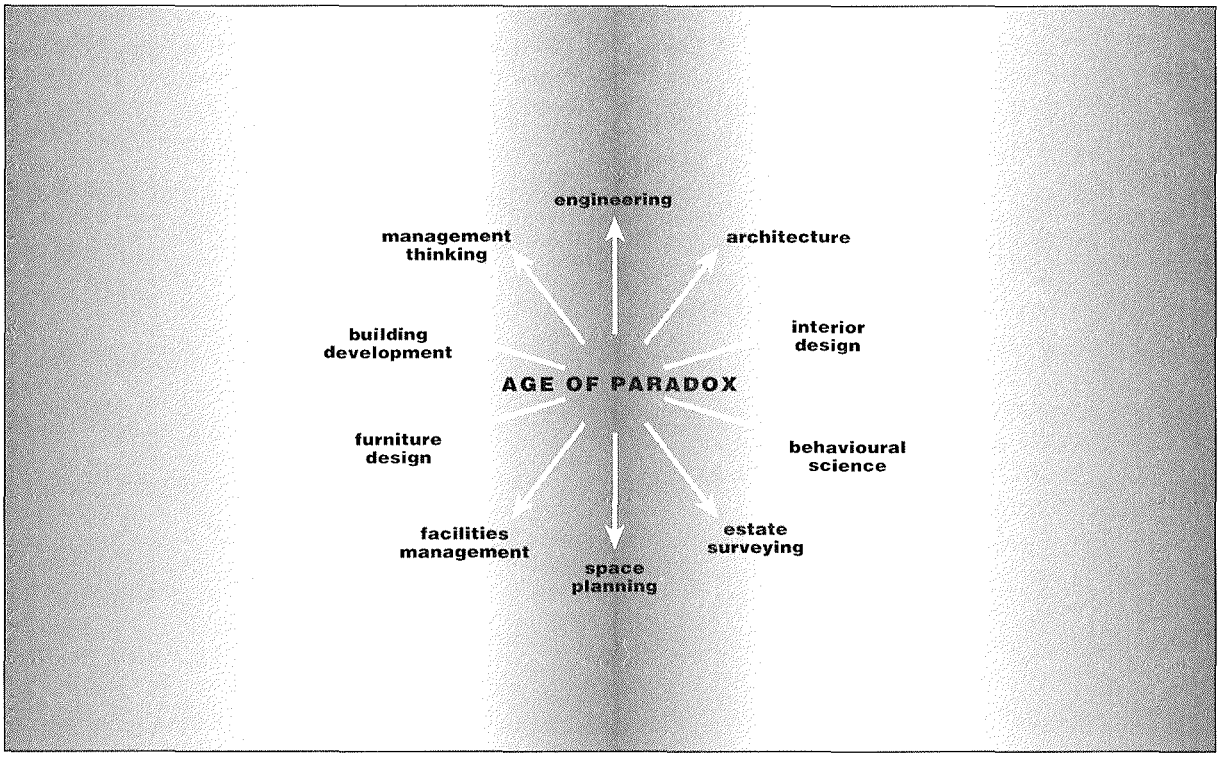

Figure 1 Disconnections exist between the many separate disciplines which influence building and organisational design.

Figure 2 Andromeda Galaxy

dissolve. We can follow scientists into these new areas because we are familiar with them; the problems respond to spatial thinking and are less concerned in elegant equations and advanced mathematics.

The New Science is just as exact and rigorous as physics but, instead of being about simplicity, it is concerned in 'complex adaptive systems'. These range way beyond the traditional boundaries of science to include, for instance, the world economy, ant colonies, transport networks, developing embryos and cities. Complex adaptive systems have many levels of organisation. In the brain, separate groups of neurones form speech centres, the motor cortex and the visual cortex. In a similar way, a group of individual workers forms a team, a group of teams forms a department and a group of departments constitutes a company. Such systems constantly revise and re-arrange themselves in response to knowledge gained and outside influences.

Each complex adaptive system, according to John Holland,[2] is a network of 'agents' acting in parallel. In the brain, the agents are nerve cells; in organisations, agents may be individual workers; in towns, agents may be individual households. In all cases "each agent finds itself in an environment produced by its interactions with the other agents in the system." Nothing is fixed because, in complex adaptive systems, each agent is constantly reacting to what the other agent is doing.

The Architects' Dilemma

My brief excursion into the science of 'complexity' (ie. at the edge of order and chaos) highlights one of the key paradoxes of the architectural process. Of necessity, to provide finite results in the form of building enclosures, architects engage a wide spectrum of 'agents' to serve their task. The result can be the creation of an ingenious and complex adaptive system but because this occurs with often very little knowledge of, or control over, other internal adaptive systems, the building's life may be thwarted from the very beginning. The skills of even the very best architects do not always succeed in adequately predicting the future. Of course, the time differential between the outside and inside is recognised; the outer system can be expected to stay intact for 70 years or more; the inner systems engage in frequent and often fundamental change. What is inside strives to permeate the skin of the building enclosure (Figure 3) or, alternatively, shrink to insignificance as other internal adaptive systems take over. Flexibility, if this is defined as in-built flexibility, has seldom been able to cope with the extent of physical and mechanical change that constantly occurs inside buildings. In the Age of Paradox, the events that take place appear always to exceed our expectations.

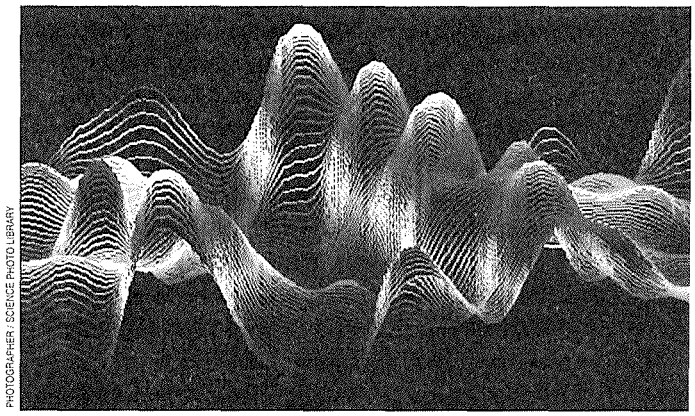

Figure 3 Inner systems may strive to permeate the skin of a building enclosure. (DNA seen by tunnelling microscope)

Looking Back to an Age of Certainty

Our present Age of Paradox, which has introduced complexity into all aspects of building design and use, was preceded by an Age of Certainty when, apparently, architects and builders were able to produce a sense of order that could better cope with unforeseen change. The oft quoted example is the 18th century London house. (Figure 4) Apart from its initial function as a residence, it was equally able

Figure 4 18th century London houses, Charing Cross

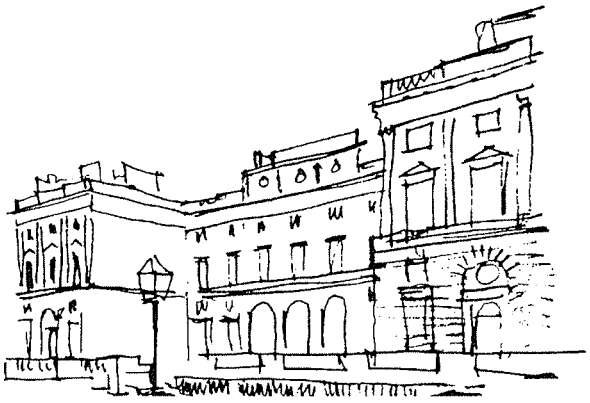

Figure 5 Somerset House in the Strand. Sir William Chambers, 1776.

to provide a base for a merchant or even a government department (although, face-to-face communications took place in coffee houses or the market place). The formula of the house persisted. Somerset House, for instance, was a multi-functional establishment containing galleries, salons, and institutes as well as a tax office. (Figure 5) In essence it was a domestic building on a grand palatial scale reflecting the style of royal palaces built elsewhere in Europe. Today, it performs much as it did 200 years ago.

The invention in the 1880s of the long distance telephone, together with the telegraph and the typewriter, shaped a new pattern of work which has persisted ever since. It enabled administrative functions to be separated from the market place or manufacturing plant and prompted the development of buildings devoted specifically to organisational activity. In Europe these early offices maintained the concept of the large house. (Figure 6) Suites of executive rooms at lower levels were linked via a grand staircase to upper floors devoted to work. But, in the USA, a new order was created which represented a negotiated compromise between commercial and environmental interests; the concept of building high could only make sense

Figure 6 Hudson House, Covent Garden. Sir Edwin Lutyens, 1904.

if the substantial mass of fabric involved could be made to support correspondingly substantial areas of usable space. In Manhattan and Chicago, unlike Europe, public health regulations did not preclude the building of deep office space in which enclosed cellular offices could be located in positions without direct access to natural light and ventilation. Hence, the skyscraper was born....

"The age found its form in a new type of office building: a sort of human filing case, where occupants spent their days in the circumspect cave of paper."[3] (Figure 7)

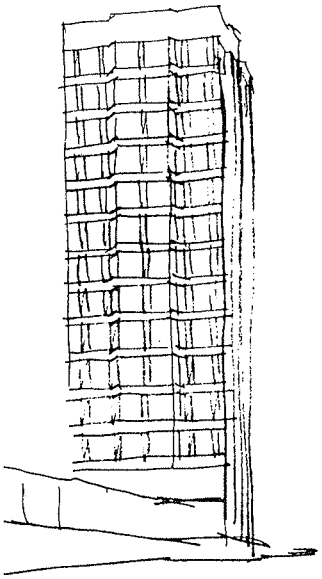

Figure 7 Reliance Building, Chicago. Burnham & Root, 1894.

In an Age of Certainty, few architects appeared to experience doubts on the validity of the buildings they were creating. Detailed knowledge of the organisational adaptive systems they were to contain was not sought nor did it feature, as a major priority, in the design process. (This was in marked contrast to the introduction of mechanical adaptive systems, including air conditioning and hydraulic lifts, which were vital, of course, to the successful development of high buildings.) It was assumed that clerical activities should be relegated to the back (or top) where they could remain unobserved by casual visitors; the front office existed primarily to impress. Office democracy had not yet arrived nor had the term 'functionalism' entered the vocabulary of architects. As a result, buildings reflected image as a first priority and their form was dictated by a combination of site conditions, building economics, and public controls.

The developments I have described took place during the last decades of the 19th century and early decades of the 20th century. Although the architects of the time were not particularly inquisitive about the needs of people occupying their buildings, they did succeed in demonstrating a remarkable degree of 'clairvoyance' in producing results which have stood the test of time. Buildings designed for one generation have proved to be perfectly valid for succeeding generations. The reason, I believe, is because flexibility, as an aim, was not so much on architects' minds; more, they were striving for a

degree of 'stability' which was capable of change. This is a quality that people (ie. building users) both recognise and want. It is a paradox of our time that, by seeking more to meet peoples every need, we move further away from what they want.

Causes of Disconnection

Scientists, in examining non-linear nature (ie. aspects of nature where the whole is equal to more than the sum of its parts), have revealed that everything is connected. For example, the flap of a butterfly's wing a millimetre is one direction may change the course of a hurricane in the opposite direction, one thousand miles away. Apparently, even the most tiny movements of an adaptive system can grow, under certain circumstances, until the system's future becomes completely unpredictable - or chaotic. Something similar happens in buildings; it is evidenced by the very high 'churn' rates that can occur in which people are relocated two, three or more times a year. They may never have an opportunity to stabilise themselves in a familiar setting but, instead, suffer the stress of exponential change and continual disruption.

High rates of churn are accepted by many managements as an inevitable outcome of the pressures under which they work; they are regarded as a responsible and responsive reaction to organisational change. Another less supportive interpretation, which I share, is to regard continual physical change as a sign of failure, by the managers and designers concerned, to take a wide view and apply strategic design thinking. If something requires fixing as soon as it exists, it was probably wrong in the first place. As WG Bennis observed in his article on Changing Organisations:

"In every age there is a strain toward organisational form which will encompass and exploit the technology of the time and express its spirit".[4]

In the Age of Paradox we are still searching for that form.

I recognise, of course, the extent of the revolution that has taken place in our organisations. The undemocratic paradigms of the past have been replaced by new patterns of work; people's tasks at the workplace have been re-engineered in order that they can better provide a sense of achievement. At long last, managements are beginning to appreciate that the creation of a sense of satisfaction at work is influenced (even if it cannot be determined) by the environment in which work takes place. Generally, an over-simplified push-button idea of people's needs is being replaced by a recognition of their complex and shifting expectations. What is lacking in this process of radical change is an ability to comprehend and therefore unify the various complex adaptive systems that impact on organisational design. More often than not, we can observe that the complex adaptive systems of organisational life work against one another. They are not synchronised; as one catches up, the other moves on.

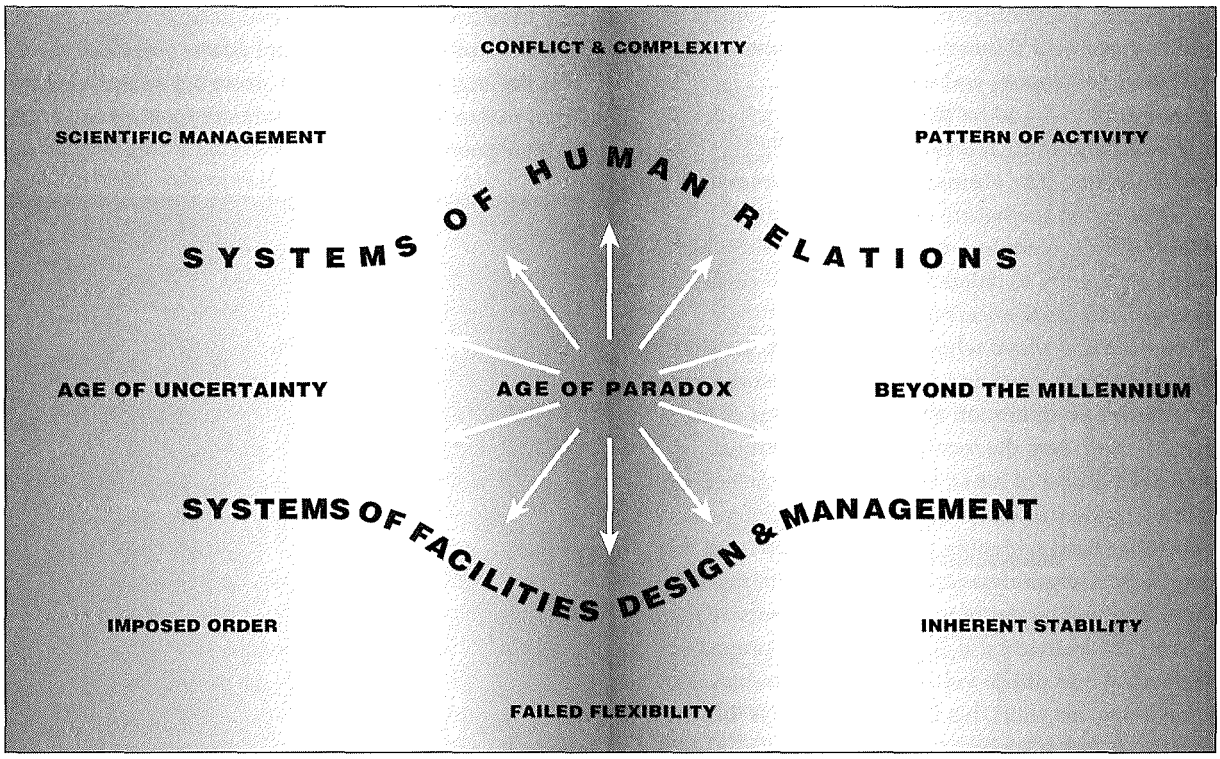

Figure 8

An example of disconnection, well known to all of us, is the Property Market. By the time it has moved to fill a perceived gap, the need for space has receded. Consequently, maximum supply occurs at times when demand is at its lowest. We accept the inevitability of this type of situation. Even the scientists of 'complexity' know that equilibrium can never be achieved; if it were, the system would be dead. But, as we begin to emerge from the Age of Paradox, it should be possible to achieve a greater degree of congruity between the various adaptive systems that act on organisational life - less novelty, more stability. To test this idea further, I am examining, in particular, two complex adaptive systems which can often be seen to working and odds with one another (see Figure 8):

- Systems of Human Relations
- Systems of Facilities Management and Design.

These two systems require different types of intelligence; analytical and interpersonal in the case of Human Relations; spatial and practical in the case of Facilities Management and Design. Maybe this explains why it is apparently so difficult for these two types of thinking to act together in unison.

The Growth of Human Relations

Caring about people as individuals, taking an interest in what influences their attitudes to work can be described broadly as 'The Human Relations' approach to management. Within the last 50 years, sociologists, psychologists, behavioural scientists and management thinkers have made immense strides in developing and defining what organisations should be striving for in terms of improved and more relevant management environments. The Human Relations movement recognises that the nature of the employment relationship is complex - an adaptive system which needs constantly to balance organisational demands against individual expectations.

It was Elton Mayo who, in the 1940s, concluded that a manager's task in organising teamwork (and stimulating co-operation amongst members of the organisation) was the most important but most neglected aspect of his or her job. Mayo opened up a chink in the principles of scientific management which has been widening ever since. As part of this process McGregor developed 'theory Y' (to replace the traditional model of management 'theory X') where "the individual is continually encouraged to develop and utilise voluntarily his capacities, his knowledge, his skills, his ingenuity in ways which contribute to the success of the enterprise."[5] The process of change, according to Argyris, was one of mutual adaptation "where the organisation modifies the individual's personality and the individual, through the informal activities, modifies the formal organisation. These modifications become part of the organisation."[6]

A total organisation, therefore, is much more than the formal organisation; Argyris regarded it as a composite of four different but inter-related sub-systems which result in four kinds of behaviour:

- the behaviour that results from the formal organisational demand
- the behaviour that results from the demands of the informal activities
- the behaviour that results from each individual's attempt to fulfil his idiosyncratic needs
- the behaviour that is the resultant of the unique patterning for each organisation of the three levels above.

For me, Argyris's grasp of the complexities of organisational life comes somewhere near the truth; certainly, it accords with the findings of my own studies into organisational activity. Although these have been undertaken with the express purpose of defining the physical forms in which change can be managed, I arrive at the same conclusions. The adaptive system of interpersonal relations in organisations may have become more complex, more individual and less and less related to clearly laid down lines of communication but, always, it operates in accordance with its own 'unique pattern'. It is this pattern which, once identified, provides the key to successful organisational design. The scientists of complexity would not be surprised at this finding; they see "order emerging spontaneously from molecular chaos and manifesting itself as a system grows".[7] (Figure 9)

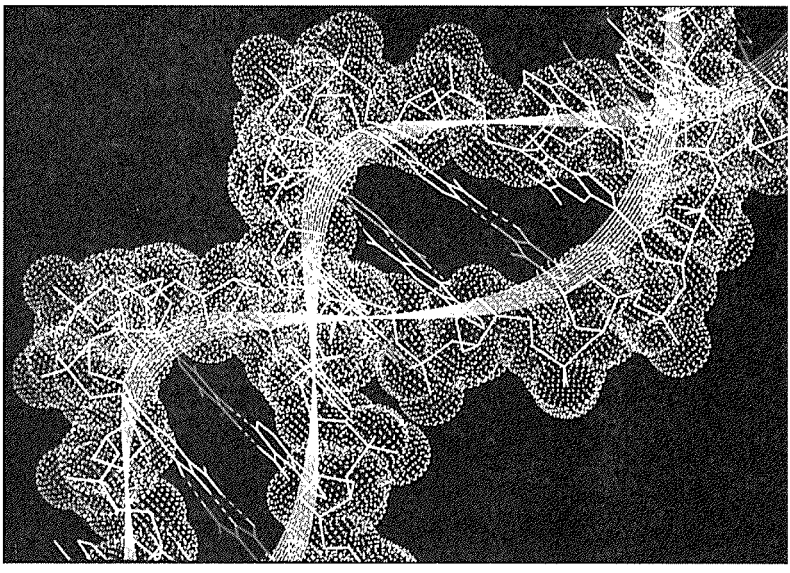

Figure 9 DNA Molecule

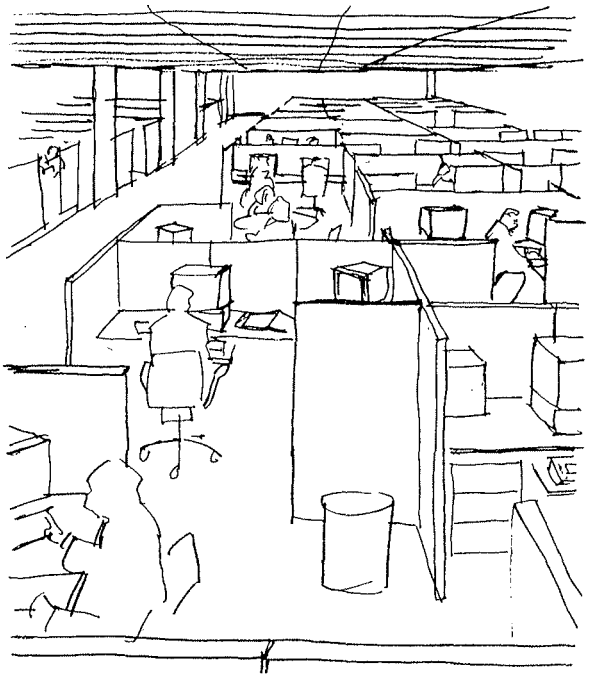

Figure 10 Typical installation of wall-to-wall screen based furniture.

A Bridge to Facilities Design and Management

The tasks involved in defining the specific adaptive system, or unique pattern, by which an organisation maintains itself and then translating this into a physical format requires a broad range of intelligence, spatial and practical as well as analytical and interpersonal. As these skills are unlikely to be found in one person (or consultancy) dialogue needs to take place, at an early stage, between management strategists and facilities managers and designers. If this does not occur, results can be hit-or-miss. Sometimes successful, by chance, but more often, installations are created in which people can be seen to be constantly struggling to make new management initiatives work in conditions which provide little appropriate physical support. (Figure 10) In my experience, installations which consist of little more than wall-to-wall screen based furniture have been a significant cause of discontent and 'churn'. Even though a degree of in-built flexibility may exist in such installations it is seldom sufficient to make up for a fundamental failure in communication at the outset of a project.

Mismatches between management aims and the buildings occupied by organisations are not solely caused by designers. The management theorists I have already referred to (Mayo, Argyris, McGregor) and many others have seldom made mention of the potential contribution of the working environment to organisational success. It is as if an early misinterpretation of the Hawthorne experiments forever coloured their thinking by consigning the environments in which people work to a low level of priority. This partly explains why the revolution in management thinking has not been reflected by an equivalent fundamental reappraisal of the workplace. For their part, designers and architects have remained content to produce buildings and interiors which are based on an outdated view of human activity in organisations; little has changed since the invention of the skyscraper. As Robert Sommer opined, as long ago as 1969:

"what is needed is a shift of temporal perspective. Just as scientists are thinking more about the future, designers must shift some of their attention away from the past (buildings that have been) and the future (Utopia) and study buildings on the narrow plane of the present and from the stand point of user behaviour."[8]

Although it is 30 years since Sommer's extortion, it still remains pertinent. Much has been achieved architecturally and in the design world in the intervening period; conditions of increased comfort and efficiency have been created at the work place; much dedicated effort has been directed towards making buildings more responsive to human need. (Figure 11) But, overall, architects and designers have not moved far towards understanding the conflicts and complexities of organisation design, nor have management theorists embraced spatial thinking in order that they can better comprehend the contribution that design can make to organisational success. However the gap is just beginning to close: "a fragile bridge has been built between design and the social sciences."[9] We now accept that there is a behavioural basis for design.

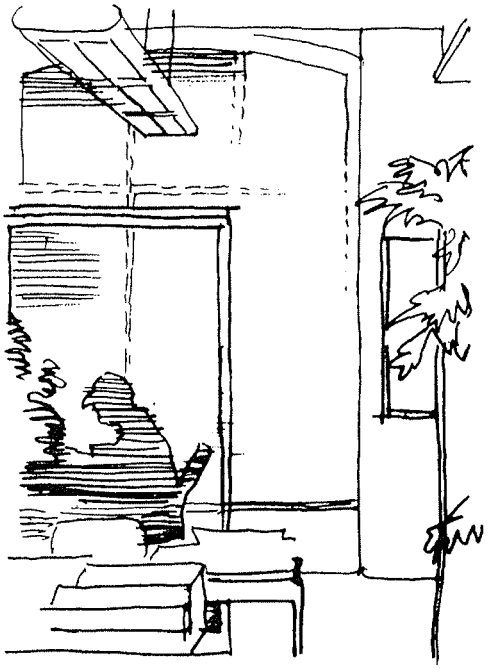

Figure 11 Workplaces responsive to human needs are a feature of this conversion of a 19th century cotton mill for CV Home Furnishings. Trickett Associates, 1990.

A Behavioural Basis for Design

A determination to uncover an organisation's 'unique pattern' requires us to tackle, head-on, the conflicts and complexities of organisational behaviour. This has been defined by Payne and Pugh as:

> "..... the study of the structures and functions of organisations and the behaviour of groups and individuals within them. It is an emerging, inter-disciplinary quasi - independent science drawing primarily as the disciplines of psychology and sociology, but also on economics, operation research and production engineering."[10]

The interconnectedness of the skills required is important; analytical and interpersonal skills need to be allied to spatial and practical skills if the results of research are to be effectively applied. Of equal significance is the stress placed on 'the behaviour of individuals and groups'. From my own work, in uncovering the determinants of behaviour in organisations, I find that it is the functioning and formation of groups that becomes a key factor. People in groups need to experience a sense of belonging so they can more easily define themselves in relation to others. They are substantially dependent upon their own work groups for obtaining an understanding of the social and technological environment in which they work.

Further, they need the help and support of fellow group members in order to carry out their tasks effectively. For this reason, the way people are arranged in groups (the physical configuration of work positions and the shared spaces between) plays a key role in enabling an organisation to establish a physical form which accurately reflects its operational aims and management philosophy.

An investigation and analysis of an organisation's unique pattern, and the way its groups are linked through communication routes, can often reveal forms which resemble those of the DNA molecule! (see Figure 9) These forms become simplified, of course, during the process of matching an organisation's pattern to a specific building. But, contrary to normal belief, this task does not have to be constrained by lack of group design options. The available vocabulary of group design is almost limitless; it extends way beyond the normal 'open' and 'cellular' extremes. Further, it influences the shape and size of building that an organisation requires. Reference elsewhere reviews the techniques of group design[11] and the skills involved in fitting groups (and the shared spaces between) into buildings.[12]

During the 1990s a drive towards an increased intensification of space use now demands the application of more sophisticated planning and management devices. As a result, the two types of adaptive system, human relations and facilities management and design, have begun to act together as never before. Group design still remains a key issue, however, whether or not it includes the provision of shared use workplaces.

More than anything else, it is the adoption of a behavioural approach to design which spans the divide between the many disconnections I have referred to earlier. It extends well beyond an analysis of user needs by establishing how buildings, and what happens inside them, can influence the frame of mind of their occupants and help instill a new set of values which have a direct impact on organisational success. The strategic importance of the behavioural approach cannot be over emphasised. It helps to ensure that the often huge cost of re-establishing an organisation in new premises can be seen to have a positive and measurable impact on productivity. Further potential outcomes are equally far-reaching; they include:

- allowing a sense of order to emerge from diversity
- encouraging informal communication at all levels in an organisation
- acting as an aid to creativity
- contributing towards people's self esteem.

It would take a close examination of case studies to fully explain the benefits gained by those few organisations that have adopted a behavioural approach to design. (British Airways and Scandinavian Airline Services come to mind, in particular.) To many, the process appears difficult because it must inevitably embrace both the social and psychological issues which now play an important part in any programme of organisational and environmental change. To tackle them successfully, they require the application of both interpersonal and spatial forms of intelligence. When these are successfully combined it becomes possible to resolve the key paradox of organisational life (as referred to earlier); an increased understanding of people's needs will enable the design process to provide what people want. A direct result will be installations which are less subject to the continual churn of physical change. Although in-built flexibility may still be required, it will act within a pattern of operation which remains inherently stable.

Beyond the Millennium

In illustrating the added value that can be obtained by causing two specific adaptive systems to act together, I have emphasised the importance of making crucial and sometimes unexpected connections. This approach applies equally to the many other complex adaptive systems which impact on building design. These include technology systems, communication methods, building enclosures, environmental control systems and many more. All need to be 'unified' in order that their benefits can be maximised. To achieve this, as has happened in the New Science, traditional categories of expertise may need to be dissolved; instead of focusing on the simple and separate pieces of organisational design, increasingly, it will become necessary to gain an understanding of complex 'wholes'. The main skill required to enter this world of discovery will be an ability to see connections (where none have existed before) often though the use of sophisticated computer simulation techniques.

Complex adaptive systems never remain fixed for long; all are in a constant state of revision and rearrangement relative to one another. In the Age of Paradox, there has been a tendency to place the burden of flexibility on just one or two systems (eg. environmental systems, facilities management and design) with the result that they break down. Beyond the Millennium, all systems must play their part, within a unified whole, in responding to development and change. This is again analogous to the new science of complexity where it is understood that no one system can be 'optimised' at the expense of others.

Turning now to the design of building enclosures (Figure 12), I have made reference to the attitudes that predominated in an Age of Certainty. Paradoxically, many buildings from this period have proved themselves well able to withstand the impact of fundamental change (see Figure 11); they now accommodate new types of technology systems, communication networks and human relation systems, etc. which could never have been imagined by their original creators. With the benefit of hindsight, it is evident that building forms in an Age of Certainty were successful in anticipating function.

Conversely, in the Age of Paradox, form has followed function with less prescient results. We are surrounded by many buildings, created in 1950s and 1960s, which must be regarded as virtually obsolete because their outward form has been identified too closely with one specific type of internal adaptive system. Buildings constructed to contain specifically Burolandschaft layouts are a prime example. In the Age of Paradox, the agents of change which work within every adaptive system have often been ignored, to disastrous effect.

In reaching beyond the Millennium, I am not advocating a return to the Age of Certainty (ie. buildings based on little knowledge of what they were to contain) but, more, a determination to uncover the connections between the many and various complex adaptive systems which underlie organisational design. In this endeavour, new interdisciplinary skills will be required to:

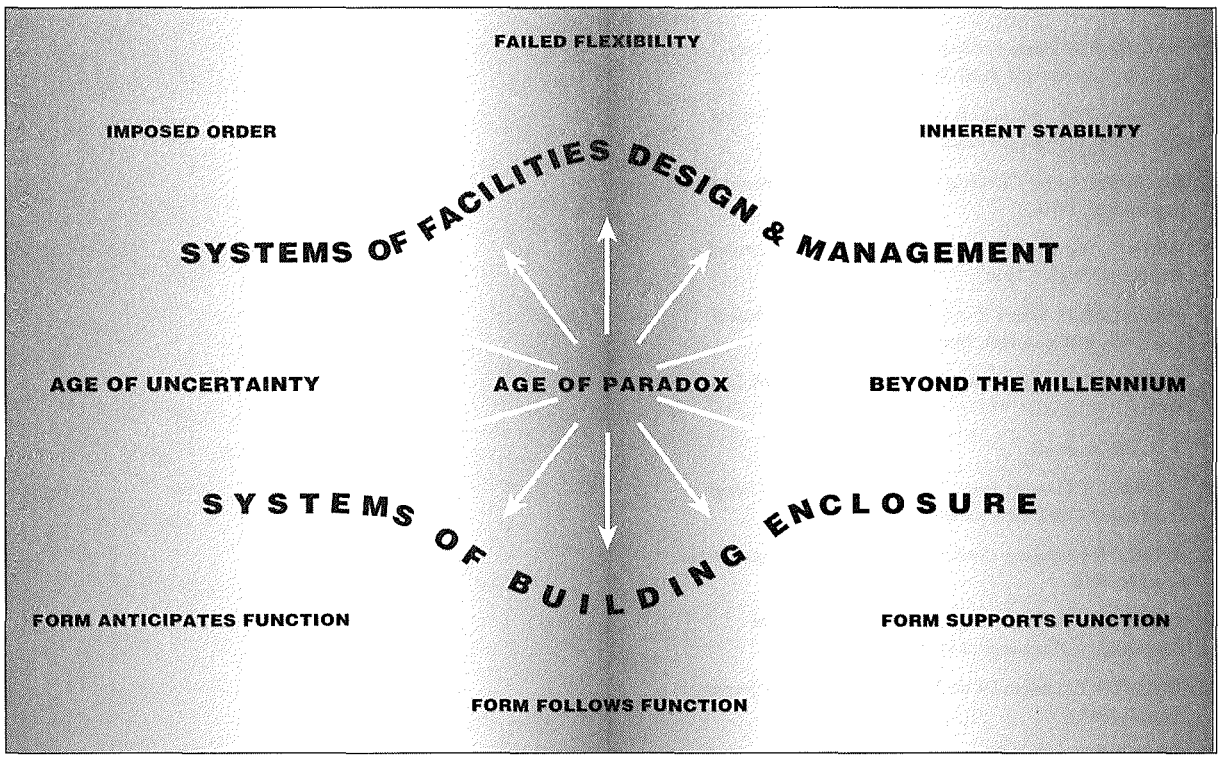

Figure 12

- uncover a pattern of operation which remains inherently stable
- provide control systems which are intelligible and accessible to users
- find building forms which support rather than follow function.

Such objectives can be met only by applying a process of 'holistic' thinking which must inevitably cut across current specialisms. To meet the challenge of building beyond the Millennium, the design process must itself become more flexible.

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