SUDDEN CHANGE, SOCIETY AND URBAN FORM

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Abstract of Thesis

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SUDDEN CHANGE, SOCIETY AND URBAN FORM

ABSTRACT

Rapid changes in the environment create situations which man has never previously experienced or anticipated. Situations such as social revolutions, migrations to new places, or disasters often require that society re-organises itself in a short period of time, breaks the continuity with its past and reaches a new state of stability. This re-organisation is responsible for the emergence of a whole series of psychological and social effects. The main objective of this study is to explain the nature of the changes in urban form which occur in such situations.

One of the major assertions of this thesis is that continuity is an inner characteristic of the self. It is one characteristic of the temporal dimension of life and not a reflection of a continuity in the spatial dimension. Therefore, the contribution of the designer is to maintain the temporal continuity of cities while explaining the spatial transformations through models based on

discontinuous behaviour.

The cultural development and the physiological limitations of man to rapid change are taken as evidence in the demonstration of the extent of the problem. Within this context, radical change in the formation of the environment is shown to be an expression of the human mind and not the direct effect of changes in the environmental forces. For that reason, the effect of sudden change in the environment is studied in relation to the concept of time: the direction between past, present and future.

As this assumption does not require any kind of spatial continuity, a model based on discontinuity is used to evaluate the transformation of cities in circumstances of rapid change.

SUMMARY OF THE THESIS

Following the aims of our research, this thesis will be divided into two major sections. Section One is devoted to the analysis of the problems raised by the relationship between radical change in the environment and radical change in urban form, while Section Two will be devoted to the search for a new alternative through which, the designer could try and solve the problems of representing the relations between rapid changes in the environment and urban forms.

The first part of Section One introduces man as the inheritor of two major and interrelated characteristics: biological and cultural. The analysis of the development of culture is aimed at demonstrating that man, as an active organism, is capable of creating his own universe while biologically, it is shown that sudden changes in the environment can create serious physio-psychological problems.

The second part of this section is devoted to the discussion on urban form presented as the expression of the human ability in shaping the environment resulting from the development of mind and culture. Although the form of the environment is shaped in such a way as to respond to physical and/or socio-psychological forces, it is believed that a sudden change in the nature or

magnitude of these forces does not necessarily lead to similar changes in the form of the built environment.

The most serious problem created in situations of sudden change is the introduction of discontinuity which is understood, here, in its temporal dimension as explained in the first part of Section Two. Time, for us, is a two-dimensional category. On the one hand, it is constituted by the artificial division of the physical world and on the other hand, it is also directional. Directionality refers to the continuity that exists behind the discrete elements. The designer may conserve such a direction by creating the image of time.

As continuity is an inner psychological state, the continuous models used in the interpretation of the various urban forms, such as the biological analogy, cannot present a complete picture of the transformations. This is why the second part of Section Two is entirely devoted to the examination of a model based on discontinuity as well as continuity. This model has been first devised to explain the process of development that takes place in science. Finally, it will be argued that the "catastrophe theory" is a suitable model for explaining changes in urban forms.

SECTION ONE

Problems in rapid change

and role of the spatial formation of cities

SUDDEN CHANGE: AN INTRODUCTION

Changes are always occuring in the environment. These changes are not smooth in every case; they may also happen in a sudden fashion. A disaster may destroy completely an area, or the construction of a new settlement may radically alter the image of a place. A given society may also change radically as a result of the intervention of different internal and external factors.

These processes happen in a variety of ways. However, for the purpose of this study, the types of sudden changes that we shall be concerned with fall into two categories: on the one hand, the changes in social formations and, on the other hand, the changes in the spatial structure of cities.

Revolutions, the rapid transition in traditional cities are well-known examples of first categories, while migrations are considered in our case to constitute one of the aspects of radical changes in the environment with which the individual or society is confronted. Finally, disasters represent the extreme case of rapid environmental change, with all the associated shocks and trauma that accompany it.

Revolutions: the modern era has been characterised by a

series of great revolutions that radically altered the image of many a society. Some revolutions have fundamentally changed the structure of the modes of production (the industrial revolution, for instance), while others have profoundly altered the political and social systems (e.g. the French revolution). There have also been revolutions which affected most the cultural and intellectual structures as, for instance, the various cultural revolutions that have been proclaimed in many parts of the world. All these form part of the political and ideological symbolism and thought of the modern world.

The cause and root of the modern concept of social revolution is still the subject of controversy. Economic constraints, religion, racial discrimination, the political need for modernisation and many other factors may result in considerable unrest. Today, the dominating concept of revolution is probably the marxist theory (1), but there is certainly no environmental model which could elucidate the causes of revolutions.

Several scholars have distinguished between the long-term factors that contribute to the dissatisfaction with the existing order of things and the immediate sources of irritation that lead to the violent attempts to overthrow that order (2).

The results of revolutionary changes, as understood in the

modern sense, are the following: firstly, there is the violent suppression of the existing political system, with the elimination of the basis of its legitimation and the symbols of its structure. Secondly, one sees the displacement of the incumbent political elite or ruling class by another. Thirdly, changes in all the major institutional spheres follow - primarily, in the economic structure and that of class relations - leading to the modernisation of most aspects of social life, economic development, increased industrialisation and, finally, growing centralisation and participation in the political processes. Fourthly, one sees a radical break with the past. Fifthly, given the millenarian ideological image of revolutions, it is always claimed that these revolutionary changes will bring about, not only institutional and organisational transformations, but also moral and educational reforms which will result in the emergence of a new breed of men.

Revolutionaries always set themselves strong goals to achieve in the future. While these goals might have been reflected upon and matured over a relatively long period of time, they become apparent after just a short period. These goals help the advocates of revolution establish a society on a completely new basis (3).

In spite of all the possible variations of revolutionary changes, they all seem to follow the same process of

filtering the past symbolic structures and creating new images of the future.

Transition of traditional societies: nowadays, the antithesis between traditional and modern societies is a familiar one whenever one is thinking about the differences between the contemporary world and its past. The term "modernisation" has also been frequently used as an explanation for the global processes by which traditional societies achieve "modernity" (4).

In traditional societies, the power and authority of tradition are passed on from one generation to the other which inherit the same way of life and the same view about the world. These elements are never subject to any change in form or content according to fashion or the spirit of any period. Tradition, in this sense, has a normative character and its effectiveness is based on its continuity and durability.

In contrast to this, the characteristic that distinguishes a modern society is not such a continuity but, rather, its changeability and the high rate of speed at which changes take place. Therefore, the transition from a traditional society to a modern one can be summarized as the passage from a slowly changing way of life to a rapidly changing one.

According to de Vries (5), the transition from a traditional structure of society to a modern one is accompanied by the following factors:

a)- Prime movers: this term refers to the major forces which put the society in motion. These forces could be of an economic, technological, or spiritual nature.

b)- The catalytic agents: they represent the accelerating agents of change, such as generation-tension (6), or moral indignation.

c)- The inhibitors: as the word indicates, these represent all the various forces which try to prevent or slow down the process of change, either because of the fear generated by them or simply acting as reactionary forces trying to preserve the old order of things.

These are the various types of forces which act in one way or another upon society, causing it to move towards a certain direction, or preventing the processes of transformation from taking place.

One very important factor in any process of transition is time. Indeed, although we speak of rapid social change, in most cases the various elements and stages in this transitional process can be easily identified; the old social order, the new type of order, or the co-existence of the two can be distinguished from one another. But

there are other situations where the upheaval is really sudden, almost catastrophic; these particular cases are those in which physical violence is usually involved (7).

The transition from a traditional structure to a modern one is, as we have already said, characterised by the introduction of a way of life based on a rapid pace of change in society over a short period of time. These changes may be desired by one group and more or less strongly opposed by another.

Disaster: the term refers, here, to any sudden, unexpected or extraordinary misfortune suffered either by individuals or groups. Following this definition, the various types of disaster may differ in several ways: in the nature of the precipitating agent (explosion, earthquake, etc...); in their source of origin (natural forces or human action); in their degree of predictability, probability and controllability; in their speed of onset (instantaneous, progressive,etc...); finally, in their scope (focaussed, diffused) and their destructive effects on people and physical objects (8).

The interest of the social scientists tends to centre on the relatively large-scale community or societal disasters. They tend to concentrate on the sudden and rapidly developing events that disrupt the prevailing order of life and produce danger, death and loss of

property. In formal sociological terms, a disaster may be defined as an event, concentrated in time and space, in which a society undergoes a severe danger and incurs such losses to its members and physical appurtenances that the social structure is disrupted and the fulfilment of all or some of the essential functions of this social structure are prevented from being carried out. In this sense, a disaster affects the very system of biological survival (e.g. shelter), the system of order (e.g. cultural norms), the system of meaning (e.g. values), as well as the motivation of the actors within all of these various systems (fig.1-1-1).

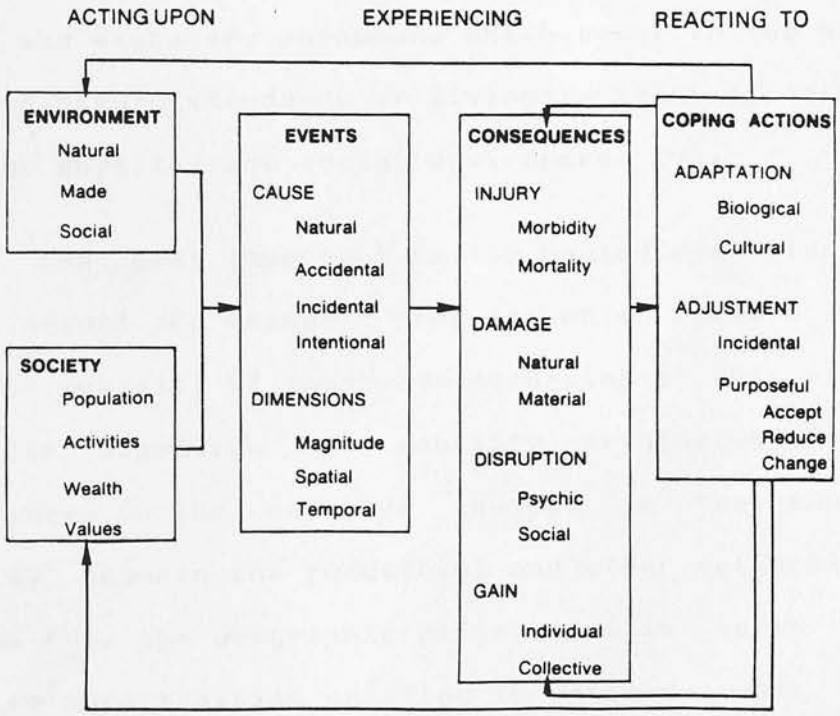


Fig.1-1-1 The environment as hazard

This concept, as understood within the context of our study, refers mainly to the sudden environmental changes which may lead to the total or partial destruction of a city. It refers to the extreme and most shocking type of change in the spatial dimension of the city and to the process by which the individual and the community try to come to terms with it and re-adapt their environment to it.

Migration: migration, as it is commonly understood today, appears as the result of a dissatisfaction with the contemporary environment. The disparity in opportunities available to people provides the main motivating force behind the migratory phenomena which occur in the hope of enjoying higher standards of living in terms of income, or a better physical and social environment (9).

Today, the most important factor behind migration is the technological and economic progress which require a high level of mobility of manpower. According to this view, the need for migration and mobility originates from the differences in the relative choices in the employment capacity between the industrial and other occupations, as well as from the geographic differences in terms of the relative opportunities existing in various areas.

Migration may also be politically motivated, or may be caused by psychological reasons, or even may happen as

part of a way of life. It may be either voluntary or involuntary. For most sociologists, it represents a more or less permanent movement of people across a social boundary.

As far as this study is concerned, migration is analysed in terms of the radical change in the environment that it causes by the movement from one place to another and which the individual or the community is confronted with.

NOTES

(1) N. Abercrombie (1984), p179.

(2) C. Leiden & K. Schmitt (1968), p37.

(3) J. Galtung (1974), p49.

(4) A. Smith (1973), p59.

(5) E. de Vries (1961), p25.

(6) This represents the psychological tendency of the younger generation towards novelty. See E. de Vries, ibid op. cit.

(7) L.C. Brown (1973), p193.

(8) R.W. Kate, "*Experiencing the environment as hazard*" in S. Wapner (1976), p135.

(9) Willis K.G. (1974), p25.

PART ONE

SUDDEN CHANGE AND MAN

1-1 MAN, THE SHAPER OF THE ENVIRONMENT

Man is the creator of his universe; he is not a reactory organism to environmental forces as other species might be; in this sense, he is unique. In nature, animals fit into the environment in a precise and calculated way; they are equipped to do exactly that. But with man, things happen differently. Man's biological evolution did not make him adapted to live in any specific environment. On the contrary, his survival kit is rather crude when compared with other animal species, except for a tremendous capacity for imagination and reason which led to a series of inventions that allowed him to change his surrounding environment according to his needs, rather than accept it.

History is, in this sense, only a demonstration of man's capacity to change. There is a very unequal division in human evolution: in comparison with approximately two billion years of gradual biological evolution, a rapidly increasing gap started to appear about one million years

ago between man and the other species. This gap was the result of the cultural development undergone by man (1), up to the present civilisation which has lasted a few thousand years.

Contemporary man inherited two main aspects: the first one being the biological development, encoded in the molecular structure of his genetic make up; the second aspect being cultural, transferred through his capacity of communication and encoded in the symbolic structure of his knowledge.

While human skeletal and physiological evolution shows no sudden discontinuity and also limits for change in the environment, conversely, cultural history is a revolutionary one. The origins of such revolutionary characteristics can be seen in the light of man's highly developed brain, as opposed to other species, through which he was able to acquire his superior position on Earth.

1-1-1 CHARACTERISTICS OF THE HUMAN BRAIN

The human brain is complex, in comparison with other animals. Its capacity has been largely increased, not as a result of an increase in size, but rather through social interaction. It is the development of the spinal part of the human brain which led him to achieve such complexity.

A systematic understanding of the increasing complexity of the human brain is facilitated by Mac Lean's concept of Triune Brain (2). Mac Lean postulated three anatomical levels of the brain which correspond to the stages of evolution from vertebrates to mammals and finally to man. He noted that what he called "the neutral chassis" is essentially the same for all vertebrates; it governs the behavioural patterns required for the survival of the individual and the species, i.e feeding, flight, reproductive activity and maintenance of territory. This part of the brain which governs the biological behaviour can be called the "primitive brain" (3).

In mammals, there developed around the brain what is known as the "limbic lobe", or the "old cortex". In the higher order animals, it is this part which gives rise to practically all forms of emotional feeling. Mac Lean called this the "lower mamallian brain".

The "neo-cortex" increases in size and complexity as we come up the evolutionary scale, and it is most thoroughly

developed only in man. The neo-cortex is that area of the brain governing those behavioural patterns which have enabled mankind to choose its environment deliberately; it is the seat of anticipation and planning.

Esser (4) defined the neo-cortex as an environment entirely made up of abstractions, that is of patterned relationships between perceived and anticipated objects and events in the environment, without reference to the emotional world. Therefore, this world is opposed to that of nature which is structured only in limbic terms. On the neo-cortex level, we organize our experiences with the help of our conceptual coding system which transcends physical space and time.

Despite the fact that the limbic and neo-cortex environments can be studied separately, they are interrelated. The normal human being dwells in both environments, and both must be synthesized adequately in the "real world".

1-1-2 BRAIN AND MIND

The relationship between brain and mind has been the subject of prolonged debates throughout the history of human science and philosophy (5). A simple way of referring to the mind is to characterise it as the total sum of the brain's activities which include such aspects as consciousness, creativity, memory and will.

Consciousness, itself, refers to many aspects. Basically, it can be defined as the activity of the individual's mind in interaction with the environment. It represents a dynamic entity continuously undergoing change, being constantly modified by changing circumstances. In the same way as human relations have been transformed during the evolution of society, human consciousness has also gone through a process of transformation. Modern man's cranial capacity may not be so different from the early *homosapiens*, but his environment and forms of society are radically so and, hence, his consciousness too (6).

Some psychologists also referred to the unconscious world and saw "creativity" as the link between the outside world and this unconscious world. Freud (7) believed that human behaviour cannot be explained as much in terms of conscious as in terms of subconscious wishes and feelings. His major contribution was the discovery of a way of bringing some of these subconscious wishes up to the level

of consciousness.

Jung (8) also pointed at the very long realm of subconsciousness which can never be made conscious. For him, it is impossible to ascertain how large this realm of the subconscious is. He also stated that the realm of consciousness has a subconscious connection with an eternal, endless common subconsciousness. Creation, for him, raises the imagination from the deepest subconscious and brings it into relation with conscious values, transforming it until it can be accepted by the mind of others.

However, it is the emergence of consciousness and of the creative capacity of man which brought about the distinction between human beings and other animal species; thanks to these characteristics, he was able to become more varied and more equipped to deal with complex interactions than is possible for other organisms and acts positively in changes in his environment.

1-1-3 THE FORMATION OF CULTURE

Consciousness enables man to bring into focus certain aspects of existence at different periods of time. Furthermore, it allows him to erect a framework according to which those aspects of the universe can be related to each other. Although the basic pattern of rhythm in the universe affects human beings and transfers its cosmological message to them equally, the process of focusing and framework building enables man to put a variety of systems of interpretation regarding the wholeness of the universe. The creation of systems of interpretation regarding the wholeness of the world has not always satisfied man; at different periods of time, he found himself caught in a dilemma as a result of such interpretation. As Rose said (9):

"Every time man believed that he had reached to the apex of civilisation, he was faced by a new and greater void; he always found himself and the civilisation that he had built threatened with forces of his own creation. He frantically searched for remedies to rid himself of those forces of destruction which threaten to deprive him of his cherished dream of ultimate bliss, but discovered that his world-view lacks definitive criteria to help him judge between right and wrong and his learning and expertise failed to give him universal criteria to distinguish between good and bad...".

For primitive man, the way to find stability and refuge from this situation was myth and magic which, later, developed into religion and science. These provided man with ways of explaining change in nature as well as with a justification for shaping his environment. Unexpected or sudden changes in nature were assumed to be governed by the magical powers which exist in nature, while at the same time, it was believed that these powers were responsible for the sudden changes in the environment.

1-1-4 THE DEVELOPMENT OF CULTURE

Primitive man was completely embodied in the world that surrounded him, fulfilling his basic needs; he was so engulfed by his will to survive that he did not have time and probably no mental capacity to contemplate.

The transformation from the zoomorphic to the anthropomorphic brought about a revolution in the intellectual history of man. Since then, man found himself part of a system of ideas much more complex than that of the biological relationships with other people. As soon as two or three individuals came together, myths were developed and magical, religious or other kinds of explanations of reality appeared. In fact, it can be said that the total sum of human efforts has been spent in the questioning of the "why" of things (10).

a)- Myths: myths are stories or "tales" that are invented in order to explain how the earth was created, why the seasons change, or to explain how fertility is controlled.

There are many anthropological and psychological explanations for myths. Malinowsky believed that their function was to maintain social harmony. On the other hand, Levy-Strauss believed that they reflected the structure of the human mind; he therefore thought that they dichotomize things into categories such as earth and heaven. Freud, too, believed that myths were a predictable

human product, given the nature of our unconscious and its way of composing dreams. Jung assumed that all human minds tend to form the same symbols; indeed, he believed strongly in a collective unconscious or radical memory.

Myths are based on the relationships between the destinies of men, or men and gods. In myths, time, or rather the succession of events, plays a determining part in the eternal polarity of life and death and are always in direct relation to the cosmos. In fact, the stars and heavenly bodies become themselves the personification of deities.

b)- Magic: primitive man believed strongly that symbolic activities are effective only when they express deep and passionate desires. Art and rituals represented the expression of such desires through which primitive man attempted to act against the natural forces (11).

Magic manifested itself since the beginning of self-awareness; it represented the translation of myths into rituals. It was basically developed with the discovery of fire. The relationship between man and fire is fascinating since it was an element that changed the history of mankind. It was the mysterious power of fire which transforms and affects deeply the elements, and people related it to worship and magic. It became therefore a symbol and took a central position in shrines.

In the early stages of human development, the prevailing view of life was a magical one. At this stage, man was unable to perceive any separation between his own ego and the surrounding world, nor did he distinguish between between earthly phenomena and the incomprehensible powers of nature. Time and space were unfamiliar concepts to him. He believed that magical forces were latent in nature and in the objects by which he is surrounded. He was afraid of these incomprehensible effects and worshipped them as fetishes and as reflections of eternal forces, trying to influence them by invocations. The effects of the cosmic forces of nature were seen in the succession of day and night, in the rain and the subsequent floods that brought fertility to the soil after the drought, as well as in the ryhthmic sequence of the seasons.

c)- Religion and science: as the primitive world was represented as a dynamic whole, characterised by a relative lack of differentiation in the spheres of reality, the modes of symbolisation were also unified in myth and magic. A cognitive understanding of the world was unknown and the environment was believed to consist of both friendly and hostile objects which were then associated with good or bad cosmic forces. Later developments produced a differentiation in symbolic systems.

Generally, knowledge can be classified into descriptive and non-descriptive symbolic systems (12). The main descriptive systems are science and philosophy, whereas the most important non-descriptive symbolic systems are art and religion. While the former's aim is to reach a cognitive and instrumental understanding through advanced and systematic abstraction, the latter's more concrete purpose is the attempt to grasp the totality of the processes which are seen as inherent in nature and human life.

1-1-5 THE CONCEPT OF CULTURE

Various definitions of culture have been given from widely different perspectives. From the anthropological view, this concept is understood to refer to the lifestyle of human groups. The term "lifestyle", itself, refers to the customs (social norms) peculiar to a group of people sharing the same set of concepts about the physical universe and society (beliefs) as well as the same set of criteria for proper social behaviour (values). Rapoport (13) classified the different anthropological definitions of culture as follows:

a)- A way of life typical of a group.

b)- A system of symbols, meanings and cognitive schemata transmitted through symbolic codes.

c)- A set of adaptive strategies for survival related to ecology and resources.

He categorised each culture according to the nature of three of its components:

1- The precedents or traditions which provide the rationalisation for action and the choice of action.

2- The moral precepts which define the strength and purpose of action.

3- The style or routine behaviour which provides the contents, themselves embodying all the previous components.

According to this view, the precedents become embodied at the institutional level as protocols, which are related to other elements of the system and, therefore, extremely difficult to change. Consequently change becomes impossible unless the precedents are preserved or conserved.

While this definition of culture puts the emphasis on its characteristic of continuity, Montagu (14) sees culture as a new dimension which man creates by increasing the complexity of his symbolic representations. As he wrote: *"Man is a symbol-maker; by making and using symbols, he creates a new dimension of experience which, at the same time, yields him an increasing control over his environment"*.

There is also a certain amount of confusion about whether these definitions of culture refer to the material or mental world. Usually, anthropologists refer to culture as both material culture/material products and artifacts and beliefs, values and norms. Their explanations about the origins of artifacts and tools are given in relation to the patterns of social behaviour found in given societies.

There are also those who, in their definition of culture, put the emphasis on its cognitive products which they call ideas, or conventional understandings, or cognitive models, or world-view, or cultural code (15). Among this

group, there are some who consider material culture as being simply the product of culture and not culture itself. Leading anthropologists, such as Malinowsky, maintained that the material culture could not be considered as part of society, but rather as part of the man-made environment in which social and cultural life takes place. If the term "society" is meant to refer to the patterns of interactions among the groups composing it, then material culture refers to the tools and technology that make those interactions possible and that express or support elements of the non-material culture.

Ino Rossi (16) believes that the material culture - such as technological inventions, for instance - is only a consequence and a realisation of certain ideas and that it has an important bearing on the emergence of new values and beliefs. He also tried to specify the relationships between material culture, non-material culture, society and ecological conditions (fig.1-1-2).

The relationship between the physical environment and cultural phenomena will be discussed in more details in the next part. What is important to remember at this stage is that culture must be understood as a changing phenomenon as well as being a tool for changing the environment. It is something that man makes and uses; it is not an accumulation of treasures; it is a changing network to which every member of a community makes a

contribution and which, in turn, moulds every member of the community.

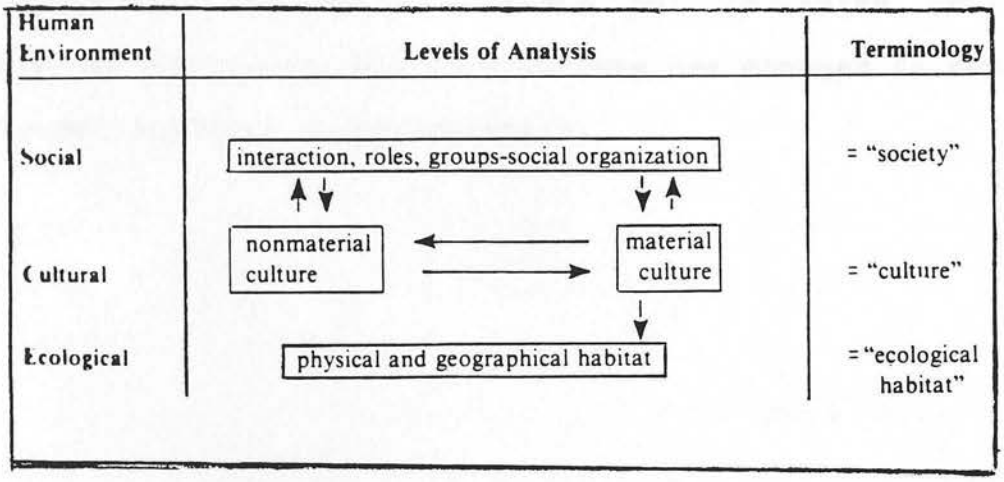


Fig.1-1-2: Interrelationship of the ecological cultural and social levels of analysis

The sum of a culture is inevitably greater than its individual parts, but it only becomes real, it only exists at all, when it comes alive in the actions and imaginations of man. This contribution of culture to the lives of individuals does not occur in a homogeneous manner; one could not, for instance, find two distinct individuals having exactly the same way of life. The issue of how much diversity there is and the extent to which distinctive ways of life are likely to survive raises critical problems that need both factual information and

theoretical explanation.

The pace of social change has greatly increased in the last few decades and has compounded with cultural contacts. Naturally, this had an effect on the authenticity of every culture; but in spite of the external pressures, yet each culture has managed to retain its own specific characteristics.

1-1-6 CULTURAL EXCHANGES

If one includes, in the definition of culture, all the customs and attitudes as well as the artefacts evolved by any human group, it becomes a series of overlapping "ecumenes" (17). In fact, a culture can interact with and overlap others without losing its continuity.

Daniel (18) showed that it is possible for a culture to maintain a certain continuity, even under political, military, ethnic or linguistic changes. He also stressed that to identify the mechanisms of preservation is very hard. Furthermore, he made distinction between object and subject of culture and stated that in any cultural exchange, one can identify two different characteristics of culture: cultural-free and cultural-bound. In the latter case, the subject of exchange, or the object to be exchanged, can only be transmitted with the culture in which it originated. If, in that case, the receiving culture rejects the cultural accretions, the exchange will not take place. The former case is the antithesis of the latter: here, subject and objects can be transferred without necessarily leading to any cultural transformations. One further point worth mentioning is that there is no absolutely cultural-free or cultural-bound exchange between cultures. In each transformation, both characteristics act together.

Another concept of culture which is important in cultural exchange is that of "cultural barrier". Each culture represents everything that the individual derives from the community in which he was brought up and which he does not share with individuals brought up in other communities and according to different ways. This may show what an individual picks up from other cultures and may be the link between his own culture and the others; but every part of the furniture of his mind that belongs to the community of which he is part and that is not shared with another community acts as a cultural barrier (19). This could be an element with which to distinguish one culture from another, since each person tries to conserve this barrier and is usually reluctant to have to overcome it.

Adaptation usually affects a culture and may also give it a new direction, but this does not mean causing similarity. For example, the great universal human ideas, such as religious ideas like "spirit" or "sacrifice", and moral ideas like "murder" all have varying interpretations in different cultures.

There may be some psychological problems attached to cultural exchanges. The extreme example of such a situation is that of "cultural shock" (20) which represents an initial condition of disorientation in which most people find themselves when they are confronted for the first time with a cultural environment totally alien

to them up to that moment. It can be extended to include the period of cultural adaptation which normally follows, or the alternative of settling into a stable condition of hostility and marginality.

1-1-7 ADAPTATION PROCESS

An individual should pass through a different mental process when he decides whether to accept or reject an idea which is foreign to his culture (21). This process is comprised of the following stages:

Awareness stage: at this stage, the individual is exposed to the innovation but still lacks complete information about it. Although he is aware of the innovation, he is not, at this stage, motivated enough to seek further information.

Interest stage: when reaching this stage, the individual usually seeks further information about the new idea as his interest increases; he is not, however, able yet to judge its utility in relation to his own situation.

Evaluation stage: at the evaluation stage, the individual mentally applies the innovation to his present and anticipates future situations, thus deciding where to try it and where not to.

Trial stage: at this stage, the individual uses the innovation on a small scale in order to determine its usefulness in his own particular situation. Rogers shows how the individual may need specific information about the methods of using the innovation, otherwise the innovation may be rejected at this stage (although the rejection may

occur at any stage).

Adoption stage: the main functions of the adoption stage are the considerations of the trial results and the decision to identify a sustained use for the innovation. Adoption implies the continued use of the innovation in the future.

Conclusion

Human beings respond to environmental changes, but their response is not always of a reactory kind. Culture is an active tool at the disposal of man, through which he is able to shape his surroundings, control unwanted events and create new possibilities for life.

Culture has developed through the interaction with the environment and this dynamism is directed towards man's beliefs and will. Cultural aspects may change smoothly or rapidly as a result of this interaction, but these variations are not done passively. Continuity and differentiation are conserved in any case as the survival of culture depends on its changeability.

NOTES

(1) Maxwell M. (1984), p292

(2) MacLean P.D. (1978).

(3) Greenbie B.B, "*An ethological approach to community design*", in EDRA I (1973),p14.

(4) Esser A.H., "*Structure of man-environment relations*", in EDRA II (1973), p114.

(5) See S. Hook for different views (1960)

(6) Rose S., "*The conscious brain*"

(7) See P. Rieff (1959), p65.

(8) See J. Jacobi (1946), p4.

(9) Rose S., op. cit.

(10) M. Marcel (1972), p.25.

(11) Bronosky J. (1978)

(12) F.H. George (1968).

(13) Rapoport A. (1976), p96.

(14) Montagu M. F. (1965)

(15) As for example Wissler or any other contemporary ethnoscientists, symbolic anthropologists, or structuralists.

(16) Rossi I. (1980).

(17) Culture, for Daniel, can be divided infinitely. The term "ecumene" refers to the main culture.

(18) Daniel N., op. cit., p10.

(19) M. Rogers (1962)

(20) Daniel N., op.cit., p15 and p60.

(21) M. Rogers (1962), p81.

1-2 HUMAN RESPONSE TO ENVIRONMENTAL CHANGE

1-2-1 PERCEPTION OF ENVIRONMENTAL CHANGE

Perception represents the most fundamental mechanism of interaction between people and the environment. There are numerous definitions of what perception consists of.

This analysis of perceptual phenomena has previously been used to cover different aspects of man-environment relationships: for the direct sensory experience of the environment; for the understanding and structuring of the environment; and for the description of the evolution of the environment as explained through perception (1).

Therefore, perception is broadly about receiving, acquiring , transforming and organising the information supplied to our brain through the senses.

There are several fundamentally different approaches to the study of perception, such as classical introspectionism, the phenomenological approach and the physiological one. It also raises complex philosophical issues such as the body-mind problem, the nature of reality and the value of introspection as a concept.

It is not the intention of this thesis to explore the psychology of perception in detail; it is rather a matter of exposing, in a general way, those facets of it which have direct bearing on the study of the physical environment and on the effect of accelerated change upon

the minds of individuals. Although this may require that the emphasis be put on a stimuli-determined view of perception as far as this part is concerned, this emphasis is not representative of the overall view put forward in the thesis.

The process involved in the human interpretation of the world has been studied by Brebner (2) (fig.1-1-3).

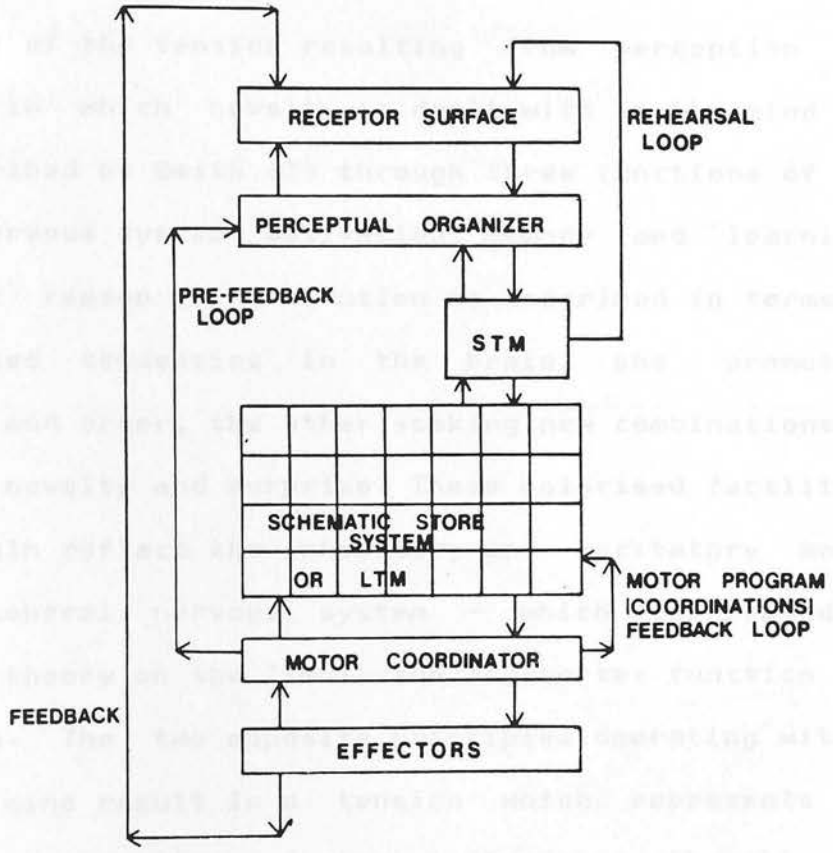


Fig.1-1-3 The process of perception

Briefly, he said that detectable changes in the sensory perceptors are organised into an integrated precept of the

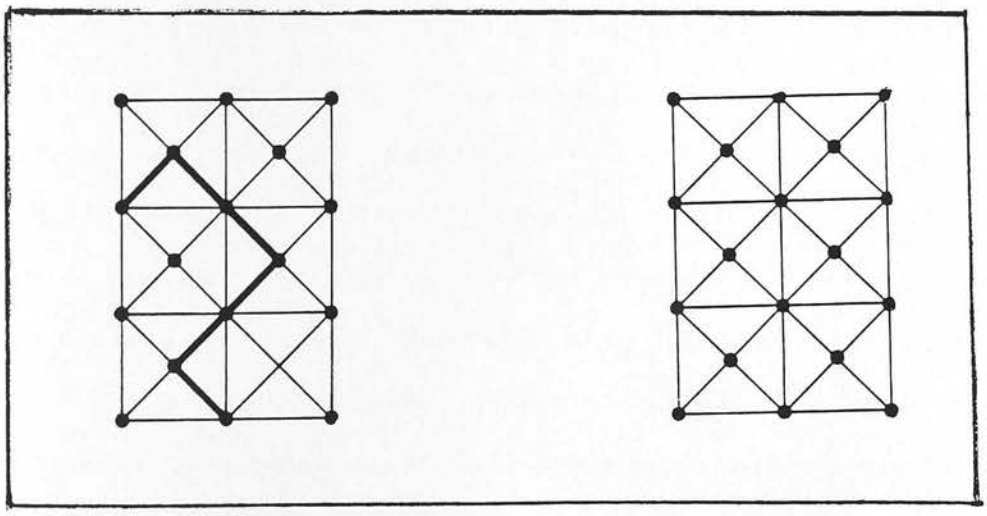
world which remains accessible to use for a very brief period in our short-term memory. Some of the information is transferred from the short-term memory to our relatively permanent long-term memory. If action is indicated, the information contained in the long-term memory maps on to response elements of programmes for motor activity, organising a response by the effects. This response creates new stimulation at the receptor surface.

The nature of the tension resulting from perception and the way in which novelty is dealt with in the mind has been described by Smith (3) through three functions of the central nervous system: motivation, memory and learning. The basic reason for motivation is described in terms of two opposed tendencies in the brain, one promoting analysis and order, the other seeking new combinations of patterns, novelty and surprise. These polarised facilities of the brain reflect the inhibitory and excitatory modes of the central nervous system - which correspond to MacLean's theory on the limbic and neo-cortex function of the brain. The two opposite principles operating within the human mind result in a tension which represents an important motivating factor influencing thought and perception.

The function of the short-term memory is to enable the brain to perceive coherence in the environment. Perception occurs in the brain in a fragmentary fashion. Short-term

memory is the mechanism which enables the mind to link together those fragments (fig.1-3).

Long-term memory is established through the connection between cells which results in the formation of patterns. Two hypotheses, concerning the process of linkage between cells and nerve pathway have been offered. One hypothesis suggests that all knowledge pre-exist in the brain; in this case, perception and thought are just processes of internal discovery. They simply represent the process of extra-emphasizing to a pattern of cells and pathways (fig.1-1-4 a). The other hypothesis proposes that long-term memory involves the formation of new linkages (fig.1-1-4 b).



a) Existing network b) pattern of cell connection

Fig.1-1-4 Linkage between cells and nerve pattern

Past experience is an important factor in perception. The

information reaching the brain must be reduced considerably and the most relevant data abstracted. Therefore, the input of sensual experience is categorised in its basic elements which are called schemas. Schemas interconnect and coincide at many points and are extended into sub-categories as experience develops.

1-2-2 HUMAN LIMITATIONS TO CHANGE IN THE ENVIRONMENT

There are many limitations in the process of receiving information, the most obvious ones being the physiological limitations of human sensorial organs. There are also limitations in the ability to abstract information, due to the design of the human neural mechanisms, as well as cultural limitations resulting from the action of the social selective forces on the minds of individuals. Therefore, overstimulation or a rapid increase in the level of novelty in the environment can lead to psychological disturbances.

As an organism, man has managed to achieve a balance in his relationship with the environment. Within such conditions, he is able to respond to the real world within his brain. As soon as something changes within the range of perception of our senses, the pattern of signals arriving through our sensory channels into the central nervous system is modified. The routine, repetitive patterns are interrupted and to this interruption, we respond in a particularly acute fashion (4). When the complexity of the environment increases, this condition could not remain stable anymore; man becomes unable to respond logically to these signals. The continuous overloading of the environment with novel signals may also lead to psychological problems.

1-2-2-1 THE BODY REACTION TO SUDDEN CHANGE

The body reaction to a particular change in the environment has been studied by Toffeler who noticed that: "*...the pupils of the eyes dilate, photochemical change occurs in the retina. Our hearing becomes momentarily more acute. We involuntarily use our muscles to direct our sense organs towards the incoming stimuli; we lean towards the sound, for instance, or squint our eyes to see better. our general muscle tone rises. There are changes in our patterns of brain waves. Our fingers and toes grow cold as the veins and arteries in them constrict. Our palms sweat. blood rushes to the head. Our breathing and heart rates alter*".

Under certain circumstances, we may undergo all these changes and, sometimes, even more, as for instance in the case of what has been called the "startle reaction". But even when we are unaware of what is going on around us, these changes take place everytime we perceive novelty in our environment.

E.N. Sokolv (5) has explained in more details the reaction of our body to novelty by introducing the concept of what he called "orientation response" or "reflex". He asserted that the neural cells in the brain store information about the intensity, duration, quality and sequence of the incoming stimuli. When new stimuli arrive, they are

matched against the "neural models" already stored in the cortex. If the incoming stimuli are neural, they would not match any of the existing neural models. Consequently, there occurs an orientation response. If, however, the matching process reveals their similarity to previously stored models, the cortex shoots signals to the reticular activating system, instructing it, in effect, to "hold its fire".

In this way, the level of novelty in our environment seems to have direct physical consequences. Besides, one should also mention that this process of orientation response is not an unusual affair. It takes place thousands of times in the course of one single day as various changes occur in the environment surrounding us.

However, there is a limit to the capacity of the orientation response system. It can breakdown under sensory overload. The long-term repetition of one orientation response will be followed by an adaptation reaction. This is quite a different matter from orientation response. While the latter is primarily neuronal and centred in the nervous system, the adaptation activity is a matter of chemistry and hormones. This reaction is usually accompanied by an increase in the body metabolic activity, which corresponds to the need to provide extra energy to the body, allowing it to respond to the change. Adaptive reaction is not a rarity; it takes

longer to arouse, lasts longer and happens a countless number of times within the course of a single day. However, the repeated stimulation of adaptive response can lead to serious psychological problems.

1-2-2-2 PSYCHOLOGICAL PROBLEMS OF OVERSTIMULATION

A successful adaptation occurs only when the level of stimulation - the amount of change and novelty in the environment - is neither too low nor too high. When the environment is overloaded (or underloaded) with information, serious psychological problems will develop.

Toffeler identified three stages of human behaviour in different situations of extreme stress. the first stage is characterised by confusion, disorientation, or by a distortion of reality. Secondly, there appear signs of fatigue, anxiety, tenseness, or extreme irritability. Finally, the third stage is characterised by the emergence of a point of no return, a point at which apathy and emotional withdrawal set in. In more details, he described the psychological problems resulting from overstimulation as sensual, cognitive and decisional problems.

Experiments in sensory deprivation have shown that the complete absence of novel sensory stimuli can lead to bewilderment and impaired mental functioning. By the same token, the input of too much disorganised, patternless, or chaotic sensory stimuli can have exactly similar effects.

Obviously, an organism's ability to cope with sensory input is dependent on its physiological structure. The nature of its sense organs and the speed with which impulses flow through its neural system set biological

bounds on the quantity of sensory data it can accept. Many environmental events may occur at rates which are too fast for human beings to follow; they, therefore, get samples from their previous experience. When the environmental signals are regular and repetitive, the sampling process can yield a fairly good mental representation of reality. but when it is highly disorganized, or when it is novel and unpredictable, the accuracy of the imagery is necessarily reduced and, as a consequence, the image of reality is distorted. This phenomenon may explain the confusion which happens as a result of sensory overstimulation.

While sensory overstimulation increases the distortion with which we perceive reality, cognitive overstimulation interferes with our ability to "think". Some of the human responses to novelty are involuntary, while others are preceded by a process of conscious reflection. This variability depends upon each individual's ability to absorb, manipulate , evaluate and retain information.

Rational behaviour is particularly dependent on a ceaseless flow of data from the environment. It depends on the power of the individual to predict, with at least some measure of success, the outcome of his own action. In order to do this, he must be able to predict how the environment will respond to his acts, response which, in turn, will depend on the nature of the information that

the environment fed to him.

To have an accurate behaviour in a novel situation, individuals need to gain information at high rates of speed. The more rapidly changing and novel the environment is, the more information the individual needs. However, as we mentioned before, human beings abstract, codify and classify the information that they receive in various ways. Furthermore, this ability depends, in one sense, on time. In short, the overloading of the environment with new information may result in the inability of the individual to make a correct assessment of the situation and to behave accordingly.

Decisional overstimulation happens when the balance between "programmed" and "non-programmed" decisions in individual life breaks up. A programmed decision is one that is of a routine nature, repetitive and easy to make. Non-programmed decisions are those that are made about matters which should be studied and weighed with a vast amount of information and high psychic content. For each person, life is a blend of the two types of decisions. If this blend is too high in programmed decisions, we are not challenged enough and the consequence is boredom. On the other hand, if the non-programmed decision are far more frequent than the programmed ones, if the environment, for instance, is so novel that programming becomes impossible, life becomes painfully disorganised.

1-2-2-3 BEHAVIOUR OF SOCIETY IN SITUATIONS OF EXTREME CHANGE

The effect of undesired rapid change in society can be seen in two ways: as creating a danger or as leading to an interruption with familiar situations

The critical sense of the first possibility is when a disaster threatens a society. Experience shows (6) that the sharing of a common threat to survival and widespread suffering usually leads to a dramatic increase in social solidarity and a temporary breakdown of pre-existing social conditions. Such a developed solidarity seems to have a major significance in facilitating both social and personal recuperation. It resolves pre-existing social and personal conflicts, prevents the usual disorganisation of response to trauma and privation, reduces the amount of self-aggressive and anti-social behaviour and motivates people to devote their energies to socially regenerating tasks.

Robert (7), through the study of the effects of disasters on the family structure, found a strong sense of unity, leadership and love between the members of the family during that situation. The effect of sudden dangerous change can be described briefly as follows:

a)- Families tend to develop a greater internal solidarity.

b)- The social relationships tend to be strengthened.

c)- The disappearance of ethnic and minority group differences..

A disastrous change in the environment leads, however, temporarily to a disorganisation in society and the establishment of an emergency social system. The duration of such a situation depends on how rapidly the normal social processes can take over the adaptive task (fig.1-1-5).

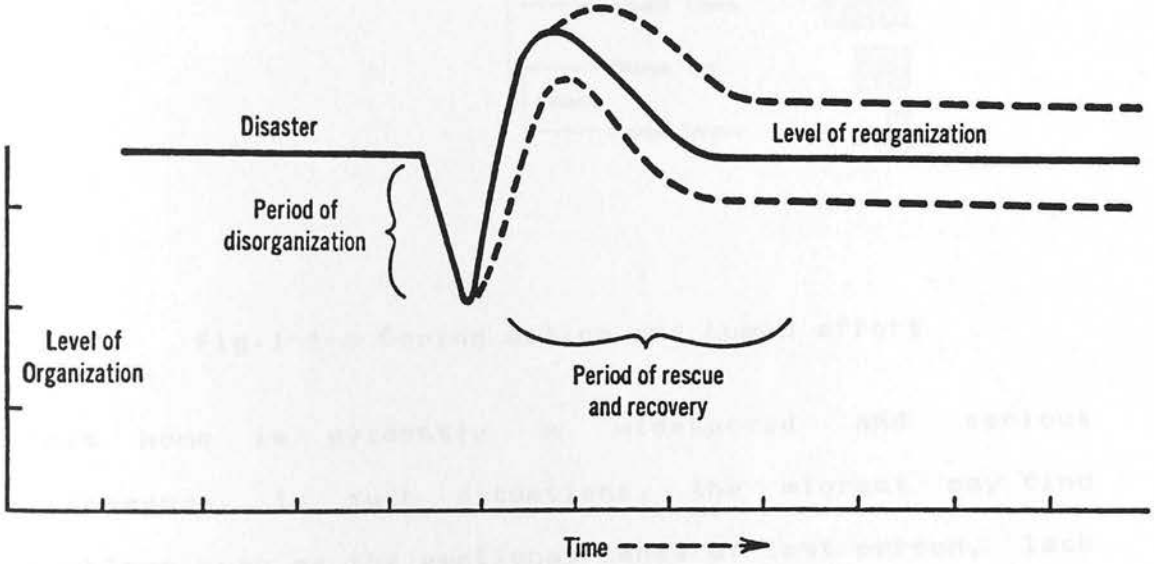


Fig.1-1-5 Adjustment to a crisis

Sudden change also may affect society in the long term. This can happen when society tries to cope with a new situation after a disaster or losing the previous social relationships

In the case of migration to a new area, grieving for a

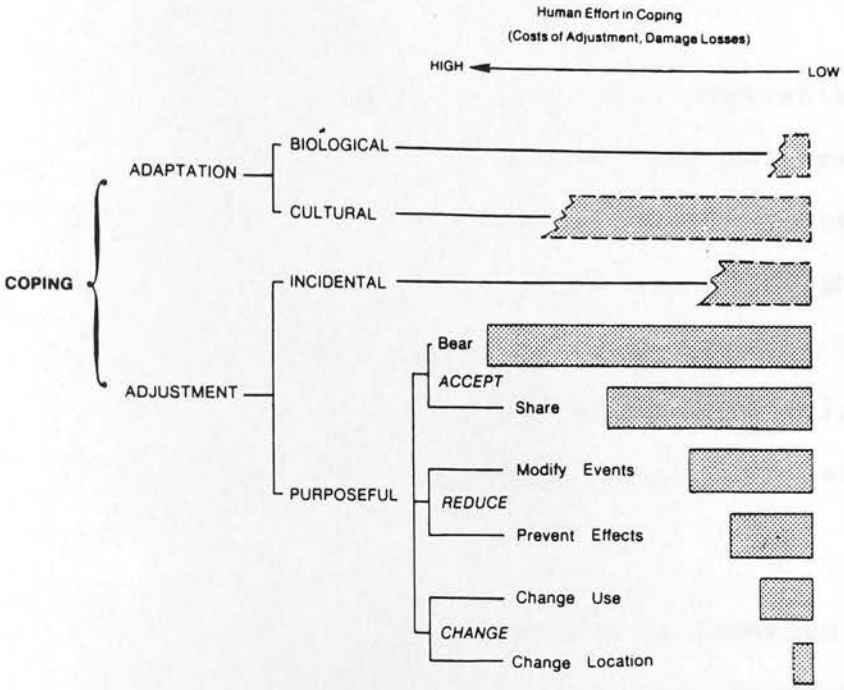


Fig.1-1-6 Coping action and human effort

lost home is evidently a widespread and serious phenomenon. In such situations, the migrant may find problems such as the emotional sense of lost person, lack of group identity and spatial identity (8). These effects vary from group to group; for some people, the environment is experienced as an autonomous social or cultural network; as for others, it could include the self and the physical entity as well. There is also some evidence suggesting that a new environment, be it physical or social, could be adopted as in the old in the longer term (9).

1-2-3 ADAPTATION THEORY

As we mentioned earlier, there are limitations, both physical and psychological, to the ability of human beings to deal with external stimuli. Man's capacity to change depends on several factors. In order to study the extent to which the human mind can bear change and its important factors, psychologists have developed a theoretical model which they labelled "the optimal level of stimulation theory".

According to this concept, there is an inverted U-shaped relationship between the magnitude of the stimulation and the arousal value, the interest in, or the preference for any given stimuli (10). Except for the variables representing the intensity of the stimuli, there is no systematic evidence on the optimal level and the concept deserves more consideration, in view of its patent relevance to man's response to the wide-ranging nature of the stimuli in the physical environment. Furthermore, it is indirectly linked to Helson's adaptation-level theory (11) which responds to any stimuli varying along some assumed dimensions. This theory maintains that for any specified dimension of stimulus variation, the individual establishes an adaptation level (AL) which determines his judgment or evaluative response to the given stimulus located on that dimension. In particular, with reference to an evaluative response, the principle is that the

deviation from the adaptation level in either directions are evaluated positively within a certain range, while beyond these boundaries, they are experienced as unpleasant (fig.1-3).

The concept of adaptation level was also developed by Nuhemow and Lawton (12). They considered the environmental transactions as a function of different factors (fig.1-1-7).

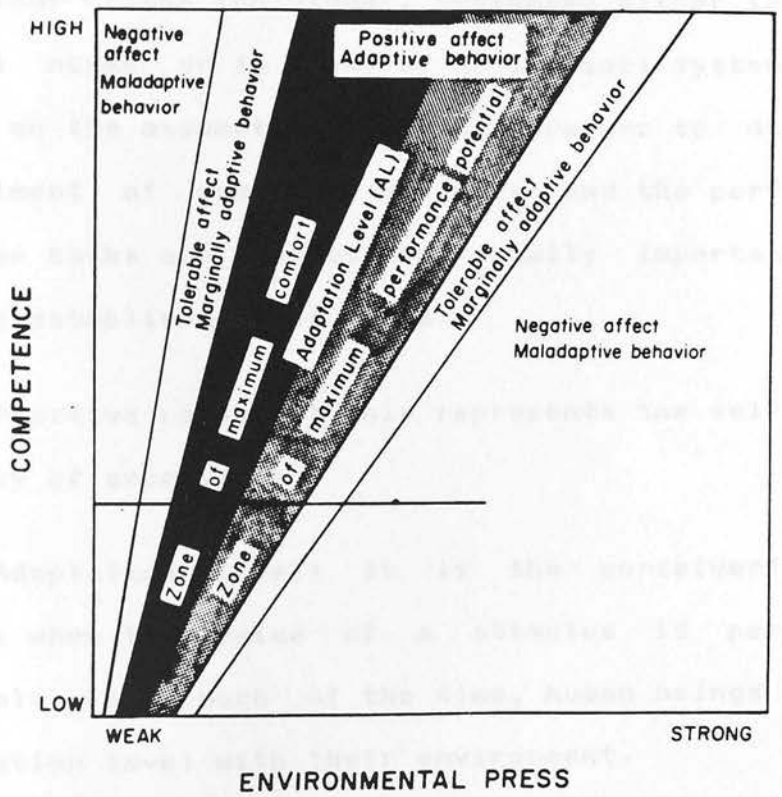


Fig.1-1-7 Graphic representation of adaptation

Their model required the following definitions:

a)- Individual competence: this refers to the enduring ability of an individual and depends on intelligence, perceptual ability, social tact and so forth...

b)- Environmental press: it refers to the external aspects of the environment that are presumed to have some motivating force for the individual, whether he is aware of them or not.

c)- Adaptive behaviour: it is the external observable behaviour of the individual, evaluated either in terms of social norms or in those of an a-priori system of values based on the assumption that the pleasure to others, the fulfilment of one's own potential and the performance of complex tasks are separate but equally important factors in the establishment of norms.

d)- Affective response: this represents the self-evaluated quality of experience

e)- Adaptation level: it is the perceiver's receptor status when the value of a stimulus is perceived as natural. For much of the time, human beings are at the adaptation level with their environment.

f)- The optimisation function: this suggests that for moderate levels of stimulation, a positive effect is engendered by stimuli that depart in either direction from the adaptation level. As the stimuli proceed further

towards either higher or lower levels of intensity, they may begin to evoke a negative inner response. As the diagram shows, there is a range of environment pressure which are adaptive for an individual. When environmental press are either much greater or much less than those to which the individual has grown accustomed, he will experience a sense of discomfort and inadapation happens. The environmental press diminish over as a natural consequence of the adaptation process.

CONCLUSION

Through the interaction with the environment, man develops cultural aspects but the increase in the acceleration of change leads to serious psychological problems. The human problem to accept change to his surroundings is basically the result of the limitations of his sensual organs and of his neural system. Furthermore, an important factor in this interaction is that the change in the degree of novelty in the surroundingsor the long term adaptation to new environments is past experience. In fact, novelty can be accepted when there is a certain degree of familiarity. Confrontation with the environment which has not been experienced or disconnecting one with his past lead to psychological problems of discontinuity. The extent of the problems and the process of adaptation to sudden change depends, however, on personality, on the context in which the individual grows up and on the nature and extent of the change.

1-3 MODEL OF MAN AND CHANGE

As the result of differentiation in both human beings and situations, there are numerous variables which make it impossible to design a universal model of adaptation for man.

The cultural and biological aspects are two basic and extreme aspects of the problem of human reaction in relation to changes in the environment. These difficulties led to the emergence of a number of contradictory theories relating to the study of man. These theories range from behaviourism which sees no difference between animal behaviour and human behaviour to existentialism, for which the human condition is beyond scientific understanding.

Bertalaffy (13) identified four different types of theories of man on the basis of the concept of change in human behaviour that is used in each of them.

One of the leading concept of man is the stimulus-response scheme according to which the behaviour of both human beings and animals amounts to no more than a series of responses to stimuli coming from outside. This stimulus-response scheme relies in part on the assumption of the existence of inherited neural mechanisms as in reflexes or instinctive behaviour. The main feature of this particular model of man is the assumption that human behaviour is constituted by a series of acquired or

conditioned responses. Bertalanffy asserts that this model can be seen applied in many psychological studies as those carried out by Pavlov which were based on the repetition of conditional and unconditional stimuli, or in the ideas developed by Skinner which are based on the reinforcement of successful responses, or again in Freud's work on childhood experiences.

The second significant concept of man used in science is that of "environmentalism" which states, in accordance with the stimulus-response scheme, that behaviour and personality are both shaped by outside influences. In other words, what these two concepts are saying is that the human brain can be programmed at will just as a computer would be. This second concept has been used by a certain number of people who believed that they were capable of changing the personality of an individual simply by using the power of conditioning, as well as by those who believed that the personality of an individual is shaped in early childhood (14).

The third alternative concept of man is that which is based on the "equilibrium principle", the principle which says that the behaviour of human beings is essentially a process of reduction of tension to such a level as to allow one to become normal or satisfied. The Freudian "principle of stability", which asserts that the basic function of the mental apparatus consists in maintaining

homeostatic equilibrium, is very central to this third alernative concept of man.

The fourth and final concept is that which assumes that behaviour is governed by the "principle of economy". Behaviour, in this particular viewpoint, is said to be based on utilitarianism and that it should be carried through in the most economic way, that is with a minimal expense of mental or vital energy.

One very important characteristic of man which none of these four concepts has evoked is his ability to be creative. All of them regard man simply as a passive organism with only biological values. For the stimulus-response scheme, there are in human behaviour no creative, exploratory activities of any kind. Regarding the equilibrium principle, it should be mentioned that human beings are not always trying to reduce tension but are, in some occasions, doing in fact quite the opposite, that is building it up; this is because stress is not, in every case, dangerous or potentially harmful to human beings (15). Finally, the utilitarian scheme does not pay due consideration to human culture at all.

Human beings are not just passive organisms reacting to the external environment; they cannot be characterised in a homogeneous fashion which relies solely on the effects of these external factors. Man is also the creator of his

universe. It is this characteristic that led to the emergence of radically different cultures and to the gradual domination of man over the environment which was made to accomodate his needs and requirements. The concept of man and his complex relationship with the environment would be incomplete without a proper consideration of his creative abilities.

NOTES

(1) Rapoport A. (1977), p75.

(2) Brebner J. (1982), p27.

(3) Smith P.F. (1974), p23.

(4) Toffeler A. (1970), p294.

(5) Sokolv E.N. (1963), p26.

(6) This has been proved by numerous studies. See Baker (1962).

(7) Robert C., in S. Wapner (1976), p186.

(8) Rudolph H. Mous (1976), p199.

(9) W.H. Helson & al, in S. Wapner (1976), p204.

(10) Smith P.F. (1977), p28.

(11) William H. Ittelson & al., in S. Wapner (1976), p204.

(11) Helson H. (1964), p.

(12) Nasimow L. & Powell M., "*Towards an ecological theory of adaptation and ageing*", in EDRA I (1973), p27.

(13) Bertaffey (1971), p97.

(14) Ibid op. cit.

(15) Beshon & Geoffrey (1976), p191.

PART TWO

SUDDEN CHANGE AND THE SPATIAL DIMENSION

2-0 URBAN FORM AND SUDDEN CHANGE: INTRODUCTION

Through the power of his mind, man was able to shape his own environment. In the course of time, he managed to create forms which fitted to their context and which responded, in a very complicated manner, to their surrounding forces.

These physical or socio-cultural forces do not, however, result in the creation or the modification of the form of the environment. Radical changes in environmental forces do not necessarily lead to radical changes in form. In fact, it will be argued in the course of this study, that a sudden change in urban form may be the result of the intervention of factors other than those of its context. The physical environment may reflect somehow the radical changes in society but its role is mainly supportive and not effective.

2-1 BASIC URBAN FORMS

Radical changes in spatial formation could not be out of some basic form. There are, underlying all the variations of forms that one perceives, imagines or thinks of, typical fundamental experiences which C.G. Jung (4) called "archetypes". He believed that there are two basic layers in the unconscious: the personal unconscious whose contents are derived from the present lifetime experience and the collective unconscious whose contents are inherited and essentially universal, that is equally shared by all the members of a species. It is this collective unconscious which is the site where Jung's "archetypes" are located. Archetypes are, therefore, empty forms that must be inferred or derived by abstraction from a class of experienced images or symbols.

Some designers, by referring to this idea, tried to develop a classification system for these major elements of form. According to Kepes (2), there are only two basic morphological archetypes in the design of all elements: on the one hand, there is the expression of order, coherence, discipline and stability; on the other hand, one finds the expression of chaos, movement, vitality and change.

This concept has also been adopted by E. Bacon (3) who suggested that it applied to the design of cities from ancient times to the modern ones. In fact,

unity-in-variety represents one of the most powerful archetypes of human experience. As an example of this, one can say that the work of scientists looking for universal laws is based on precisely such an archetype.

In a more detailed way, Moholo-Nagy (4) makes use of this idea in the study of the origins of urban forms. He concluded that there are some basic forms which have been repeated throughout history by different cultures. These basic forms seem to represent, if one goes along with Moholo-Nagy's argument, the primary choices for the satisfaction of man's needs, even in the future. As he wrote:

"No concept of man-environment ever dies and none ever becomes obsolete. Since the basic relationship of man to earth and man to man are unchangeable and non-progressive, he must return at some junctures in his social consciousness to a certain environmental ideal".

All the variations in urban forms can be grouped together according to a certain number of distinctive patterns such as the geomorphic, concentric, linear and cluster patterns. Each of these forms is assumed to carry special meanings and functions. Geometric concentric planning, for instance, would represent a strong sense of centre, a contrast between the man-made environment and nature, a single way of communication and is, originally, the abstract expression of the human need for security and his

will for domination.

The linear type of planning can be traced back to the ancient Egyptians for whom it expressed the unifying concept of man and god as well as the unity between oppositions. This kind of planning introduces movement and the concept of mutual connection in planning.

Finally, cluster patterns are representative of those settlements which do not have the original characteristics of either city or village. They can be said to refer to old urban complexes which existed from the beginning of cities but which, in recent centuries, have grown rapidly as a response to overcrowding and to the need for the provision of better conditions of life.

These basic forms are , however, subject to change in the morphology of the city and they represent only so many choices for man, whatever the forces existing in a particular context might be. A radical change in the morphological sense could not take place out of the archetypes which are, more or less, universal and shared by many different cultures (5). In different cultures, places and times, one can find variations of these basic forms which are supposed to represent the effects of the different forces in action in that particular situation.

2-2 FORM AND FORCES

It is not uncommon, in architecture, to assume that there are some environmental forces which determine the form of settlements and to interpret the variations in urban forms as the results of changes in these forces in different time and place. These environmental forces could be represented by physical factors such as climate, material availability, the effect of which can be easily followed, or by non-physical factors such as social and cultural conditions which affect the environment in a much more complicated way. While some designers prefer to emphasize the importance of only one of these factors, there are also those who see the various architectural forms as resulting from a very complex process of interaction between the totality of these forces.

In any case, it still remains very hard to go along with the assumption that major changes in the totality of environmental factors leads to sudden change in the actual built form. Listed below are some of the main determinants of built form which have resulted in the formulation of a series of theoretical models, each of which relying on one single determining element (6):

a)- Climate and the need for shelter.

b)- Materials, construction and technology.

c)- Site and ecological factors.

d)- The need for defence against hostile

elements.

e)- The economic situation.

f)- Religion, rituals and symbols.

g)- Socio-cultural factors.

a)- Climate and the need for shelter:

Climatic determinism has always been widespread in architectural thinking; it has always been regarded as a strong factor in the formation of settlements, especially in those situations where extreme climatic conditions prevail (fig.1-2-1a).

Shelter is of supreme importance to man and constitutes a prime concern in his contant struggle for survival. Over the centuries, man has developed many types of dwelling in order to shelter himself against the extremes of weather and climate. The vernacular and traditional layouts of towns and buildings are usually regarded as a good response to the prevailing climatic conditions, but nevertheless the resulting form cannot be said to have been determined by this factor.

Furthermore, while it would be totally unreasonable to deny the great importance of shelter as an aspect of the built form and as a response to human needs, built form cannot be considered as a natural or universal act. There exist quite different concepts of form independently of

the degree of the need for shelter-making. Different forms may be produced under similar climatic conditions and, conversely, there might exist similarities in the built form under two different climatic situations. From this, it follows that, clearly, the climatic aspect could not be considered as a determining element of form.

b)- Materials, construction and technology:

The availability of materials, construction methods and technological knowledge make possible or impossible certain decisions. This represents a natural process since natural forms are the results of tension and compression of forces; and as the expression of a kind of logical use of structural material which results in maximum strength and efficiency for a minimum expenditure of material, the urban form does to some extent follow this procedure (fig.1-2-1b).

It can be argued, here, that the built form is not the result of a natural choice, but of human will. Certain types of spaces (7) are organised in the same way throughout the world while built of different materials and relying on different constructional methods and technological knowledge. This would suggest that form is, at least partially, independent of these factors. As Rapoport pointed out, they may well be accounted for as modifying factors, but they decide neither what is to be

built nor its eventual form; these are decided on other grounds.

c)- Site and ecological factors:

The condition of the land has always been an important factor in the formation of villages. Peasant communities have always built their settlements in such a way as to maintain a harmonious relationship with nature, following the contours of the existing natural elements such as rivers and hills in order to get the maximum benefit from nature which would correspond best to their special way of life.

Ardalan (8) has identified three types of layout for villages depending on the existing ecological conditions (fig.1-2-1c):

1- The linear type of settlements: in these types of villages, the general pattern of streets follows the path of water or the direction of some linear feature in the site.

2- Cluster settlements: these types can be seen in both open plains in response to hot climatic conditions and in semi-mountainous regions where they are able to take advantage of the sloping sites for best biological needs.

3- Random type of settlements: these are found in hot

and humid regions.

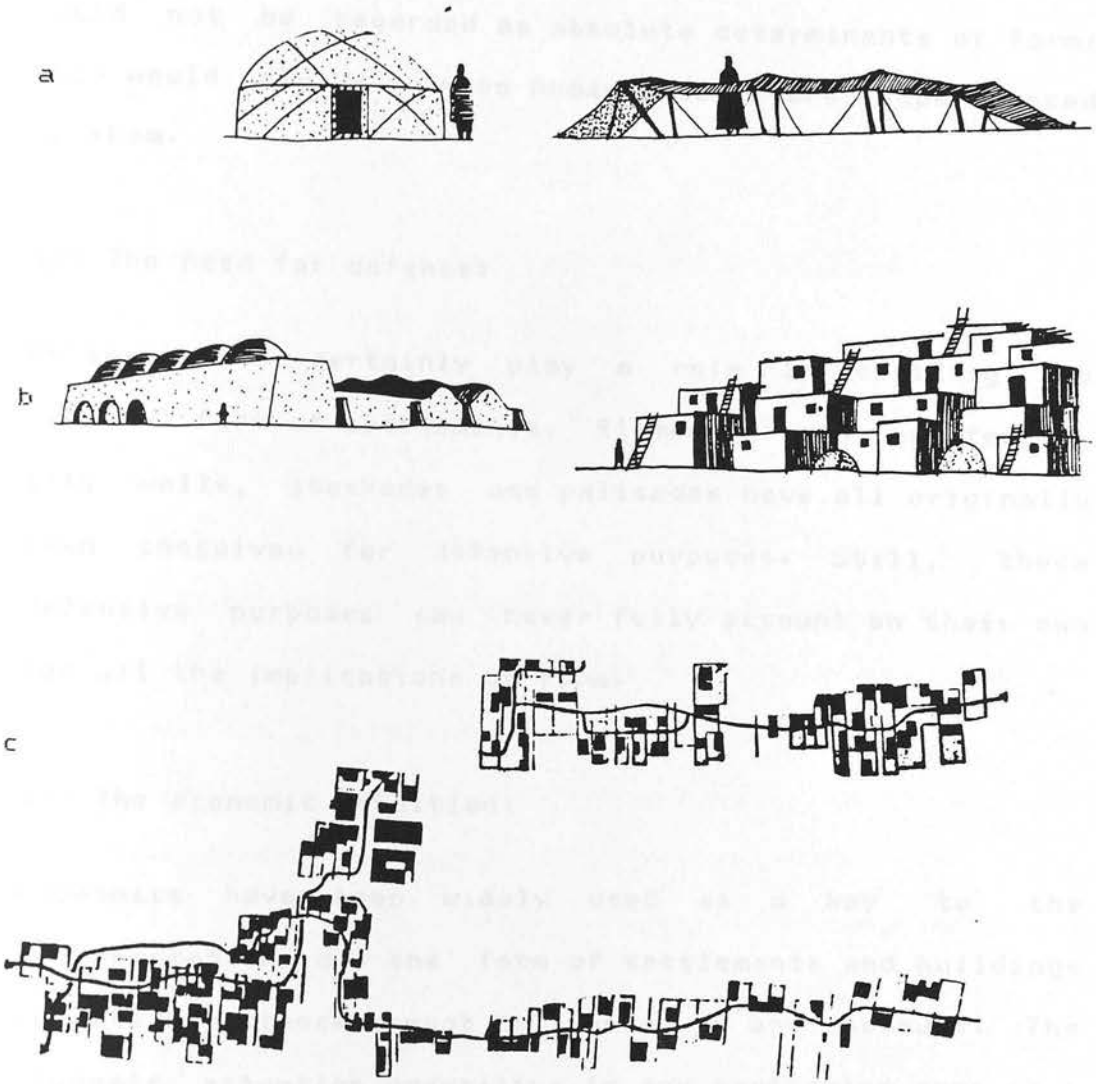


Fig.1-2-1 variation of built environment
under The effect of environmental forces

a)- Climatic forces

b)- Material forces

c)- Ecological conditions

However, although sites and ecological conditions do affect the shape of settlements to a certain extent, they could not be regarded as absolute determinants of form; they would only be so when human values are superimposed to them.

d)- The need for defence:

Defence does certainly play a role in deciding the eventual form of settlements. Elements such as fences, city walls, stockades and palisades have all originally been conceived for defensive purposes. Still, these defensive purposes can never fully account on their own for all the implications of form.

e)- The economic condition:

Economics have been widely used as a key to the interpretation of the form of settlements and buildings and its importance cannot be ignored in any account. The economic situation prevailing in any particular case is a major force acting on the social structure and affecting the whole environment.

The argument for economics as the determining factor in the shaping of the built environment becomes, however, very suspect when it is realised that even in economies of great scarcity, there are examples which clearly show the

intervention of forces at work other than economic ones. It is for this reason that one would be right to suspect that, although the economic conditions existing in any particular environment constitute one of the most important factors, they cannot be interpreted as acting on a single basis.

f)- Religion, rituals and symbols:

This is one of the non-physical factors intervening in the shaping of the built environment which is usually brought up against those who believe in the supremacy of the physical forces only.

While both men and animals seek shelter, places to store things and favorable micro-climatic conditions, only the former possess a spiritual dimension which is unique to them and which distinguishes their built artefacts from nests, beehives, etc... One could mention many instances which illustrate the way in which religious beliefs have affected the form, plan, spatial arrangement and orientation of the houses (9); but here again, it would be an oversimplification of reality to suggest that everything can be traced back to one single cause, in this case religion, rituals and symbols.

g)- Socio-cultural factors:

In this case, the built form is regarded as the expression of cultural phenomena. The form and organisation of space is said to be influenced by the cultural milieu to which it belongs and from which it emerged. Very early in recorded time, the built form became more than only shelter for primitive man and almost from the beginning, the notion of "function" indicated more than simply a physical or utilitarian purpose.

Lewis Mumford (10) has already argued that man was a symbol-making animal before he was a tool-making animal, that he reached specialisation in myth, religion and ritual before he did in the material aspects of culture and, finally, that ritual exactitude came before exactitude in work. Man put his energy first into the development of symbolic forms rather than utilitarian ones, even when he was barely starting.

Confirmation of this fact can be seen even in those societies where there is a high criticality of choice, due to strong physical constraints; there, socio-cultural aspects never cease to operate.

Rapoport, notably, demonstrated that the man-made environment is not simply the result of the combined effects of physical forces or any single causal factor, but that it is instead the result of the effect of a whole series of socio-cultural factors. He also said that it is

these forces which constitute the primary forces and that the physical conditions act only as secondary or modifying forces.

If the built form is believed to be the expression of the intervention of social forces, it becomes an event in a time-space continuum and not simply a configuration in space. The forces affecting the built form become a function of change in society which is variable. The form may be changed or may remain constant during a certain period of time in the same way as societies would. This does not mean, however, that one can identify a causal relationship between society and built form; indeed, there are many instances in which sudden social changes did not lead to any major change in the actual built form.

While the socio-cultural aspects can be justifiably regarded as important factors intervening in the decision about the final choice among many possible alternatives, it remains a fact that the form of the built environment cannot be seen as resulting from the effect of one single factor. In fact, for some architects, the built form is created in a very complicated manner, involving the interaction of all the forces that are present in its context.

In his book, "*Notes on the synthesis of form*", Christopher Alexander (11) tried to demonstrate that the design of

elements is a complicated process, following his belief that forms are always the results of a "diagram of forces". His particular view expressed in that book is clearly representative of that line of thinking which relies on biological analogies. By referring to the work of d'Arcy Thomson on biological forms, he was looking for ways of achieving in the built environment a precise fitness of form to its context as it exists in nature. As he wrote:

"*...every design problem begins with an effort to achieve fitness between two entities: the form in question and its context. The form is the solution to the problem; the context defines the problem*".

Therefore, the form, itself, is not the problem; it is the combination of the form and the context which is important. Furthermore, Alexander recognised that traditional cities achieved such a level of fitness during many times (a process of design which he referred to as "unself-conscious"), while the development of architectural individualism in the recent decades has led, in his eyes, to an artificial production of forms (a process which he calls "self-conscious").

Although one should accept the richness of traditional cities and the ways in which they managed to adapt to the surrounding landscape and also accept the notion of design process as a complicated one, one must recognize, however,

that there would still exist many possible formal alternatives for any design problem in any one context. In other words, the diagram of forces, of which Alexander spoke, may result in variety in form depending on the context; this flexibility is linked to human creativity and adaptation.

2-3 URBAN FORM AND BEHAVIOURAL SCIENCE

For the last two generations, there has been a lot of interest shown in the possibility of relating the findings of the behavioural sciences with architecture. This interest was first apparent in the writings of the pioneers of the Modern Movement of the 1920's and 1930's who outlined its extremely idealistic and utopian approach to the problem of the built environment. This belief in the applicability of the methods and findings of the behavioural sciences was most obvious in their claim that the social order could be revolutionized simply by manipulating the physical environment.

Since then, designers became more self-conscious as the behavioural scientists, sociologists and psychologists started to develop a new concern for the practical application of their research; a new field of inter-disciplinary cooperation was thus opened.

There are still a lot of controversies involved in the design of the built environment. There are at least two groups of designers who completely rejected the social and psychological importance of the built form. The first of these groups is that which sees architecture as a kind of amusement whose relevance is only in terms of beauty and not as a response to socio-psychological problems. The second group of designers believe that the available

psychological insights are as yet too vaguely formulated to have any serious bearing on the design and perception of urban forms (12). According to this view, the nature of life cannot have any serious bearing on the day-to-day work of the designers and planners.

However, there are many different models proposed by the behavioural sciences, each of them emphasizing a particular aspect with different types of relationships between man and the built form.

2-3-1 MAN-ENVIRONMENT MODELS

There are a number of models constructed by various disciplines which deal with the problem of the relationships between man and the environment.

One of these models, which has been central to most of the research and which covers most of the others, is the ecological one. This model is mainly concerned with the study of man in his environment and how he selects an environment under external and internal forces so as to reach a situation of equilibrium. This model assumes, therefore, that any change in the ecological conditions may result in disastrous effects on the organisms living there.

The evolutionary model, which is related to the ecological one, begins with the notion of constancy. This notion means that people are as they have always been and that there might be some problems and dangers with certain types of arrangement in the environment and forms of human adaptation. According to this view, important insights about human characteristics, their predispositions and limits, can be obtained from the study of the physical environment in which man has evolved.

The other type of models which resemble the ecological ones are the ethological models. These are based on spatial concepts, the most important of which being that

of "territoriality" (13) and that relating to domains, etc...These spatial characteristics are due to universal drives and it is them which give differentiation to groups of species in terms of the variations in the distance that the individuals of the group keep from each other.

One could also mention those models based on human perception. They can generally be divided into three categories: perception, cognition and evaluation aspects. Perception through the senses, over-stimulation and the process of adaptation, which have already been discussed previously, are all part of the studies which see the relationship between man and the environment through a perceptual mechanism of stimuli and responses.

The cognitive model, which could be part of the basic meaning of the perceptual models, concentrates on the notion of mental mapping and the nature of the images thus formed (14), how they distort reality, how they relate to the various cues and features of the environment and how the images can, in turn, affect the behaviour of the individual and the decisions that he takes (15).

To be also classified in this category of approaches are all the learning-based models. These models offer explanations as to how people learn to use their environment and how they build up a knowledge of it through mental mapping and the formation of images and,

consequently, the way in which the environment could be designed as a field for learning.

The socio-cultural models also put the emphasis on the study of the built environment. They claim that the most important element to be taken into account in design must be the way in which given groups of people define and solve problems. In this sense, culture becomes an important mediating variable in determining how things are done and, consequently, the form of the environment. These types of models are related to values, images, choices, preferences, etc...

There are many other models which are concerned with the study of the relation that man has from a particular position to the environment. Although there are those who try to devise a meta-model, that is the collection of all the various advantages existing in all the different models and their incorporation into one single model (16), there exists as yet no single and unified model which could demonstrate the validity of all the others. This is mainly due to the various and complicated attitudes towards the concept of man as they exist in the different disciplines which claim a relevance to the study of the relationships between man and the environment. One could mention, as an example of this disparity of views, the two distinct understandings of the concept of space: the first view being that of space as part of a mental outfit, the

second seeing space as a discursive element (17); these two opposing attitudes are again split into many variations. The same problem exists in relation to the concept of man. This complexity of views makes it all the more difficult to formulate a unified notion about the relationships between the two.

Furthermore, this difficulty may also be partly due to a more basic problem, namely that of the dichotomising of the reality into man, on the one hand and the environment itself, on the other. This is a distinct and yet related division. Teymur has argued that the presupposed concepts of man and environment are held together by the binary nature of the relationship that is said to bind them together, making them mutually presupposing each other. Therefore, one can find many different types of relationships between man and the environment.

In architecture, however, the deterministic relationship is by far the most common. Here are some of the assumptions that are contained in this deterministic view:

a)- The environment determines the formation and evolution of the organism.

b)- Man determines the nature of the environment.

c)- There is a two-way relationship, depending on the situation.

d)- When the above relationship happens simultaneously, it is often referred to as

"interaction" or "interface".

e)- A more sophisticated version of the above interactionism is that which specifies the nature of the relationships, e.g. "against", "opposition", or "struggle".

f)- Man and the environment exist together in unity.

As a result of the problems which are created by the very nature of the studies in man-environment relationships, it has become impossible to formulate a general type of relationship which would be always valid between the two. Each side of this relationship must be classified according to the specificity of the context and, then, the effects of the changes that one side has undergone on the other can be studied.

2-4 RADICAL CHANGE IN URBAN FORM

There are different factors which may, in certain specific situations, lead to radical change in the formation of cities. As we have already mentioned, it must be stressed that radical changes in the environmental forces, either physical or socio-cultural, do not necessarily result in similar changes in urban forms. Major changes may take place as a result of the direct action of a single factor; they may also take place through the indirect interaction of several factors. As this depends on the characteristics of the particular situation, we are going, in what follows, to analyse the history of radical changes which took place in Iranian cities.

2-4-1 MAJOR CHANGES IN THE HISTORY OF IRANIAN CITIES

The development in urban forms and the changes in the way of life of the local population in Iran have followed a series of different stages, each with a different degree of fluctuation. Therefore, it is very difficult to demonstrate the existence of any kind of correlation between these two series of phenomena in the historical sense. What we will try to explain, instead, are the major attitudes taken towards the design of cities and the major historical events that have happened simultaneously, in our attempt to identify some of the factors which played an important role in such transformations.

The earliest known Iranian city was Haban Nomna, built by Elamit at about 1250 B.C. (18). The historical development of the Elam civilisation was typologically similar and more or less simultaneous with its neighbouring Sumerian civilisation at about the 7th millenium B.C. (19). The above-mentioned city could, therefore, be considered to represent a typically Sumerian city, consisting of two walled concentric settlements with a temple in the centre. At the time when it was first built, the temple was made out of a series of different spaces used for various religious purposes, arranged around a large courtyard. Later, a sudden alteration of the nature of the religious beliefs that the Sumerian society had held resulted in the transformation of the previous type of temples into a

Ziggurat - world mountain - (20) which became a very popular type of structure in the Mesopotamia of that time (fig.1-2-2).

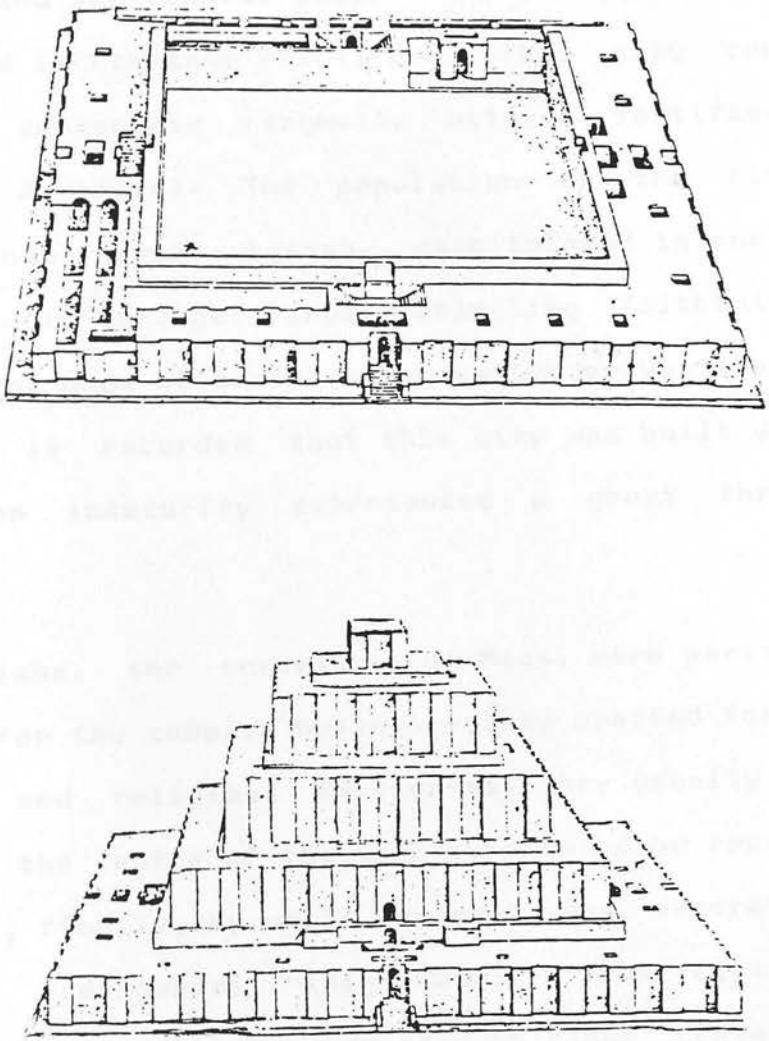


Fig.1-2-2 The development of Ziggurats

Massive migrations, however, took place on the Iranian plateau in 800 B.C. (21). These were followed by the establishment of the Medes Empire. In that era, the main city design concept was that of a circular arrangement of houses around the central palace. The best known city from that period is Ecbatana (fig.1-2-3). This city consisted of seven concentric ringwalls with a fortified core containing a citadel. The population of the city was divided into seven classes, each located in one of the concentrically arranged rings, reflecting faithfully the hierarchical mode of social organisation prevailing at the time. It is recorded that this city was built during a period when insecurity represented a great threat to society.

Archaeminians, the successors of Meds, were particularly renowned for the complex buildings they erected for their military and religious ceremonies. They usually built a castle at the centre of the town surrounded by residential areas and, finally, by walls arranged and decorated for different ceremonies (fig.1-2-4). This civilisation managed to either overcome or stay in close contact with the other major civilisations of that period. This would indicate that some architectural elements might have been adopted from these societies.

Alexander's conquest of Iran , followed by Solok and the Parthian dynasty brought about the introduction of the

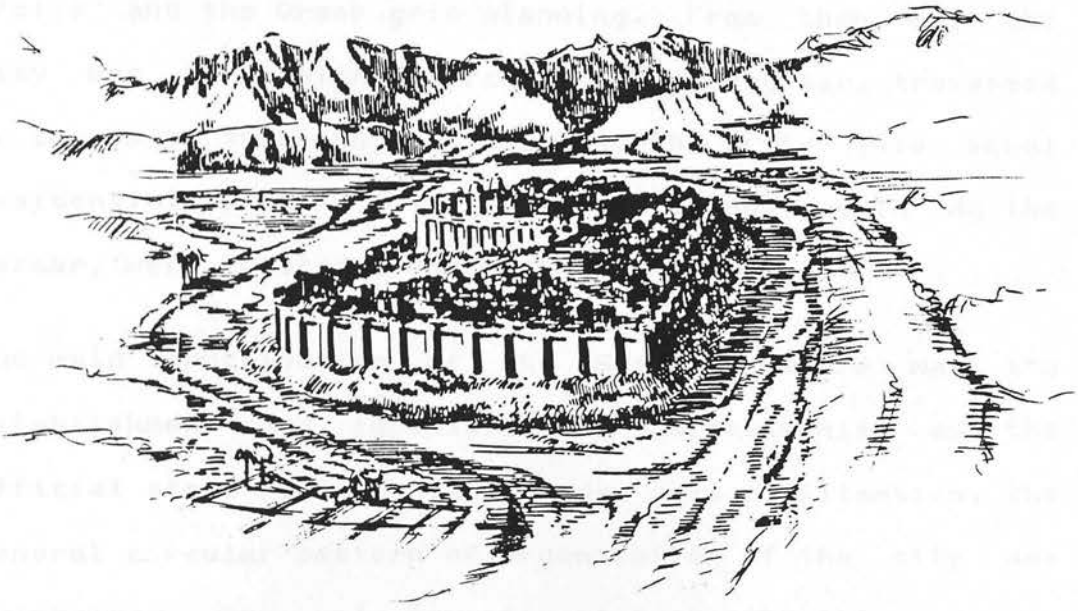


Fig.1-2-3 The city of Ectabana

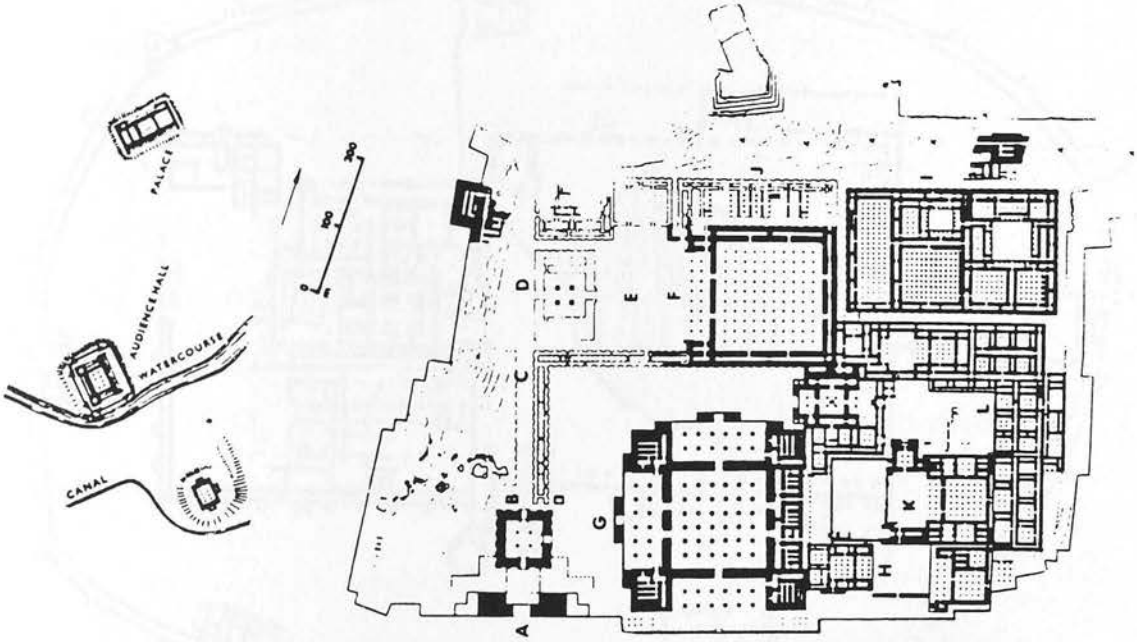


Fig.1-2-4 Persepolis, the ceremonial centre of the Archaeminians

"*Polis*" and the Greek grid planning. From then on, the city was to be either circular or rectangular, traversed by two major thoroughfares dividing the city into equal residential parts. All public buildings, such as the Bazaar, were located along these grand avenues.

The main contribution of the Sasanid empire was the establishment and imposition of Zoroastranism as the official state religion (22). Under this civilisation, the general circular pattern of organisation of the city was maintained, the only new element being the introduction, at the centre, of the fire-temple (fig.1-2-5).

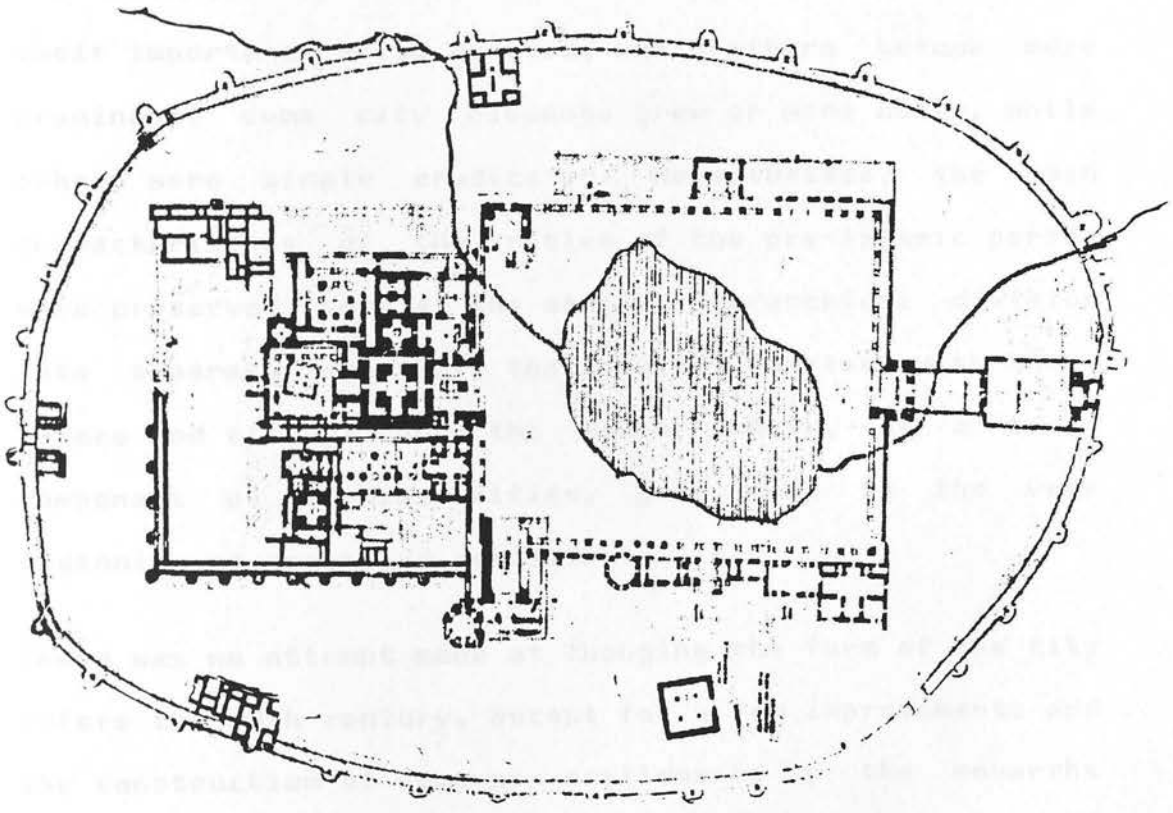


Fig.1-2-5 The Sasanid temple of fire

In the first half of the 7th century A.D., the Arabs started to pour in from the Arabian peninsula. Their conquest was made at the expense of the Byzantine empire on the one hand, and the Sasanid Empire on the other. After that, Iran became part and parcel of the Islamic world and all aspects of its life were radically altered. However, in spite of the revolutionary changes in the social, economic, political and religious aspects, there is no evidence which would suggest that great changes in the concept of city planning have followed. The pre-Islamic cities were simply integrated and adapted to the Islamic way of life. Gradually, some activities saw their importance being reduced, while others became more prominent; some city elements grew or were added, while others were simply eradicated. Nevertheless, the main characteristics of the cities of the pre-Islamic period were preserved, such as the strict hierarchical division into separate quarters, the princely quarters with their palace and citadel and the Bazaar which, as a basic component of Iranian cities, goes back to the very beginning of organised settlements.

There was no attempt made at changing the form of the city before the 19th century, except for a few improvements and the construction of some new settlements by the monarchs and governors of that time. The only major enterprise of that period was the construction, under the rule of Shah

Abbas, of the royal city of Isfahan with its great square, its harmonious expanse of gardens and the grand avenue of "*Charbagh*" (fig.1-2-6). It should also be mentioned that, under Safavid, Iran had a very close political and commercial relationship with the European countries and that it represented, at that time, a powerful country. This fact may explain to some extent the reason for the spread of open planning .

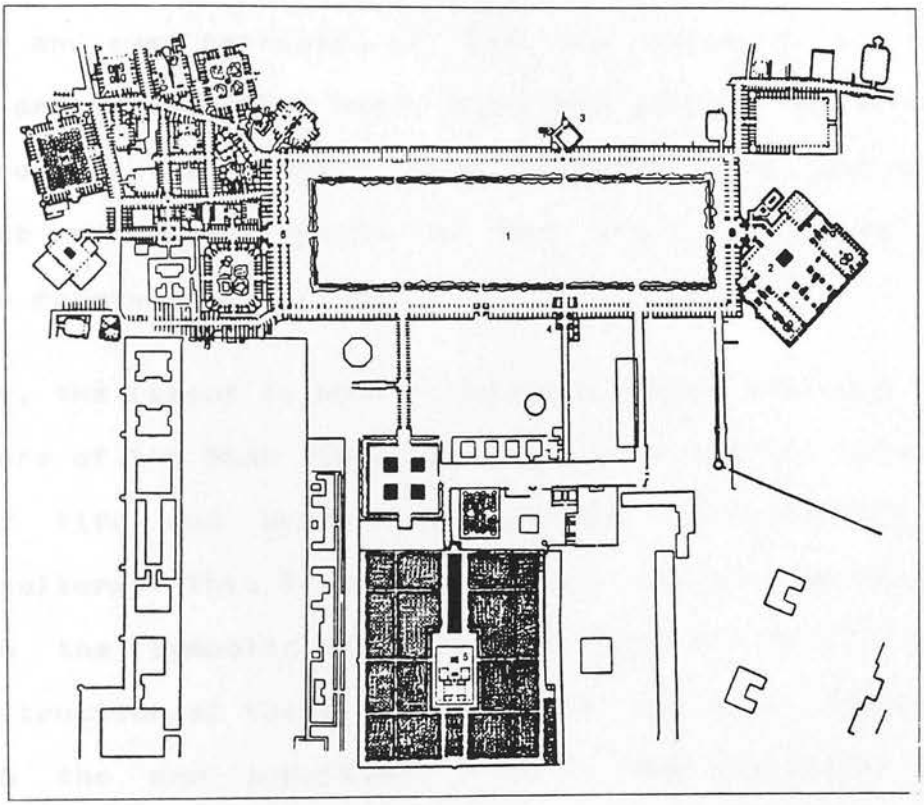


Fig.1-2-6 Isphahan

The constitutional revolution of 1906-1907 (23) brought about major changes in the structure of society. This was

followed by the breakdown of the Islamic way of life and its replacement by a "modern" and secular attitude enforced by the state, mainly through changes in the education system, as well as through the legal, political, economic and social systems. This tranformation took place over a relatively short period of time and led to the formation of a series of conflicts and oppositions in society. On the one hand, there were those people who chose to carry on living according to the traditional way of life and even retreated to the old quarters of the cities and on the other hand, those who adopted the modern standards of life which were becoming more and more apparent in the new parts of the city influenced by Western modern architecture.

Finally, the recent Islamic revolution, which followed the departure of the Shah aimed mainly at reviving the Islamic way of life and eradicating all the manifestations of alien cultures. This transformation is already happening through the symbolic expression of a new way of life and the destruction of the old symbols. It is also apparent through the new importance given to some activities and the elimination of others. However, as far as the design of cities is concerned, there is no sign of any radical changes yet.

It is hard to establish general principles which would apply to all kinds of changes in the configuration of

cities. In the particular case of Iran, one should not, however, neglect the role that society has played in the appearance of certain urban configurations. Nevertheless, it seems that the radical changes in urban forms are more a factor of introduction to society than society itself. In this sense, designers and the authorities can be assumed to represent a major factor in the formation of towns.

2-4-1 SOCIETY AND SUDDEN CHANGE IN URBAN FORM

The individual human being affects and is affected by the changes in both his physical environment and society. While these two types of changes may, in some cases, happen simultaneously, one cannot however say that there is a causal relationship between change in society and its spatial dimension. In fact, society is, to a large extent, independent from the physical environment; it could at least be argued that while a sudden change in the structure of society may have certains effects on the spatial dimensions of cities, the reverse phenomenon is not true. A sudden change in the formal structure of the city does not necessarily lead to changes in society. This is generally true in all cases of sudden change.

In the case of an environmental disaster of cataclysmic dimensions, a society may be destroyed or may revert to a more primitive level, but more often, in the cases of a less severe disaster, the society can carry out immediate repairs. Floods, fires and the physical damages resulting from wars have always had little effect on the general course of human and social history (24). A long series of shocks may exert a more telling influence if they weaken the basic resources of men and of the land or call up a new social organisation in order to cope with their continued occurence. But these reactions are more the after effects of the shock caused by the disaster than

anything else. The physical environment is not itself an agent of change in this situation.

Some studies on the migration of people to new areas (25) have shown that the new migrants try to implant in their new location the same kind of social structure as that which existed in the place from which they emigrated. They are likely to make a series of modifications to the new environment in order to approximate the one they knew, or to choose a location that shares some similarities with the old one.

As we have already mentioned, the migration to a new environment is always accompanied by an astonishing hardihood of social patterns and values. However, this represents the effect of the new social environment and not the spatial one as some would be tempted to think. The response to any physical environment will differ according to age, to the type of culture, etc... While some changes might occur as a result of the migration to a new environment, generally the same social patterns are allowed to persist.

As a conclusion, one could say that sudden changes in the spatial structure do not directly and automatically lead to similar changes in the social structure. Generally, societies operate to a large extent independently from the physical setting. The one exception to this principle is

the case when the changes taking place in the environment are of a catastrophic dimension as, for instance, when all communication networks are cut off or when a large number of people are confined to a very small space. In such a case, a society might re-assess its structure and principles or it might even collapse altogether.

The other case in which the physical factors may have an important effect on society is that when those elements are directly linked to an important social role. Here, the modifications undergone by the physical elements will be followed by similar adjustments in the patterns of social behaviour. As examples of such societies, one could mention those which are heavily dependent on the ecological conditions prevailing in their surroundings, fishing or agricultural societies.

While the sudden change in the physical form can hardly be noticeable in the form that society takes, radical changes in the structure of society can be said to manifest itself, over a long span of time, in the physical structure of the environment. Alterations in the visible environment can usually be read as a sign of social change, but the complete picture of the social change cannot be gathered from simply the analysis of the physical environment. What the latter provides is only a clue as to what exactly happened without explaining it comprehensively. The type of social formation cannot be

predicted from the spatial dimension of society.

A social revolution is not, as a matter of course, followed by a spatial upheaval, but it is accompanied by an iconoclasm, that is the destruction of the symbols of the previous era. The new pattern of activities may simply accomodate itself to the old spatial container and no other alterations need to happen.

Society is not a variable of the physical form (26); it is to a great extent autonomous. The physical environment is also not the concrete expression of the social relationships for which it provides the setting; it is just a potential environment as it only provides the setting for possibilities of social interaction .

CONCLUSION

The act of designing is something that no other being but man is capable of doing. The variety of forms which were created by man is initially related to the power of imagination, the development of his mind and his consciousness.

Man sees the world differently at each period of time in history. Myths, magic and religion represent the concrete demonstration of some of the frameworks that he imposed on reality, the physical dimension of the world being one of the ways of presenting them. As man responds to the surrounding social conditions, the urban form of a particular culture can be said to represent the prevailing condition of time.

Each culture has formulated its own norms, as far as the design of the built environment is concerned, norms which make it distinct from other cultures. Culture as a structure of society is adaptable; the physical form that one culture takes may be transferred and adopted by another society. That transfer could either be cultural-bound, or cultural-free.

Therefore, while each culture develops some phenotypes, it may at the same time adopt dissimilar forms as well. This is due to the active role that man takes with regard to his surroundings. Urban forms are created by the human

mind in such a way as to express his will and needs, but he does not rely exclusively on such forms to fulfill his stated needs.

The main issue raised by each sudden change is the stability and continuity of society which can be achieved through a whole range of internal and external factors. The issue is that of the creation of a bridge between what society was and what it is going to be. The physical environment can act as a factor in the preservation of such continuity but, again, the physical continuity cannot be regarded as a guarantee for social continuity.

NOTES

(1) C.G. Jung (1978).

(2) Kepes G. (1965).

(3) Bacon E., in his book "*Design of cities*".

(4) Moholo-Nagy (1968), p18.

(5) Ibid, op. cit. p13.

(6) Rapoport A. (1969).

(7) As the courtyard or the linear organisation of space.

(8) Ardalan A. (1976), p25.

(9) this was explained by Mircea E. (1961).

(10) Mumford L., in "*Knowledge of man*" by Dillions (1968).

(11) Alexander C. (1964), p15.

(12) Alexander C., "*Major changes in environmental form required by social and psychological demands*", in W.M. Quade (1971), p48.

(13) For instance, E.T. Hall (1966) and E. Geoffman (1963).

(14) The studies done by K. Lynch, for instance (1960).

(15) Rapoport A., "*An approach to the construction of a man-environment theory*", in EDRA II (1973), p124.

(16) Ibid, op. cit.

(17) Teymur (1982), p31.

(18) Sultanzade H (1982), p54.

(19) The Cambridge history of Iran

(20) Sultanzade H., op.cit, p60.

(21) Pope A. (1965)

(22) The Cambridge history of Iran.

(23) Avery (1965)

(24) Lynch K. (1972), p215.

(25) Ibid, op.cit., p20.

(26) According to the deterministic view.

SECTION TWO

TEMPORAL DIMENSION AND CHANGE IN URBAN FORM

A PROPOSAL

1-0 INTRODUCTION

In one sense, change means time.This covers not only the sequence of physical entities, but also thedirection which takes these entities in the mind of a person. By presenting change as two dimensions of time, the problems of rapid change could also be divided into two: those which arise from human limitations in memory in sequences of change in the objects and those which arise from the interruption in the continuity of direction. It is the latter category of problems which will be emphasized in this part as an important aspect which designers should strive to maintain in cities.

Temporal continuity arises from the interrelation which one makes with past, present and future and it is in this way that stability could be acheived in changing situations, otherwise and basically complexity unifies by directing towards timeless phenomena.

1-1 TIMELESS PHENOMENA

Man has always tended to assume that changes in the world are not random. Basically, there are always some reference points which constitute the source, the origin or the essence of events; and the kind of phenomena which justify complexities.

Through this conceptual assumption, orientation in the world takes place; changes are apprehended and become possible and a stable condition is created to protect man from instability. These concepts are assumed to act out of the temporal present but as a refuge place for man in complexity. The best example of these ideas can be seen in religions in which God, Heaven and Hell constitute the beginning and the end.

In architecture, there are also many examples which could be mentioned. The "Golden Rule", "centralised space", "utopian space" are all basically timeless. Referring to environmental discourses, Teymur (1) stated that:

"The mechanisms which act in man-environment studies are in a homogeneous field. the main function of this field is to enable the discourse to be assured legitimacy and to provide an unquestioned field of reference that is itself a given".

He believed that concepts such as "original unity",

"centre circles", "models", "division" and "demarcation" are part of these mechanisms. These concepts, although governing the mechanisms of man and environment, can also be found in all aspects of life as well as in the design of cities. They are primary aspects of orientation and should be emphasized whenever there are radical changes in the environment.

1-1-1 CONCEPT OF ORIGINAL UNITY

Through this concept, it is believed that there is for each object an origin from which it developed and at which time it had its essence constituted. In such a perspective, it is held that everything existed originally in harmony with itself and with its surroundings but that later, a split has occured. The religious view of this original unity is expressed through the belief in the oneness of the world, in the unity with God and in the original natural harmony of things and men. This belief is what created cosmologies which, in turn, are said to carry the universal truth emanating and ending with God Himself. In this sense, man believes in his closeness to God. One extreme example of this can be found in Islamic mysticism and cosmology according to which the whole world is essentially a united entity (2). According to Ardallan (3), in Islam, the whole world is perceived to be but various manifestations of the same universal truth and the

universal soul. Thus, architectural elements, buildings and cities are, according to this view, all different scales of the same cosmos and are all originally united by the universal spirit.

Examples of this in architecture are not rare. Concepts such as "harmony with nature", "human scale" or "total environment" all presume that there must be an original unity underneath the apparent diversity. This belief in an original unity contributed to the constitution of some "pure principles" which provide guidance for human actions by reducing complexities to simple rules. The traditional ideal types and the "Golden Rule" in classical architectural practices are prime examples of such fixed principles. Historical analysis in architecture has shown how these principles have dominated past approaches to the design of cities. One obvious example would be the design of structures like the Egyptian pyramids or the temples in ancient Greece.

1-1-2 SENSE OF CENTRALITY

The human world is centred. Man perceives that there is a centre in which he is located. This is a primary concept which man discovered in the earlier stages of his history by perceiving and representing the world as a system of similarities (4).

This concept is also very clearly present in religion. In the religious sense, the "centre" represents an ideal point which does not belong to the profane geometrical space, but only to sacred space; a point at which communication whith Heaven and Hell may be realised.

Like the concept of unity, the centre in religion is a fixed concept. When referring to the religious centre, Teymur said that:

"This is the paradoxical place where the different planes interact, the point at which the sensuous world, the created world can be transcended. But by transcending the universe, the created world, one also transcends time and achieves stasis: the eternal non-temporal present".

The concept of centre is also a basic principle in the design of the environment. Norberg-Schultz (5) has explained how man's space is centred externally when he said:

"In terms of spontaneous perception, man's space is subjectively centred. The development of schemata, however, does not mean that the notion of centre is established as a means of general organisation, but that certain centres are externalised as points of reference in the environment".

The externalisation of centres varies according to

cultural differences. To those who believe in cosmologies, the centre is explicitely expressed through geometrical concepts of space. In relation to this point, Tuan (6) stated that:

"*A term such as homeland is at the centre of an astronomically determined spatial system; a vertical axis linking Heaven to the Underworld passes through it; the stars are perceived more around one's abode and it is the focal point of a cosmic structure*".

In Islam, the "Kaaba" represents the centre of the world, the point at which it is connected to Heaven (7). As well as being the subjective centre, it is also the objective centre.

For other societies, the centre represents more an ideal goal which one can only attain after a hard journey. To reach the centre is to achieve a consecration or an initiation (8).

1-1-3 THE CONCEPT OF UTOPIA

Utopia is a concept which has existed in some form or another in all societies and at all times. It does not just refer to the well-publicised utopia in the modern history of architecture. Generally, it represents an ideal scheme of human perfection or of social organisation. It is an ideal goal out of the temporal present where it can

be seen but not achieved.

In architecture, in order to achieve an objective and progressive result, "utopia" takes on different meanings. It usually refers to either some futuristic cities or to a representation of an idyllic original past (9). In any event, the basic characteristic of utopia is that it is timeless.

Lewis Mumford (10) distinguishes between two types of utopia: a utopia of escape, seeking an immediate relief from the difficulties or frustrations of the present ; secondly, a utopia as a reconstruction providing a condition for our release in the future. He further believes that at the origin of the construction of a city, there has to be a utopian idea. Another writer, Doxiadis (11), interprets the utopia of escape and reformulates it in terms of the distance from the possibility of its realisation. Human reference to any of these utopias is dependent on stress and environmental load. As Doxiadis has stated:

"*The greater the distance, the more our utopia is an escape. The more it can be called utopia and the smaller the distance, the more it is a utopia, a place which can be built and achieved*".

In the practice of architecture, there are two types of utopian projects: those that are imaginable societies of

the future, to be desired or dreamt of or simply predicted; secondly, those that propose immediate practical action by founding new communities of an ideal character. The latter type has been used in many experiments, especially during the eighteenth and nineteenth centuries when impulses to migration and revulsion against urban industrialisation were at their peak (12).

Their motivation however varied greatly from socialist ideology, belief in co-operation, to escape from religious persecution or simply the hope for a new way of life, to settle the unemployed or to advance human happiness. In short, to bring goodness.

1-1-4 CONCLUSION

Original unity, sense of centrality, concept of utopia are just some of the basic aspects which are built out of the temporal present. There are, actually, numerous concepts which express this idea. Take, for example, the notion of "tradition" as an ideal which may either express some of the principles which help to direct us in our modern societies, or be only a way of avoiding complexities. Another example would be that of the "personal stability zone" (13) which refers to some principle central to the behaviour of every individual.

These concepts contain a certain number of ideas which could be summarized as follows:

1- There is, beneath the apparent diversity in the world, a hidden original unity.

2- Each element has its own essence from which it developed.

3- There exist some principles by means of which change is justified and measured.

4- There is a centre in human life in which man is located.

5- There exists an ideal world out of the temporal present.

The concepts used in architecture in different ways, e.g human orientation and cognition of space, a reason to contract an imaginative architecture or a mechanism for discourse. The concept for human is a psychological feeling which directs the complexity of life and is distinct from those in architecture.

Man needs to have a goal, to have a direction in life. A source, a centre or an ideal point are some basic concepts governing human intentions and orientation.

They become united in either a physical sense or they simply exist in the imagination. One culture may assume this by changing cyclically towards these principal points, whereas other cultures may achieve this by linear

means (14). All these points indicate the basis of time. Time is meaningful whenever the goal is realized.

NOTES

(1) Teymur N. (1982), p94.

(2) Nasr A. (1965).

(3) Ardallan N. (1973).

(4) Norberg-Shultz C. (1971).

(5) Norberg-Shultz C., op. cit.

(6) Tuan Y. (1979), p71.

(7) Ardallan N. (1973), op. cit.

(8) Tuan Y., op. cit., p179.

(9) Teymur N., op. cit., p98.

(10) Mumford L.

(11) Doxiadis (1966).

(12) "*The encyclopedia of architecture*"

(13) Toffeler E. (1970), p301.

(14) Ardallan N. (1975), p4.

1-2-0 TIME AND ENVIRONMENTAL CHANGE: INTRODUCTION

The concept which arises from change as experienced and observed can be best explained in terms of time.

Time is a vital dimension of all life. In the physical world, there are many forces, both internal and external, all of which we, as men, experience to a greater or lesser degree. There are distinct differences between these two main corresponding forces. Generally, our environment can be represented in terms of external forces ; for instance, the sun, the moon, the flux of gravity and planetary pressure are all signals that indicate the forces of external time. Man is aware of these objective aspects in nature such as the changing seasons and the regularity of tides and wave patterns.

Through his senses, man is also aware of another world which is closer to his experience which can be called the internal time; for instance, body temperature, brain activity, heart rate and breathing (1)., all have a rhythm which corresponds to the external rhythms of the universe (1). Time is also observed and estimated in our man-made environment in order to control information and co-ordinate activities. For example, in a city, many elements measure time: clocks, bells, timetables, traffic lights have all been adopted to improve our orientation through time (2).

All these observations demonstrate that man must have some concept of time that he can follow.

1-2-1 BASIC CONCEPT OF TIME

The internal and external nature of time is a discontinuous phenomenon even if man has repeatedly tried to represent it as continuous.

The subjective and objective concepts of time have always fascinated man and many conflicting theories about the relationship between the two have been offered.

Ancient philosophers sought to relate the concept of time to some corresponding objective reality. Descartes and Kant were among the first people to emphasize the subjective character of time. In the eighteenth century, Kant initiated an epistemological answer to the problems of time. He asserted that we do not appreciate time objectively as a physical thing but that we simply accept it as a pure form of sensible intuition (3).

Other philosophers of the eighteenth and nineteenth centuries sought to explain the notion of time as arising from association and memory, from successive perception. From about the middle of the nineteenth century, some psychologists empirically studied the relationship between time as perceived and time as measured in physics (4). The

main conclusion that came out of these studies was that men and animals are adapted to the sequence and duration of time.

1-2-2 PERCEPTION OF TIME

The human experience of change is a complex process. One primary element is that of a succession of events in a continuous way; but distinguishable events are separated by more or less lengthy intervals called durations.

So, sequence and duration are both fundamental aspects of what is perceived in change. Awareness of sequence and duration is not far from the definition of perception which, in turn, corresponds to his definition of "present time" (5).

In a mathematical sense, the present is only a point along the continuum of becoming, an instant where the future is transformed into past. From a different perspective, the psychological present is more prolonged. It is a brief period during which successive events seem to form a perceptual unity which can be apprehended without calling on memory.

A series of physically discrete stimuli that impinge too rapidly on a sensory structure will appear to be uninterrupted and indescribable. This depends on a critical range of frequency upon the senses. Awareness of

a unitary sequence ceases (for auditory and visual stimuli) when the interval between them increases to approximately two seconds. Between the upper and lower limits, there are optimal values which are most likely to produce perception of a sequence.

Duration, the interval between two successive events can be either full or empty according to the sensory stimulation that is applied. An empty interval is bonded by two perceptively discrete stimuli and it is full when there is continuous stimulation being delineated by an onset and cessation. To experience an empty duration is to perceive a sequence, while a full duration corresponds to the temporal length of a stimulus.

Human subjects need a minimum of about 0.1 second of visual experience or about 0.1 to 0.2 of auditory experience to perceive duration; any shorter experience would be called instantaneous. Direct unitary perception of duration occurs up to a maximum period of approximately 1.5 to 2 seconds from the beginning to the end of a continuous sensory stimulus.

When an interval lasts for more than a few seconds, it is no longer directly peceivable as a whole. However, the length and duration can be estimated on the basis of memory but this would not be precise or calculable as it would be in the physical world.

1-2-2-1 PAST, PRESENT AND FUTURE

We use time to give order to events mentally. This happens through identifying them as co-existing or successive. This is how Lynch (1972) explained it (6):

"Moments do not exist in themselves; they are classes of events in which there is no need to distinguish one event as occuring before the other".

It is the structure of our brain which allows us to learn, recall, foretell and create a social hypothesis of time.

The psychological present, as mentioned already, is an immediate ordering of perceived events very much like the visual spatial ordering of visual stimuli. It is a temporal relationship created between sensory events by grouping them together as "happening now", while also conceiving them as being successive or simultaneous, stable or changing, quick or slow.

As the "present" is the immediate perception of events, one can also say that the past is what we call memory. Its original function is to inform present action by experience. The sense of the past is built up out of the recollection of fragmentary sequences tied together by internal associations as well as out of playful and continuous fables and, finally, out of a sense of history

as causally connected and temporaly co-ordinated. There are two distinct types of memory: a short-term memory which stores current events and a long-term memory which is a more permanent organisation of selected patterned events which can be recovered without recalling all one's personal history in the sequence in which it happened (7). However the past can also be assumed as imaginative creations which refer to some selected events.

The sense of future arises out of a distinction between purpose, effect and result; it is the conceptual basis for action which seeks a delayed gratification. Future, like the past, contains imaginative creations which select only the desired events.

The concept of time can be best illustrated as in fig.1 where the present is what we perceive immediately without necessarily calling on memory or on expectation, while the notion of past is the experience of the flow of memory and the future corresponding to our expectations or desires.

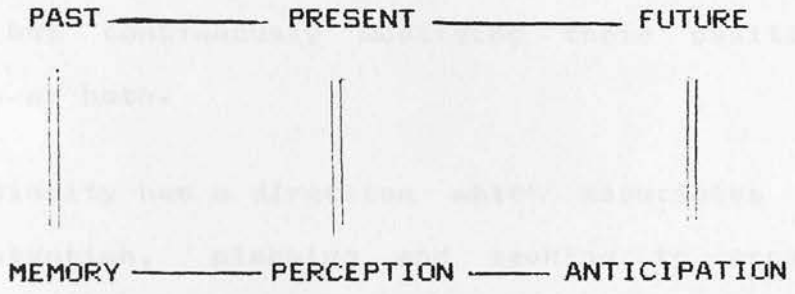


Fig2-1-1 Demonstrating that humans have a sense of the co-existence and interaction of past, present and future because memory, perception and desire exist as a unified field of forces.

1-2-3 DIRECTION OF TIME

In a recent book, "*The form of time*" (8), Jacquet was able to state that time is the continuity of the existence of things. It is this assumption of continuity which is necessary to describe events, process and change. This is to say that the definition of an event, process or change requires the conception of the same things continuing to exist, but continuously modifying their position or condition or both.

This continuity has a direction which associates itself with intention, planning and seeking to accomplish something. In other words, man's life is lived in intentionally directed and organised episodes or events.

The goal illustrates the direction of time. Jacquet also proposed that the sense which gives continuity to events is linked to human's unconscious world. This provides the background against which our conscious awareness of time stands out (discontinuous events). According to this concept, the root of time can be analysed in three definable stages: man's conscious stage; man's pre-conscious stage; and finally, man's unconscious stage (9).

a)- Time in man's conscious world: human conscious awareness of time is a focused point in time. As all focused perceptions, these points are bounded,

verbalizable and recordable material for objective scientific measurement and control. Through this focused world, movement and change in things are perceived; but this focused perception is organised into a static, discontinuous and atomistic world in which time phenomena aredominated by the spatialised notion of the discontinuous divisions on a clock. However, this is a discontinuous environment, but if we wanted to define continuity in this sense, then hypothetically we could assume an infinite number of beads are strung along a thread at an infinitely short distance from one another.

b)- Time in man's pre-conscious world: the pre-conscious experience gives the background and surroundings to our flitting consciously focused and verbalised precepts. It is the peripheral awareness in which we sense the "ongoingness" of things we perceive, as in motion, and by means of which we can formulate our sense of extension of events in terms of a continuous flux. This world is that which Freud formulated. As he put it:

"An idea may be in conscious focus one moment, then not in conscious focus the next one and it might be brought back into focus again; in the interval, the idea was we do not know what. We can say that it was latent, and by that we mean that it was capable of becoming conscious at any moment".

In this world, time, space and form are held together in a state of fused Being and Becoming. It gets also our direct experience of the space-time continuum and not of space and time as separate.

c)- Time in man's unconscious world: this is an unverbalised world. It would incorporate the psychological world of the continual flow of desires, passions, goals, intuition and will. It is the world of primary fused memory, perception, desire and intention, combined into what might be termed the "moving present", that is moving out of the past and into the future.

It is these unconscious phenomena which give us the notion of time as having a direction which expresses the goal-directedness of intentional behaviour. It is in this world that the direction of time is made up and that we see the discrete stimuli in a continuous way, i.e orientated towards goals.

1-2-4 THE TWO DIMENSIONS OF TIME

Jacquet's definition of direction of time leads to the conclusion that time has two dimensions: succession and intention. The temporal axis of intention is the idea of past, present and future, passage and direction, flux and change, duree and continuity.

The temporal axis of succession is the axis along which we

standardize our calendars and clocks, our ideas of earlier and later, before and after, temporal discontinuity and atomism. Constancy and permanence are always associated with this concept. They are expressions of our experience of a cross-sectional or spatial abstraction from events; expressions of our capacity to make mentally time stand still for a moment while we record (as in photography) the happening of that moment in time. We can then date this frozen moment on a calendar or clock as having occured on such and such a day, at such and such time (fig.2-1-2).

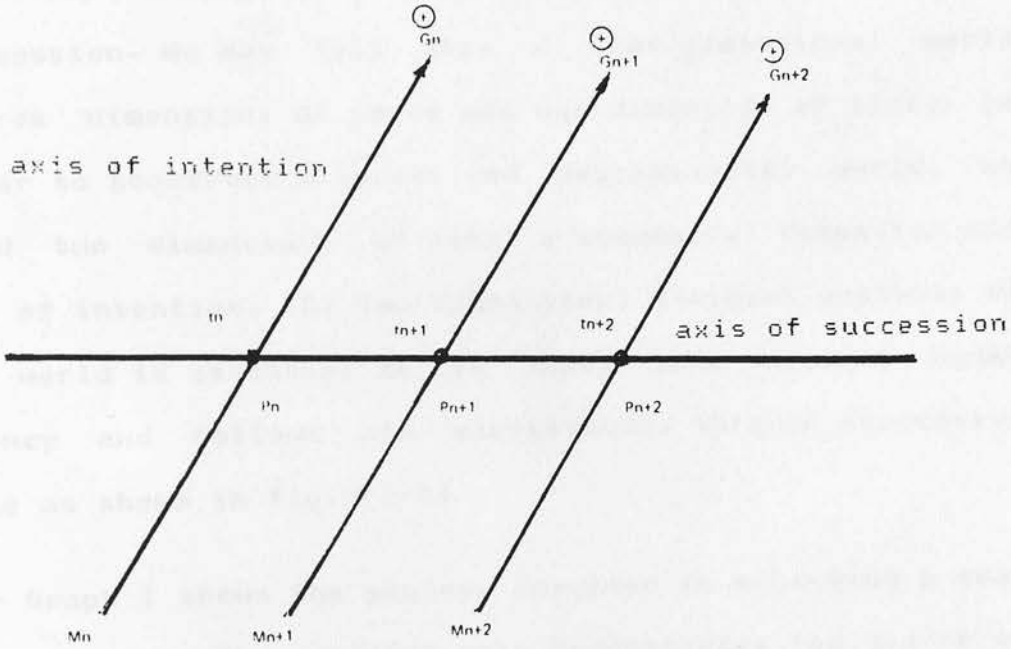


Fig (2-1-2): The two dimensions of time.

G: goal

P: perception

M: goal

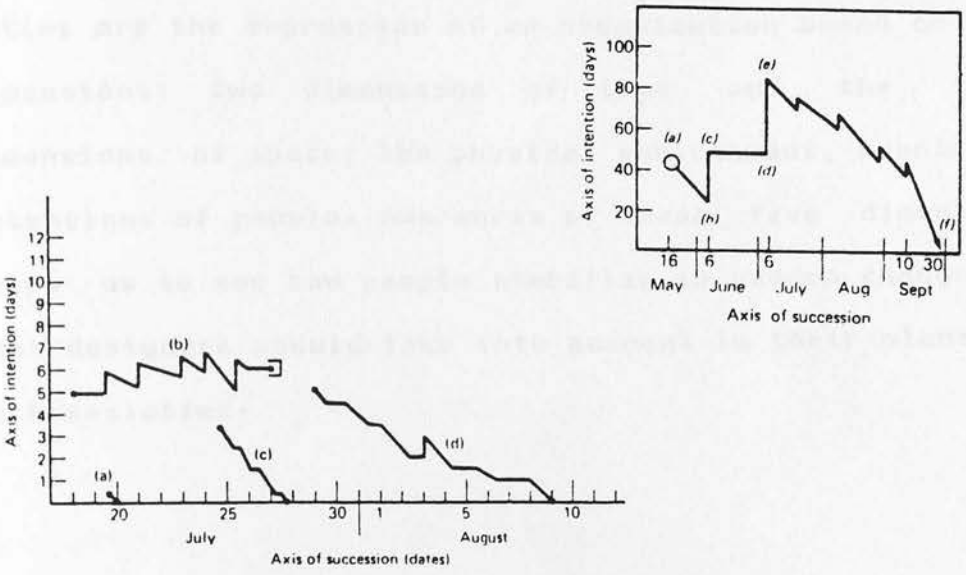
T: time (successive)

In the construction of the four dimensional world, even the physical world of the theory of relativity, we only need one dimension of time which is the dimension of succession. We may call this a four-dimensional world (three dimensions of space and one dimension of time). In order to construct a social and psychological world, we need two dimensions of time: a sequential dimension and one of intention. The two-dimensional temporal analysis of the world is essential as it takes into account human agency and follows its vicissitudes through successive time as shown in fig.2-1-3:

a)- Graph 1 shows the process involved in achieving a goal through time. The vertical axis demonstrates the degree of achievement of a goal in relation to the individual's anticipation (which is different from its achievement in reality)

b)- Graph 2 shows that a goal is not a static thing; it is a living and changing entity as are all social and psychological phenomena. The goal will disappear when a person achieves it or decided to abandon it.

c)- Graph 3 shows the complexity of the process of making, achieving and abandoning goals as well as that of re-orientation.



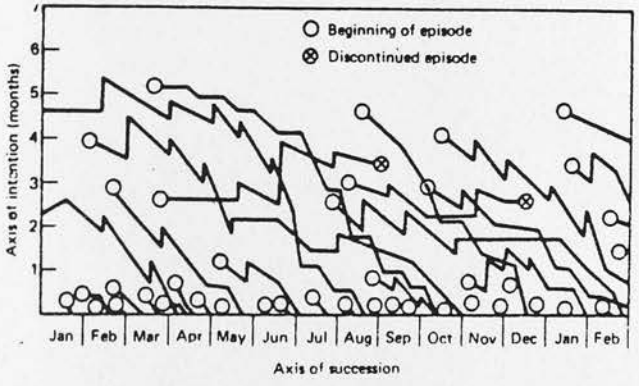


Fig (2-1-3): Process of achieving goals through time

Cities are the expression of an organisation based on five dimensions: two dimensions of time and the three dimensions of space; the physical environment, events and intentions of people. Awareness of these five dimensions helps us to see how people stabilize in sudden change and what designers should take into account in their plans for such societies.

NOTES

(1) Lynch K. (1972), p17.

(2) Ibid, op. cit., p65.

(3) El Azm S.J. (1967).

(4) for instance, the experimental studies done by Pavlov.

(5) Norman P.A. (1967), p118.

(6) Lynch K., op. cit., p90.

(7) Smith P.F. (1974), p26.

(8) Jacquet (1984), p115.

(9) According to Freud's theory.

1-3-0 ARCHITECTURE,TIME AND SPACE: INTRODUCTION

In the four-dimensional conception of architecture, the time dimension corresponds to the axis of succession. In this concept, time and space are regarded as being either separate or parts of a continuum. Generally, the four-dimensional framework of science satisfies just the conditions for understanding the material world: the motion of objects or locational statements of where and when something happened or is happening. This concept does not take into account in any sense the intentions of the persons involved in the occuring events. In other words, concepts such as thought, attitude, value and meaning, or expressions such as social interactions cannot be understood through length, breath, depth and sequential axis of time. Taking into account the social and psychological aspects, Jacquet (1) defines an event as lasting from TS1 to TS2 (TS being successive time), but the intentions of the participants have various directions at each moment Ti1, Ti2,Ti3... (Ti representing the intentional time) while the whole event may be located at various spatial dimensions (X1,Y1,Z1; X2,Y2,Z2;...).

Although such an expression takes into account the human aspect in the concept of reality, in modern art and architecture it seems that, by the acceptance of simultaneous time-space theory which is a way of producing dynamic forms, one could contribute to an intentional

dimension of time as well.

1-3-1 DEVELOPMENT OF THE CONCEPT OF TIME AND SPACE

Traditionally, time and space have been considered separately from one another. This is recognised by architects through the production of fixed and symmetrical urban forms and in the inability to express the human will and needs through this kind of spatial organisation (2).

Space has first been seen historically (as containing time) in Greek orthographic maps and then, in the landscape paintings of fifteenth century Europe. In the former, the map represents God's view since its sightlines are parallel and extend to infinity. The latter comes much closer to the human way of looking at the world by illustrating how events take place in time (3). Organising objects around a focal point in landscape pictures presupposes a major re-ordering of time as well as of space. From the Renaissance onwards, time in Europe was steadily losing its repetitious and cyclical character and becoming more and more directional. Space and time have gained subjectivity by being orientated towards man (4).

From the beginning of the twentieth century, a new concept of time and space emerged. Through this new concept, it was believed that art and science could become fused. According to Giedion (5), it was Minkowsky, a great

mathematician, who first conceived of the world in its four dimensions, with space and time coming together to form an indivisible continuum. This opened up the modern concept of art and architecture. In it, objects are looked at from several points of view, movement is introduced to urban form and what is more, emotion becomes a working concept in art and architecture. In city planning, this revolution led to the assumption that planners could provide a relationship between the desired goals of man and reality, between wishes and facts (6).

To summarize, one may assume three major orientations of time and space through history. The static serism, the dynamic field of force and the world of relativity (7). Each of these orientations uses the same three dimensions of space and the same successive dimension of time. The difference is the relation that space makes with time. Designers claim that the time-space relation could contribute to the intentional dimension of time as well (the relationship between the physical environment and human aspects was discussed in part II). How architects see this process can be seen through the historical development of urban forms.

1-3-2 TIME IN TRADITIONAL CITIES

In traditional cities, common religious beliefs offered direction to human life and justified the changes. The

urban environment was organised in a fixed way, therefore unable to express the direction. Historically, the cyclical and repetitive forms of cities could be followed to a linear and dynamic one which may be responsive to the intentional dimension of time.

Tuan (8) has an overall understanding of cosmic time in traditional cities. He recognises three forms of time: astronomic time, cosmogonic time and human time. Astronomic time is cyclical and repetitive change which is best represented by symmetrical spatial dimensions. Cosmogonic and human time are directional and could not be easily expressed in physical form. Human time represents the course of human life and it is always directional: beginning at birth and ending with death. Tuan also believes that life is lived in the future which may be as close as the next daily activities:

"Human time is assymetrical; one's back is the past and one's face is to the future. Living is a perceptual stepping forward into light and abandoning what is behind. One's back cannot be seen; it is dark and represents one's past"

Tuan believes that human time might have affected the physical orientation in some places but it has not been externalized as easily as astronomic time.

Cosmogonic time is the story of origins, including the

creation of the universe. This kind of time does not take place in cosmic space. This is because cosmic time is the arrangement of space around a coordinate system of cardinal points, therefore fixed and static.

1-3-2-1 THE DEVELOPMENT OF URBAN FORM

Initially, the reason why cities became directional could be seen as an attempt to externalize the beliefs in the direction of life. Examples of this directional organisation can be seen in Sumerian, Egyptian and Islamic cities.

a)- Sumerian city design was an attempt to make the invisible gods dwell in the temples on top of the ziggurats or "world mountains" as they were called; the settlements then grew around this centre. The ziggurat was the source of spiritual, social and economic order. Each citizen's house was at an equidistance from this source and all were equally close within the protection of this sacred enclosure. Through this kind of organisation, Sumerians achieved equal spiritual and physical security in times of unexpected events. Moholo-Nagy (9) described the Sumerian city design as creating a microcosm on a par with the galaxies and the ziggurat as a point dead in the centre of earth and sky. Communications, both spiritual and physical, were single-directed, from the house to the sacred precinct, from the city to the open land and from

man to the god (10). Dynamic energy was generated by opposing forces of good and evil, personified in the gods and quarrels.

b)- For ancient Egyptians, the Pharaoh, the chief-executive, represented God-as-Man; and this representation affected in turn the design of Egyptian cities. The principal line of extra-terrestrial communication was the processional path of the Man-God, oriented towards the north star (11). These ceremonial causeways were astronomical radius vectors joining the sun to the earth which represented the centre of the universe. Movement-oriented environments, as introduced by the Egyptians, show the events as happening in time. Time for the Egyptians was therefore not cyclical as for the Sumerians, but was rather linear and directional.

c)- Traditional Islamic cities consisted basically of a hierarchical organisation of the different elements along a pattern of movement system. The main axis of the city, the "Bazaar", represented the social, political, economic and spiritual centre of the city. This axis was in turn branched onto different residential units. In mythic Islam, time is seen as having two axes: one directional, starting from the Creation and vertically ascending to timeless world; the other being horizontal and repetitive, showing the creation in the physical world. The physical environment creates every moment repetitively so as to

become closer to the spiritual source (12). Ardalan (13) saw the traditional Islamic cities as the expression of this concept of time. The symmetrical architectural elements repeated throughout the city along linear patterns of streets. This kind of organisation of the city is assumed to show re-creation in the physical world in each moment towards a timeless world. Therefore, the city pattern is a continuous flow of harmonious spatial experience based on numbers and geometry.

1-3-3 RELATIONSHIP BETWEEN THE TWO DIMENSIONS OF TIME

The goal orientation process may be internal to an individual, but it must be externalized before it can be considered by architects. In other words, designers could not deal with unconscious and unavailable factors. Karl Popper (14) believes that the objectivity of a goal depends on its degree of social agreement between two or more people. Therefore the most objective types of social data are those which are legally defined either by legislation or by a contract. In this sense, each society may have different goals which can be taken into account in the design of cities.

As explained above, in traditional societies, the belief in metaphysical goals and the direction towards a timeless world is the most common agreement between people. This can hardly be expressed in the physical environment. As

societies become more flexible, the goal orientation adapts itself and the time extends. To carry out the events, a society needs to recall particular sections of time. The extension of time help societies to stabilize themselves on the basis of what they experience and wish. This is a dynamic process of achieving stability through time. A physical environment in harmony with people's life could clarify and express the concept of past and future that each society holds at different times. This is an objective direction as it is shared by a group and physically expressed as a spatial dimension capable of symbolizing history.

1-3-3-1 RELATIONSHIP BETWEEN PAST AND FUTURE

The direction of time arises from the concept of past, present and future when they interrelate according to events. Past and future are present concepts , viewed from this moment in time and possibly not so distant from one another. They have equal reality and a parallel structure in mind. The differences come from the data that they imply. the past is built up from a multitude of experiences, continually brought to mind by institutions, by the material environment and by written records. the concept of future feeds from the inner stuff. It is objectively less certain and subjectively less rigid and rich (15).

The organisation of data of the past and future has a major effect on the two. Lynch has explained that where past experience has been stable and orderly, giving rise to progressive change and predictable results, a concept of the future of greater range and realism is encouraged. When the past has been chaotic or frozen, the individual will contract and disconnect his image of future time. In reverse, where the future seems inscrutable or dull, the past will also look inexplicable or empty.

The present condition also affects the concepts of past and future. For example, stressful events in the present can inhibit the creation of a mental image of the future. In the same way, a preoccupation with the future or an unhealthy emphasis on the past may lead us to fail to experience fully the present.

We can refer to the past or future as our power of remembering , prediction and control let us. There is no optimum to these points; they change as outward circumstances change and as the individual's power to make intellectual or emotional connections develops.

An emphasis on the past or future, how deeply we examine them and the aspects of them that we choose to examine are related to the speed and relevance of present events. Using the appropriate concept of them could provide enough stability and dynamism to control changes.

1-3-4 SUDDEN CHANGE AND ROLE OF TIME

The need for social and psychological stability is crucial in situations of sudden change. In order to reach such a stability, one may attach oneself to timeless phenomena; but these may be subjective and out of the physical reality. As changes in societies and in the environment are inevitable, there is therefore a great need for a dynamic process of achieving stability. Those aspects of changeability which may contribute to stability are found to be in the direction of time itself; the continuity between the three tenses of time is a goal orientation process. In other words, stability is achieved through the selection of those elements of past and future which interrelate to present events. This process can be seen in situations of social revolution, migrations or reconstructions after a disaster. They represent different episodes with different goals, all trying to use and emphasize different elements of the past and future.

Revolution has always a strong goal. To change the direction of the existing situation, the connection between society and its near past experience is broken, the goal is emphasized and some concept of the deeper past which strengthens the goal is revived. In this way, society reaches the stability which enables it to overcome the transitory period. The cities which saw revolutions

become the symbols of this process (16). The buildings and elements relating to the near past are destroyed whereas those which are seen to symbolize the new direction are conserved; moreover, new symbolic elements of the promised future are added.

In migratory situations, the future would come out of the immediate new surroundings. In order to cope with the present situations, migrants dispose of some aspects of the past and encourage a hopeful beginning. This aspect covers the physical elements of the city as well. Lynch (17) has shown how the migrants to new towns welcome any physical changes that would accelerate the realisation of their goals.

Transition from traditional life to modern life which requires a rapid pace of change results in some social and psychological problems, as well as problems with the control of the different policies (refer to chapter 1). Here it can be assumed to represent a migration in time, requiring the same kind of stability as those migrating to a new environment.

The first reaction to a disaster is also to make every one's hopes and expectations as clear and secure as possible. Symbolic acts of confidence and orientation are crucial in the early days of reconstruction. (18). In some cases, the drive to return to the previous situation may

be so strong that no modifications in the old patterns can be achieved. In this sense, rebuilding becomes a kind of historical reconstruction; the re-creation of the same meanings and images.

There are some situations in which changes are not desired, as a rapid development out of the individual's capacities, a disaster or unwanted migration. In these cases, the past and future become ways of escaping from the present conditions. To refer to either past or future is dependent upon the events happening in the present. The victims of a disaster may not desire to go back to the place where calamity fell upon them (19), or in a rapid development situation, one may remain attached to the traditional norms in order to escape from the complexities of modern life. Finally, in some cases, this may lead to the construction of an imaginary future as utopians do.

Accepting the changes and trying to create stable conditions in order to control these changes depend on which aspect of time is presented in relation to events. The physical aspects of cities along with the events happening in them are the expression of time. A place may be familiar and full of significance; another may seem complex, novel and symbolising the future. The designer can conserve, provide facilities for celebration and enclave these images.

1-3-5 CREATING THE IMAGE OF TIME

Time can be presented through different ways. The environment is, as already mentioned, only a way to be aware of time. Conservation and preservation are well-established policies for looking after our historical heritage; also through these principles, we establish a way of imaging the different stages of time. Conservation and preservation are especially effective in creating an image of continuity and in extending time. We can also extend the boundaries of time by exploring deep into the the past and future as done by archaeologists or by organisations searching for new possibilities for the future (20). It is in this way that we open the range of time and develop our knowledge. Time can also be frozen and celebrated in order to relieve from psychological stress occasioned by sudden change.

a)- The time enclaving: as a response to the future shock of a super-industrialized society, Toffeler (21) proposed the enclaving of time which can then be modified and applied again to similar situations. He suggested the freezing of time at a point in past and future. People who are trying to escape from the pressure of overstimulation could be accomodated in communities where novelty and choice are deliberately restricted. Those slow-paced communities would be accessible to individuals who need or want a more relaxed, less stimulating

existence. These communities would deliberately be encapsulated and selectively cut off from the rest of the environment.

By the same token, just as there are people who require to live at the slower pace of the past, it should also be possible to allow people to experience aspects of their future, thus creating enclaves of the future as well.

Although Toffeler's proposals seem far from today's problems, Lynch's proposal is a more logical one (22). He suggested keeping some parts of the cities untouched during rapid change, not allowing them to be affected by these changes while, at the same, he suggested that some aspects of the future could be introduced in places such as museums.

b)- The celebration of time: In stagnant societies, there is, perhaps, a need for novelty and stimulation. In an accelerative society, the need may be that of the prescription of certain continuities. In the past, rituals provided an important buffer against change (23). They helped the individual to re-establish equilibrium after some major adaptive event has taken place.

Repetitive behaviour, whatever its other functions might be, helps to give meaning to non-repetitive events. The city can be designed to allow for the celebration of rituals and repetitive events. Physical elements can not

only accomodate these events but also dramatise them.

CONCLUSION

Sudden change breaks continuity. Continuity is an inner psychological characteristic; it is a direction which men give to discrete elements. As understood in this thesis, this direction is a temporal one; it is different from time as an artificial division in the physical world. This direction arises when there is a goal; it is the idea of past, present and future as they relate to events. The physical environment as an expression of this direction could contribute to the maintenance of stability in changing situations.

Human reference to past and future is always dependent of the circumstances of the present; as we change, our concepts of past and future also change. Through this changing process, man has a sense of continuity; this continuity is different from a physical continuity as transformation of similar elements. Continuity of urban form is achieved at every moment without necessarily being similar to past or future stage.

NOTES

(1) Jacquet (1984)

(2) Minai A. (1977), p35.

(3) Tuan Y.F. (1979), p179.

(4) Ibid, op. cit., p71.

(5) Giedion S., "*Time, space and architecture*"

(6) Ibid, op. cit.

(7) Jacquet (1984), op. cit.

(8) Tuan, op. cit.

(9) Moholo-Nagy, "*The matrix of man*"

(10) Ibid, op. cit.

(11) Ibid, op. cit.

(12) Ardalan N. (1975), p4.

(13) Ardalan N. (1976), p165.

(14) Jacquet, op. cit.

(15) Lynch K., "*What time is this place*"

(16) See part I

(17) Lynch K., op. cit.

(18) Ibid, op. cit.

(19) Kates R.W. (19), p145.

(20) Lynch K., op. cit

(21) Toffeler A. (1970), p318.

(22) Lynch K., op. cit.

(23) Toffeler A. (1970), p317.

PART TWO

MODEL FOR DISCONTINUOUS CHANGE

2-0 MODEL FOR DISCONTINUOUS CHANGE: INTRODUCTION

Cities change, not just in a continuous way but also in a discontinuous way. A city which is changing in a smooth fashion may, as a result of the intervention of some factors, suddenly decay or flourish. The history of urban forms shows how different forms have succeeded old patterns.

Architects and planners have always been involved in the construction of models of change in urban forms. However, their attempts were always restricted to building up models which describe smooth change. Sudden transformations have always been regarded as exceptional cases in those models. The city as an interrelated system analogous to the systems which demonstrate the survival of living organisms is a familiar example of continuous change.

The model of urban form should be the representation of a system with dissimilar elements, able to account for both

evolutionary and revolutionary changes. It is only through this model that one can describe the variation of form in time and space.

2-1-1 SCIENCE AND DISCONTINUITY

Discontinuities exist in time and space. They do not represent problems only for designers, but are also common among all branches of science.

Science has always been involved in explaining events. Traditionally, the model of change was constructed on the assumption of the existence of a kind of continuity between different entities. As through this way a logical explanation made by changing events, it was hard to deal with discontinuous transformations. The development of science can be interpreted as the constant attempt to find a rational explanation for discontinuity and dissimilarity.

The first attempt of science was against the dual concept that magical thought used in its explanation of reality. Science at that stage provided a single logic of explanation which was the law of nature (1). Newton's cosmological theories dominated this concept of science. According to these theories, change does not occur unless the determining factors themselves change. Therefore, in those models, there is a one-way flow of influence from the "cause" to the "effect". In this way the condition of the cause or the effect can be deduced from each other.

The weakness of this cause and effect model in providing satisfactory explanations for discontinuous events caused

the appearance of quantum theory, relativity and entropy in physics in company with different models in other disciplines. This new concept of science regarded change from a probabilistic perspective. The condition of the cause or the effect are predictable from each other only in terms of probability and not of certainty.

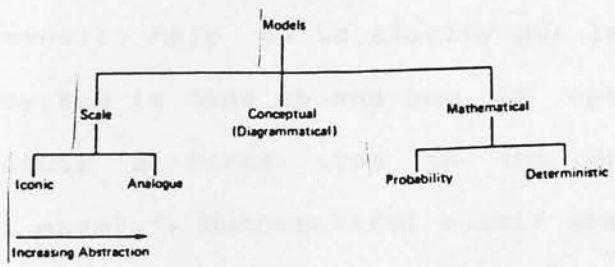
The twentieth century development of "system theory" represented an important phase in the history of scientific research. Many attempts have been made to formulize heterogeneity and diversity (2). Recently, the rapid development in mathematics resulted in the appearance of another theory which is said to provide a mathematical formulization of discontinuity (this new concept will be explained throughout this part).

2-1-2 SYSTEMS AND MODELS

In its simplest sense, a model is "a representation of reality". Usually, it is a representation of a system which is an intellectual construct of that reality. The model is arrived at through a process of abstracting from reality those aspects with which one is concerned. As Ferguson said (3):

"There is no true process to be emulated; even if one could somehow comprehend the totality of the situation, the resulting model would be so complex as to render it useless".

Therefore, a model is built in order to solve problems, to understand or to control some aspects of reality. One may build models for the purpose of communication or for projecting and controlling the behaviour of a system. In any case, the process of abstraction is complex and difficult. According to Thomas (4), the design and construction of a model can proceed with varying degrees of abstraction.



Some types of models

The simplest level of abstraction occurs when we transform reality only in terms of scale. The "scale model" differs from the real object only in size. The architect's models of buildings constitute a good example of such a model. A miniature copy of reality may, however, be called an "iconic" model. A more abstract refinement of the iconic model is the "analogue model". In this case, not only the size of the system is altered, but some of its properties are also transformed. Architectural drawings are the most familiar examples of such analogue system; they are not only reduced in size but are also representations in symbolic forms.

Essentially, scale models help us to isolate the main components of a system of interest and to organize our initial thoughts and ideas. However, in order to understand progress, a further abstraction is necesary, one which might well involve the use of a "conceptual model". This represents the idea about how the system functions; in other words, it concentrates on the relationships between the system's components. Since conceptual models help us to clarify our loose thoughts about how a system is made up and how it operates, they often constitute a first step in the construction of "mathematical models". Mathematical models are constructed by translating the ideas contained in a conceptual model into the formal and symbolic logic of mathematics. These

could be either probabilistic models or deterministic ones.

Classical mathematical models are mainly quantitative. But because of their simplicity and precision, they were unable to represent adequately the behaviour of social and psychological systems. However, recent advances in mathematical science have led to the development of models which are both quantitative and qualitative and which could represent a step further towards the understanding and description of social systems and discontinuous transformation.

2-1-2-1 SYSTEMS

The concept of systems has emerged in the present century and has played a role of central importance in the thinking and approach of many scientists and technologists. Architects and planners have also become very interested in system analysis as a way of rationalizing and improving the design process and planning decisions.

In the explanation of urban forms and their transformations, the idea of systems has often been used in an ambiguous way in words such as function, organic, organismic, holism and so forth (5).

A system, as commonly defined, is a set of interrelated elements. According to Ackoff (6):

"A system is an entity which is composed of at least two elements and of a relationship that holds between each of its elements and at least one other element in the set. Each of a system's elements is connected to every other element, directly or indirectly. Furthermore, no subset of elements remains unrelated to any other subset".

In the application of a system, two concepts of system can be found: a hard or closed system and a soft or open system. A hard system can be roughly defined as system engineering where the chief concern is with a physical

system and the significant variables of which are normally quantifiable. One of the applications of such systems can be found in "Design methods" by C. Jones (7) in which he uses the system as an input, output of a black box; nothing is known about what happens inside this box except the number of elements in interaction. Here, the system is thought of as a transformational device.

The soft or open system has been developed in social and behavioural sciences where the definition of the system and of the relationships that exist within it are not as easily arrived at as in the case of physical systems and design analysis. Consequently, the definition of a system in these areas is less clear. It may either be a real system (i.e. physical) or simply a conceptual system. It can also represent a city, that is, a socio-physical entity composed of many elements in interaction. This kind of system is usually couched in probabilistic terms rather than in deterministic ones.

There are two essential aspects in all those definitions of the various kinds of systems: firstly, rationality as the attempt to deal with the problems that exist in reality, and secondly "holism" as the way in which reality is perceived (8).

Rationality has been seen as a process of problem-solving (9). It is based upon deductive scientific methods of

analysis. It involves essentially:

1)- The observation of phenomena

2)- The development of a hypothetical explanation of what one has observed

3)- Experimentation in order to test the hypothesis

4)- The development of a theory

5)- The management of the environment through the use of the theory developed.

Holism refers to the perception of the relatedness of things in approaching reality or any problem. One abstracts from reality and forms an image of the interdependence which exists between the various elements of the system under examination.

If one can conceptualize a useful network of these interdependencies, one can be said to have in fact defined a system. Thus, the system analyst views things comprehensively in an attempt to perceive all the elements and relationships which might exist in a problem situation; what he perceives is a "whole", a "system".

This holistic approach has been apprehended differently in the various disciplines which attempted to make use of it. In physics, it represented a group of bodies moving in space in relation to one another and according to some particular dynamic laws as, for instance, the law of gravitation. This represents the scientific view of holism

as a group, set, or aggregate of natural or artificial things, forming a complex or connected whole.

The biological concept of system refers to a set of organs or parts of a biological entity with the same or similar structure, or subserving the function; the biological entity is seen in this case as an organised whole; the organism in relation to its vital processes or functions (10).

The holistic concept of biological systems has been largely reflected in the general intellectual climate of our time. Architects, particularly, have been prominent users of the natural or biological analogy in their explanations about architectural processes. The obvious example is the recurring and common place use, until recently, of the word "organic" to describe formal architectural structures.

NOTES

1) J. Bronosky (1978).

(2) M. Marugama (1973), p26.

(3) F. Ferguson (1975),

(4) Thomas, for example.

(5) F. Ferguson, op. cit., p3.

(6) R.L. Ackoff (1972), published in "*System behaviour*", edited by J. Beishoo

7) C. Jones explained it in his book, "*Design methods*"

8) F. Ferguson, op. cit, p4.

9) Ibid, op. cit, p9.

10) According to the Oxford Dictionary

2-2-0 THE BIOLOGICAL MODEL AND ARCHITECTURE

Distinguishing between an "organic" entity and a "systemic" one is a difficult task. Organic and systemic concepts are usually assumed to be identical, the distinction being only one of scope (1). The organic idea focuses on a particular type of system, i.e. a living one, whereas the systemic idea is larger in scope, being concerned with living as well as non-living systems, conceptual as well as real systems. Therefore, the general characteristics of a "system" can be applied in the study of an organic entity. In the particular case of the biological system, Bertalanffy (2) identified two principal factors: steady state and homeostasis.

The biological systems maintain themselves in a continuous exchange of matter with the environment. The living cell or organism is not a static pattern or a machine-like structure, consisting of a more or less permanent "building material" in which "energy-yielding materials" from nutrition are broken down to provide the energy requirements necessary to sustain the life process. It is a continuous process in which both so-called building material and energy-yielding substances are broken down and regenerated. But this continuous decay and synthesis are regulated in such a way that the cell or the organism are maintained approximately constant in a so-called steady state.

Homeostasis, as generally understood, represents a circular process where part of the output is monitored back, as information on the preliminary outcome of the response, into the input (fig.2-2-1), thus making the system self-regulating; be it the sense of maintenance of certain variables or the steering towards a distinct goal.

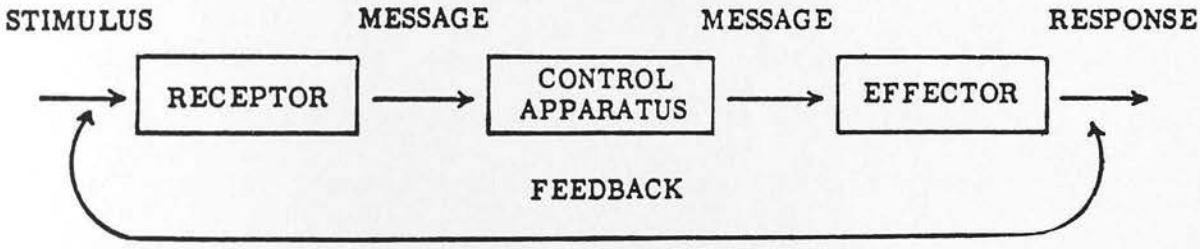


Fig.2-2-1 Simple feedback model

Architects and urban planners use this natural or biological analogy for different purposes. The idea of interrelatedness and balance of the whole is applied to the visual and functional unity of urban forms. The growing process of living organisms is also widely compared to the evolution of cities and design in time.

Furthermore, the system of classification of the different species in biology is adopted by designers in their interpretation of the origin and growth of cities as well as their variations.

2-2-1 BIOLOGICAL TRANSFORMATION

Biology is mainly concerned with the study of forms in nature, its origin and growth. The description of living things, the anatomising of them into separate and discrete organs and the comparison of related types led to the development of the theory of evolution (3).

There are two main concepts underlying the theory of evolution: firstly, it simply asserts the principle of a gradual and continuous development of form, an unbroken trajectory through time, rather than the sudden and discontinuous creation of new forms. This principle has already been applied to the study of human artefacts, to the forms of human societies and to the development of cities.

The second fundamental Darwinian principle offers an explanation for the affinity between two similar species by tracing back through the evolutionary tree to reach their common ancestor. While the first principle relates to the gradual change, the second principle does not regard any divergence. It implies that the forms most close to each other in appearance (that is morphologically, or in other words in terms of phenotype) are the closest in terms of descent or phynogenetically (fig.2-2-2).

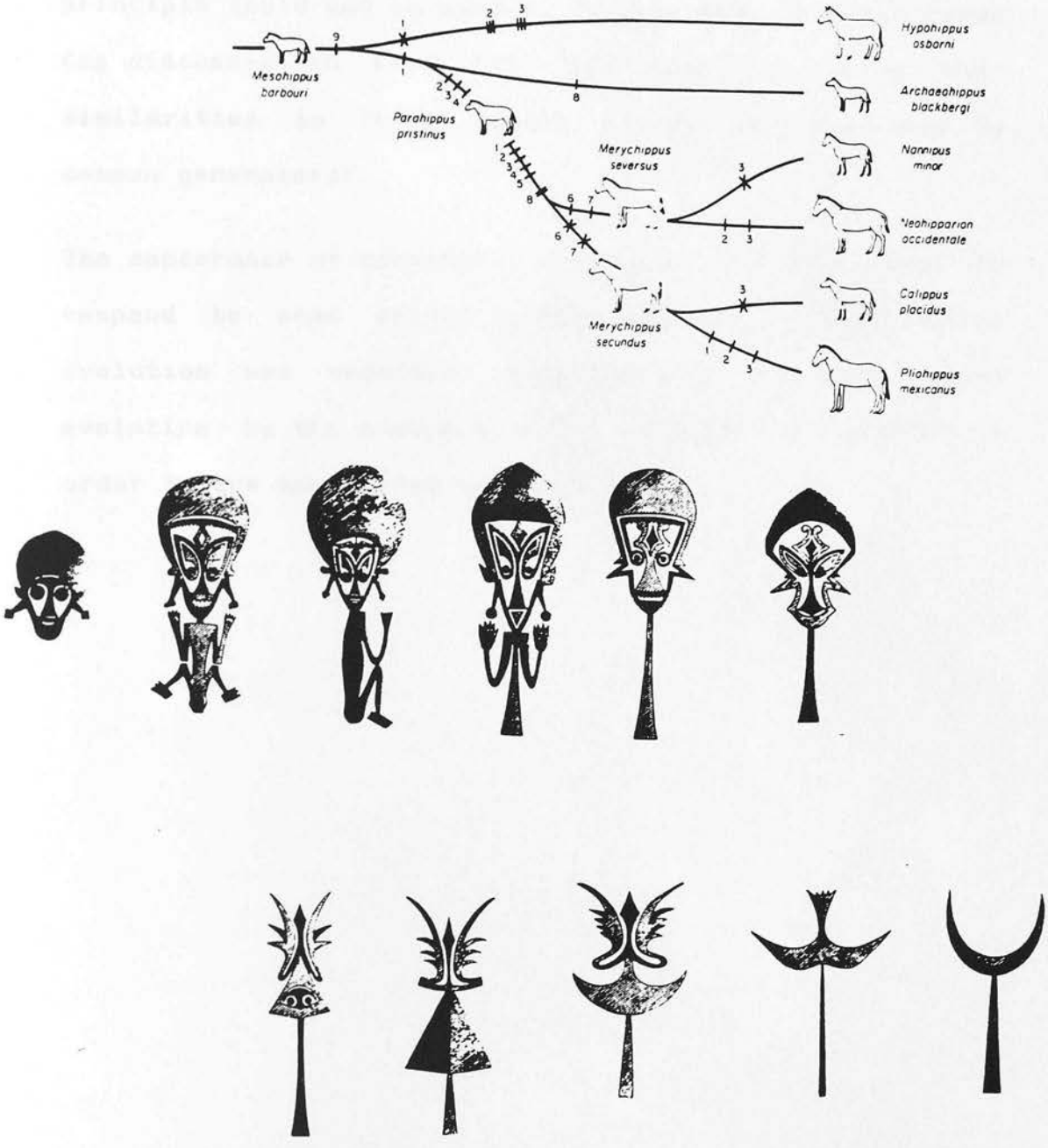


Fig.2-2-2: Evolutionary sequence for fossil horses and its similarity to evolutionary sequences for Melanesian paddles.

There are a few serious reasons why this second Darwinian principle could not be applied to the study of urban forms (as discussed in Part II), the main one being that similarities in forms cannot always be traced back to common generators.

The appearance of convergent evolution (4) was able to respond to some extent to this weakness. In this sense, evolution was regarded independently through local evolution by the analysis of the pathways of evolution in order to see how divergences occur.

2-2-1-2 COMPARATIVE TRANSFORMATION

This method for the study of forms in biology is particularly popular among those designers who hold a simplistic conception of "organic" design. The aim of this method is to seek to observe affinities between different aspects of forms through comparison. This may be a dynamic comparison, that is one which follows the development of a particular form through time and comparing its trajectory to other forms; It may also be a static comparison, that is the comparison of structures at fixed points in time in order to see which elements may be in variant to transformation. The latter aspect is important to biology and has widely affected other disciplines, including architecture.

Initially, it was D'Arcy Thompson (5) who demonstrated the manner in which certain forms in nature could, with suitable topological transformations, be made equivalent. The transformation of a human skull into a chimpanzee's (fig.2-2-3), or that of a fish of genus *Scorpeania* into one of the genus *Antigonia* (fig.2-2-4) are but two examples of this principle of topological similitude. D'Arcy's analogy does not just apply to the apparent form of a group of species but can also be used as an analogy to the form and structure of artefacts. Through his analysis of skeletal forms in terms of cantilevers (fig.2-2-5) he was able to show

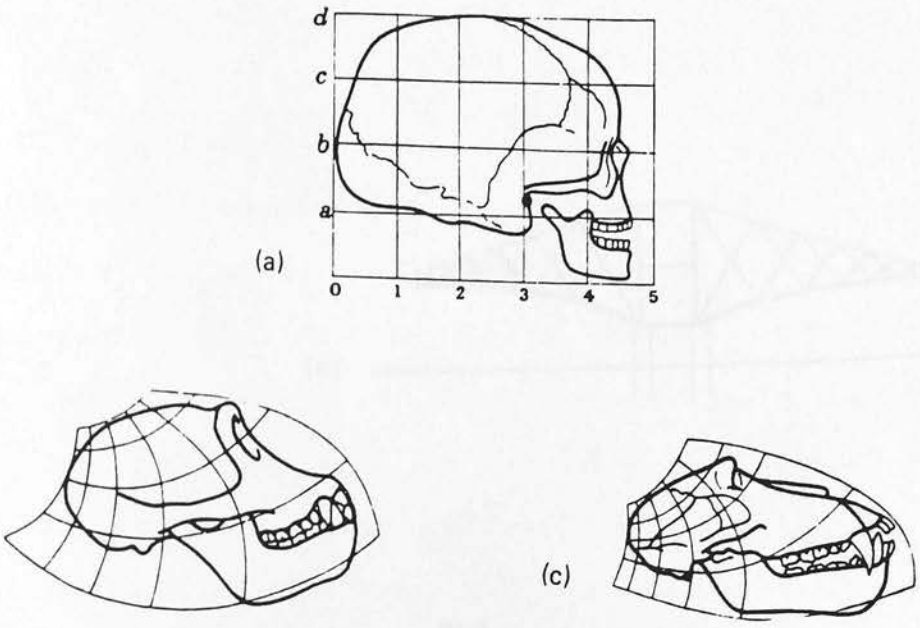


Fig.2-2-3: Transformation of a human skull to that of a chimpanzee.

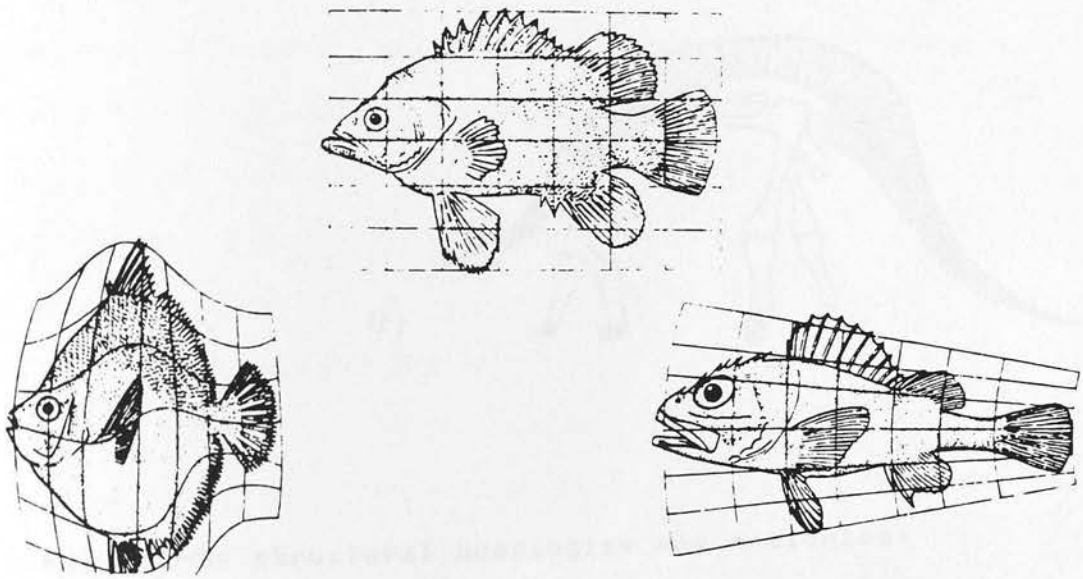


Fig.2-2-4: Continuous transformation of form: fish of the genus *Polyprion* transformed into *Scorpaena* and *Antigona* by a projection of coordinates.

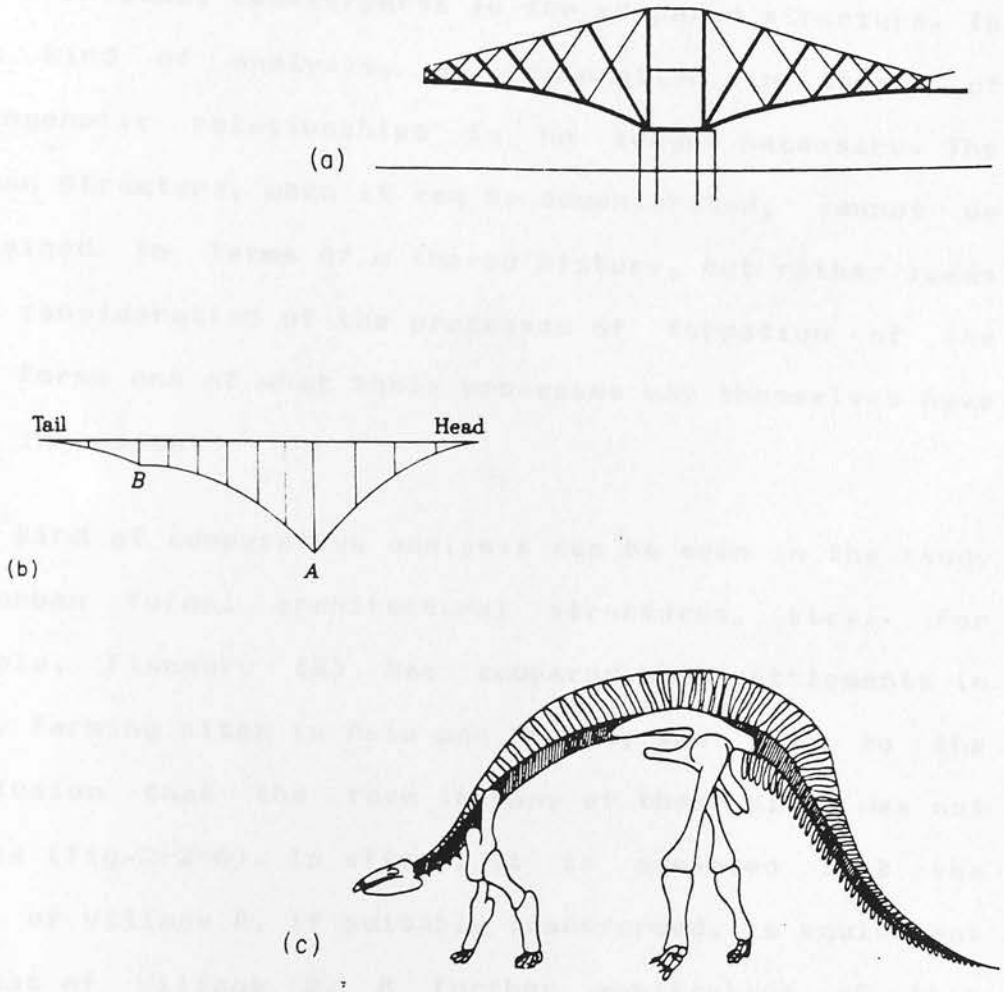


Fig.2-2-5: structural homologies and analogies:

a)- Two-armed cantilever of the Forth Bridge. Thick lines, compression members (bones); thin lines, tension members (ligaments)

b)- Stress diagram of the prehistoric reptile *Titanotherium*

c)- Diagram of *Stegosaurus*.

that the elements of one structure have analogous, albeit not identical, counterparts in the compared structure. In this kind of analysis, an explanation in terms of phylogenetic relationships is no longer necessary. The common structure, when it can be demonstrated, cannot be explained in terms of a shared history, but rather leads to a consideration of the processes of formation of the two forms and of what these processes may themselves have held in common.

This kind of comparative analysis can be seen in the study of urban forms, architectural structures, etc... For example, Flannery (6) has compared some settlements in early farming sites in Asia and Africa, and came to the conclusion that the form in many of these sites was not unlike (fig.2-2-6). In effect, it is asserted that the plan of Village A, if suitably transformed, is equivalent to that of Village B. A further application of this comparative method can be seen in the analysis by Bintliff (7) of the plan of three cities from different places and time (fig.2-2-7).

However, the concept of transformation has very wide applications in the well developed field of topology in mathematics (fig.2-2-8).

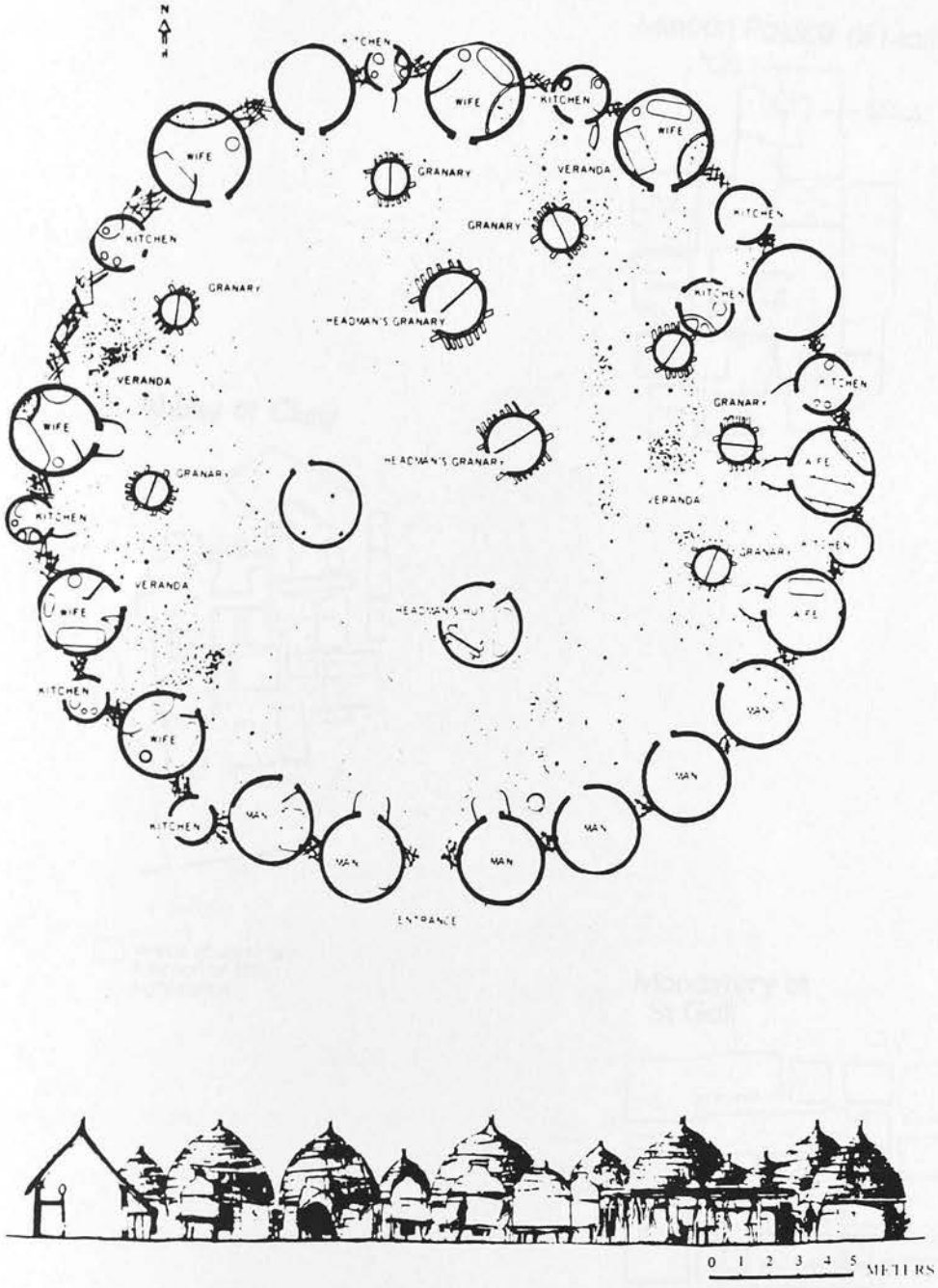


Fig.2-2-6 A circular village of round huts: a wide-spread form with elements invariant to transformations of time and space.

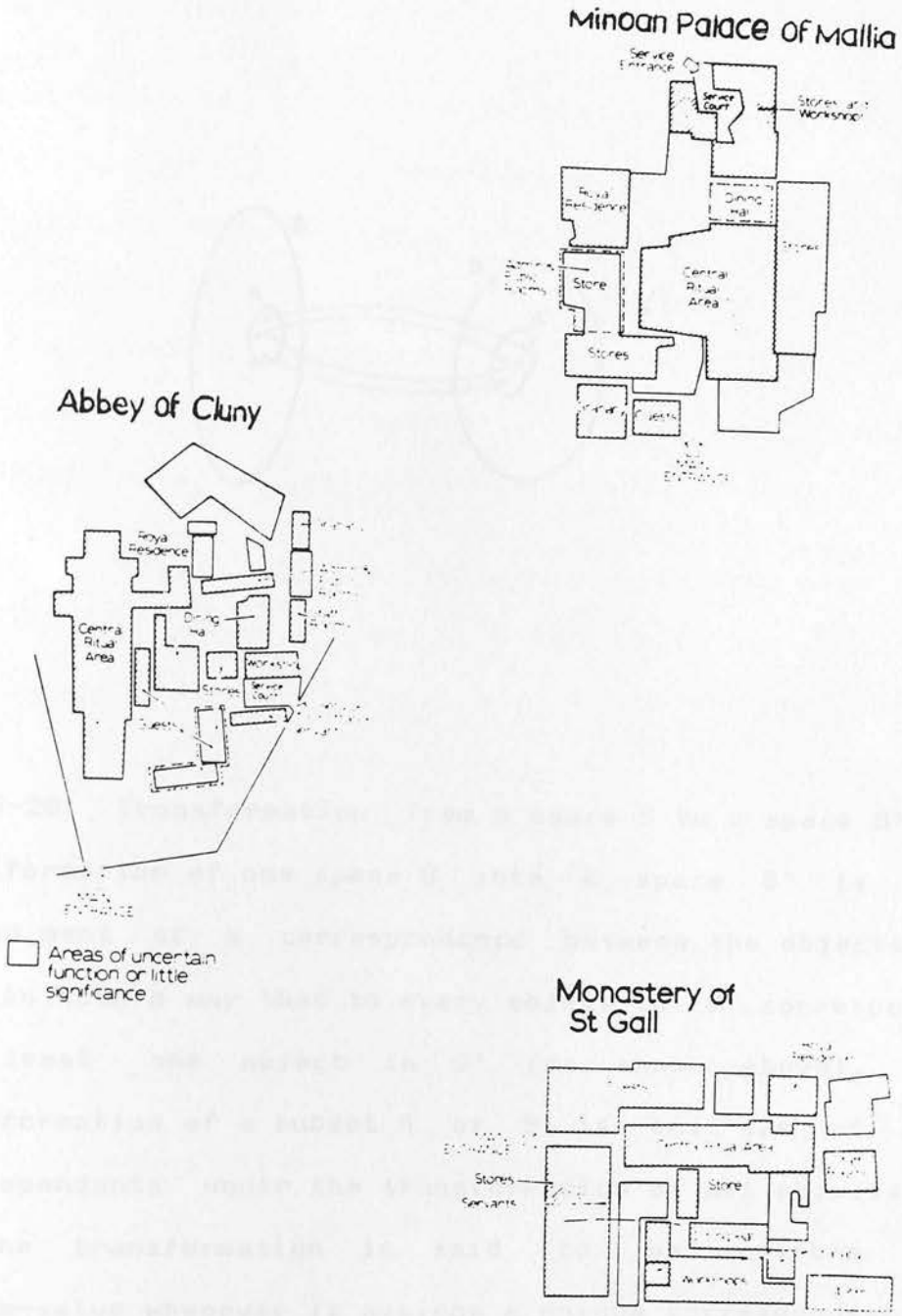


Fig.2-2-7: Common organisational principles in medieval monasteries and prehistoric palaces in Crete.

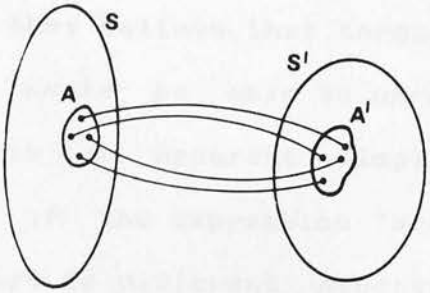


Fig-2-28: Transformation from a space S to a space S': a transformation of one space S into a space S' is the assign ment of a correspondance between the objects in S,S' in such a way that to every object in S corresponds at least one object in S' (as shown above). The transformation of a subset A of S is the set of all correspondents under the transformation of all objects in A. The transformation is said to be uniform or single-value whenever it assigns a unique correspondent to every object in S; it is said to be continuous whenever the transform (the image on the map) of every open set A of S is an open set of S'. The transformation is said to be homomorphic when it is one-one and continuous both ways.

2-2-2 ORGANIC DESIGN

For some designers, the use of the biological model is not just restricted to the superficial study of apparent forms. Instead, they believe that through the use of such a model, they would be able to unravel the complexity which lies beneath an apparent simplicity. From there comes the use of the expression "organic design" which ambiguously refers to different aspects of design.

The idea of "organic design" is mainly associated with the work of Sullivan, Wright and those designers whose works are contrasted to the International Style in architecture (8). In the study of urban forms, it refers sometimes simply to the curved streets weaving through the various "organs" of the city. Words like "heart", "life blood", "cell" and "nervous centre" are just so many analogical references to biology, used to characterise the interrelations of the different parts of the city.

Organic planning has also been seen as a kind of planning which is not just a "work of art" or an "act of the prince", but as the focal point in the development and expression of a many-sided culture whose natural setting and whose fields, factories and workshops make an essential contribution to its higher life (9). By comparing this kind of organic planning with those devised by the authorities, utopians, or those which are designed

in fixed styles, he said that:

"*Organic plans cannot be reduced to one single type or confined to any single historical moment*".

For him, the word "organic" not only means well-organised and capable of limited growth, but also alludes to a dynamic balance with a place for the full complement of urban organs. It is believed that organic planning not only seeks a structural answer to every function of the city, but that it must also express as fully as possible, both in the surface plan and the design of buildings, the needs and the ideal purposes of the community, conserving past forms that are still serviceable while preparing to accomodate future needs (10).

However, in this concept of organic planning, there is a need for an intricate knowledge of urban culture, a constant reappraisal of human needs, purposes and means as well as a cooperative participation reinforced with the community while new plans are under formulation. The movement towards the adoption of such a concept, initiated by the biologist Patrick Geddes (11), became the basis of the modern view of planning.

2-2-2-1 HOLISM AND THE ORIGIN OF THE ORGANIC ANALOGY

The history of the organic analogy goes as far back as Ancient Greece at which time natural organisms were thought to be the perfect models of the harmonious balance and proportion between the parts of a design which represent the classical ideal of beauty. According to Steadman (12), this analogy has two distinct kinds of interpretation: one to do with the visual appearance or composition and the other functional, although the two are interrelated.

In the first case, it is the organic "wholeness" of the work of art - in which a balanced and proportional relation of the parts to the whole and of the whole to the part is achieved - which is seen to be the source of beauty of that work. This wholeness or coherence provides the basis for the same kind of satisfaction as the one derived from the contemplation of the beauties of nature.

The second interpretation of the organic analogy, the functional one, is in some way a development or a further explanation of the first. Here, the analogy comes to form one part of the more general aesthetics of "functionalism", the equation of the beautiful with the useful or with the expression of usefulness; the idea that an artefact that is well designed and adapted to its purpose will be seen to be beautiful through the

recognition of its fitness for use.

Examples of this kind of interpretation of the organic analogy are not rare in the history of architecture, as for instance in the mechanical theme that was taken up by architects and design theorists during the nineteenth century. In reference to the modern movement in architecture, Steadman wrote (13):

"It is an enthusiastic appreciation of the products of the new engineering, in which rationalists and functionalists saw the results of the adherence to the same principles of economy and simple directness in the adaptation to practical purposes which has been praised in the design of nature".

2-2-2-2 TYPES OF ORGANIC ANALOGY

The concept of the organic analogy in architecture can be studied in its broader aspects. G. Herbert (14) identified five different categories of organic analogy in architecture: cosmological, natural, systemic, ecological and cellular.

The cosmological analogy refers to that fundamental aspect of the organic theory which is concerned with the universal problems of inherent order and meaning. The planner is seen here as ordering the environment in accordance with some larger cosmological or metaphysical scheme of the universe. He seeks knowledge about the structure of the universe in general in order to produce a structure for the city. G. Herbert argues that this cosmological bent can be seen in both Wright and Gropius.

In the natural analogy, the organic is equated with the natural; the organic element is said to be present in the natural processes, more particularly, in those of living and growing systems, as opposed to static ones. Herbert considers this argument as counteracting early mechanistic thinking and its consequent urban products, i.e. the nineteenth century industrial town. However, he does not relate it to those which one instinctively thinks of in this regard: Morris, Mumford and Geddes.

The systemic analogy leads the planner to look for

"systems" in the animals' and plants' life and results in the use of an organismic vocabulary. It is the analogy of elements interacting abstractly in "systems" and concretely in "organs". Herbert finds this analogy largely restricted to traffic engineering and other limited aspects of planning.

The ecological analogy is the one with which both Mumford and Geddes are associated. It is concerned with the problem of symbiosis in the attempt to discern the nature of the urban community as it is affected by the city.

Finally, there is the cellular analogy which arises partly from the consideration of the form of society as organic and partly from the consideration of natural organisms as cellular. Herbert maintains that this analogy is at the root of Perry's neighbourhood unit, Stein's and Wright's design for Radburn and Le Corbusier's superblocks.

The biological models have been used successfully by architects and planners to represent some aspects of their works. However, regarding the application of these models to society and their translation into spatial dimensions, they reveal great weaknesses. The biological models hardly pay attention to human alternatives. They always establish an ecological relationship between different species and types of relations between the elements of systems which, in some cases, change in a part may lead to disastrous results.

The city as well as society are constituted, as has been shown, of dissimilar elements, capable of undergoing revolutionary changes regardless of the past or of the surroundings. Therefore, one of the problems faced by designers, especially in situations of rapid change in society and the environment, is the construction of a model of discontinuity, a model which the continuous biological analogies are totally unable to represent.

NOTES

(1) Ferguson F. (1975), p30.

(2) Bertalanffy L. (1976).

(3) See White's "*Aspects of form*" for an explanation of biological forms.

(4) Renfrew C. (1979), p85.

(5) D'Arcy T. (1942), "*On growth and form*"

(6) Flanner, in Renfrew C., op. cit.

(7) Bintliff, in Renfrew C., op. cit.

(8) Ferguson F. (1975), p30.

(9) An explanation has been given by "*The Encyclopedia of urban planning*"

(10) Ibid, op. cit.

(11) See Boardman P. (1978).

(12) Steadman P. (1979).

13) Ibid, op. cit.

14) Herbert G., in Ferguson F., op. cit., p32.

2-3 SOCIAL SYSTEMS AND DISCONTINUITY IN URBAN FORM

In their quest for an appropriate model of form, designers have traditionally made use of system analysis as a theoretical tool. As a result, their attention was especially focused on the natural systems whose processes are embodied in physical containers, i.e. in actual forms. This concept, as explained above, was strongly criticized by those who saw architectural thought as something behind the superficial similarity between forms. As a result of this type of criticism, some designers set out in a search for a new model of form based on the social aspects of the environment; a search which centred around the models used in the social sciences.

Social scientists have developed many different models with which to represent the formation and development of human societies. Similarly, as with architects, they also used the biological model when trying to explain the different aspects of society. The evolutionary models, such as those proposed by Marx and Engels (1), the organic and equilibrium models, all are adaptations of systems of growth in the biological sciences.

Becker and Barnes (2) identified at least three distinct differences between the concept of organism and that of social systems. In the first place, they said that in an individual organism, the component parts form a concrete

whole and that the living units are bound together in close contact, whereas in the social organism, the component parts form a discrete whole and the living units are free and more or less dispersed. Secondly, and perhaps more fundamentally, in the individual organism, there exists such a differentiation of functions that some parts become the seat of feeling and thought while others are practically insensitive, whereas in the social organism, no such differentiation exists; there is no social mind or *sensorium* apart from the individuals that make up society. As a consequence of this second dissimilarity between biological organisms and social systems there emerges a third distinction: namely that while in the organism, the units exist for the good of the whole, in society, the whole exists for the good of the individual members.

Social systems are characterised by a kind of dissimilarity between the different parts and by a different relationship between the parts and the whole than those existing in organisms. It is this concept of system which seems to provide an explanation for the variations in the spatial formation of cities, which in turn is the reason for the designers' interest in the study of social systems.

2-3-1 TYPES OF SOCIETIES

Societies can be analysed from different points of view. However, for the purpose of this study, it is necessary to formulate a classification of the various types of societies according to the level of attachment of their members to each other and to the whole.

In an attempt to provide a mathematical formulation of the problem of "morphogenesis" in biology, Thom Rene (3) divided all possible types of society into two basic categories which will be evaluated for the purpose of our study: the military type and the fluid type.

a)- The military society: in military societies, each individual occupies a specified position and regulates his own movements in such a way that the global form of society is preserved as well as his own position in that society. It is clear that the global invariance of the spatial body requires a permanent interaction of each individual with all those that surround him.

b)- The fluid society: the typical example of this type of society is the swarm of mosquitoes where each individual member moves randomly when he sees the rest of the swarm in the same half-space; then he hurries to re-enter the group. In this way, stability is assured in catastrophe by a barrier carrying a discontinuity in behaviour. Thom recognised that, in human societies, this barrier is fixed

and doubly realised by the conscience of the individual and by the laws and repressive mechanisms of society. Therefore, human societies appear, according to this view, to be of an intermediary type; a type between the fluid and the military ones.

2-3-2 DISCRETE SYSTEMS

The formulation of the category of fluid societies led to the concept of "discrete systems". A discrete system is one which is constituted by a number of autonomous, freely mobile and spatially discrete individuals. In this kind of system, there is no continuous link between individual and whole as it exists in organisms. Therefore, the initial problem with this kind of system is to demonstrate how a grouping of randomly moving individuals could be called a real system. As it has been explained, discontinuity is the property of magical thought: there is no such thing as rational thought. For it to exist, rational thought needs continuity between entities.

According to the concept of "structural stability" (4), if an experiment is carried out under approximately the same conditions as those existing in reality, it produces approximately the same kind of results. This property is known as stable. Thus, if a system changes randomly in a period of time and then goes back to its initial state, the result is a stable condition. The global form of such a system arises from the behaviour of individuals, and it is a real system as it is conceivable in a period of time.

2-3-2-1 DISCRETE SYSTEMS AND RADICAL CHANGE IN SOCIETY AND SPACE

In order to find out how a discrete system can undergo sudden change, one requires more information about the modification of its two most important characteristics, the global and local rule and the relationship between genotype and phenotype.

a)- The global and local rule: the realisation of an individual in a system does not occur through its concept of global form. The global form is the collective product of a system in which discrete organisms follow a purely local rule. However, the existence of the local rule does not, by itself, produce the global result. The global form results from the rule being realised in spatio-temporal reality through a process where random movement is assumed in the first place as a background to the operation of the rule (5). Given this fact, a global order emerges of its own accord from a purely locally ordered system. In effect, the system requires both a spatio-temporal embodiment and a randomly operating background process in order to produce its order.

Seen in this light, discrete systems can both be objectively real and have a definite structure, even though this structure is neither determinate nor apparent at the level of the global system itself. Moreover, the

system is fully external to individuals while being at the same time entirely dependent on those same individuals for its existence and composition.

b)- Genotype and phenotype: there exists an actual realisation of the rule in different physical milieux which are called phenotypes. The underlying organising principle is called genotype. One genotype may produce several different phenotypes as the conditions of the physical environment change. While a phenotype is a spatial concept, the genotype is a transpatial one.

These elements , according to the biological view, produce a continuous process. The biological concept of genotype is essentially an informational concept. It describes something like a total informational environment within which the phenotype exists, in the sense that individual phenotypes are linked by a continuously transmitted information structure governing their form. Through the genotype, the phenotype has transtemporal links with its ancestors and descendants as well as transpatial links with its contemporaneous organisms of the same kind. This phenotype is continuously achieved through a description centre. The description centre holds instructions locally on how some initial material is to adopt local energy sources in order to unfold into a phenotype.

In sociology, this concept is used in a different way,

primarily because there exists no such thing as a description centre in society. Society is not characterised by a special centre and does not genetically transmit instructions for behaviour between species members.

In his search for a model for social continuity and variation, Hillier (6) developed his own version of the biological concept of phenotype. He substituted a "local description retrieval mechanism" for the description centre and asserted that the information on which the system runs is not carried in the description mechanism but in reality itself, in the spatio-temporal world. In this sense, the components of a system do not carry within them, jointly or separately, a genetically transmissable description of the system. Instead, they have a mechanism which permits them to retrieve the description of the system from the system itself, at any point in it. As a consequence, it is believed that it is reality itself which generates the programme and not the opposite. In other words, unlike the biological concept of genotype, there is, in this case, an inverted genotype.

The inverted genotype of the discrete systems is able to operate in many comparable ways to the biological genotype. For example, it allows for the conception of a mixture of structural stability and evolutionary morphogenesis, mixture which has been widely noted as a

property of both biological and social systems. On the other hand, there are also some critical differences. The discrete system, while being generally stable, can undergo revolutionary changes, as opposed to evolutionary changes, and can establish radical discontinuities in its history. It is in this sense that we can provide a model for radical transformations in society. The way in which Hillier and Hanson could apply this model to spatial dimensions was to replace the individuals in discrete systems by "space" (fig.2-2-9). They also tried to demonstrate that the arrangement of space can work analogously to a discrete system. Furthermore, they asserted that some spatial elements , in their integration and depth, could be correlated to the individuals using that space. This provided them with their claim that there always exist some social purposes behind the assemblage of urban forms. The relationship between society and space is discussed in more details in Part II. Our concern, here, is primarily with those discrete systems which could account for the discontinuous transformations in urban form in terms of a transpatial rule, while the organic view can only explain them in terms of a continuity in apparent forms or through the fitness of the form to the function and context.

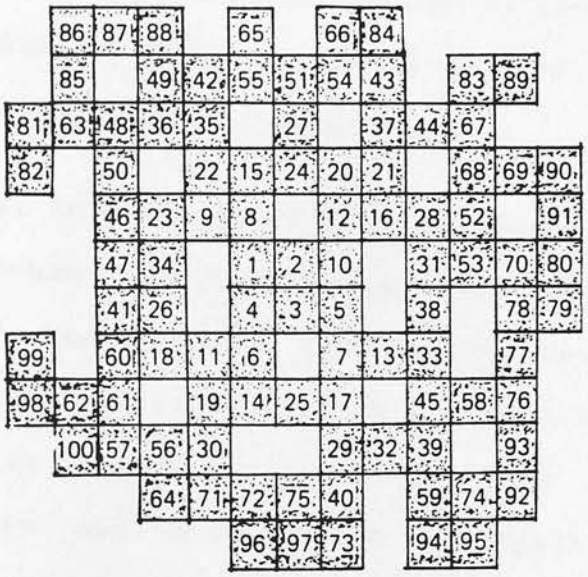


Fig.2-2-9: Generation of a complex composite from a collection of simple individual elements. The elementary objects are square cells; the rule of the addition of cells is a full face wise join and one face per cell kept free.

In relation to the subject under study, it is the external factor, acting from without the system, which causes the radical changes in spatial formations. The external factors, as explained above, do not necessarily have to intervene in a revolutionary manner to cause the system to change radically. Gradual changes in some factors may lead to sudden changes in a system.

As a result, in order to be able to provide an explanation for the urban transformations, one requires a model capable of representing the relationship between the external factors and the behaviour of discrete systems; a model which would be based on both continuity and discontinuity and which would be applicable in each particular situation, since the factors themselves are susceptible to change. depending on the context.

NOTES

(1) Marx and Engels stated that there were five evolutionary steps for social change: primitive Eden, slavery, feudalism, capitalism and socialism.

(2) In Ferguson F. (1975).

(3) Thom R. (1975).

(4) Zeeman E.R. (1976).

(5) Hillier & Hanson (1984), p34.

(6) Ibid, op. cit., p43.

2-4 CATASTROPHE THEORY AND ITS APPLICATIONS

In science, the interpretation of sudden change is a very complicated matter. Different models which anticipate or describe discontinuity in different disciplines have been proposed . These models are usually continuous or quantitative and, as such, are of not much use for such problems, especially when applied to the human sciences.

Using the topological theory of dynamic systems (1), originally developed by Poincare, Rene Thom (2) tried to construct a model for discontinuous changes in natural phenomena. This line of thinking has since been known as "catastrophe theory". It can be used as a descriptive toolin the study of change in the course of events, change in an object's shape, or that in a system's behaviour. It is a qualitative model which can also be quantified, suited to the analysis of not only smooth change, but sudden change as well.

It should however be mentioned that this theory is only a probe to investigate particular areas of behaviour, not representing the totality. As a matter of fact, it is precisely this characteristic which renders its use in this thesis possible. As Thom himself indicated:

"To each partial system, relatively independent of the environment, we assign a local model that accounts qualitatively, and in the best cases quantitatively, for

its behaviour. But we cannot hope, a priori, to integrate all these local models into a global system. If it were possible to make such a synthesis, man could justifiably say that he knew the ultimate nature of reality, for there could exist no better model".

The catastrophe model depends on the concept of the attractor as a stable state. Its effect is like that of a magnet; everything within its range of influence is drawn towards it (fig.2-2-10). Under the influence of the attractor, the system assumes a state of equilibrium. Therefore, just as in the real world where the forms that we observe are generally structurally stable, different topological graphs are used to represent such situations. As far as it takes place on the surfaces of these graphs, any system is structurally stable, being either at a position of equilibrium or passing through a position of non-equilibrium. The general behavioural mechanism of these systems can be described as follows: when an attractor which, up to a certain time, has been governing exclusively the behaviour of a system in a certain domain, ceases to do so and is replaced by a number of new attractors, each governing only part of this domain (3), what happens next is not easily predictable and depends on the co-dimension of new phases (fig.2-2-11).

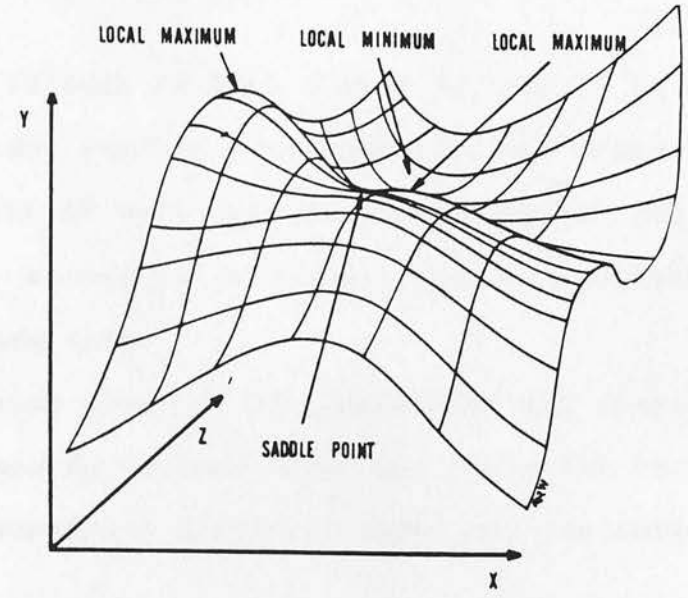


Fig.2-2-10: Attractors and equilibrium

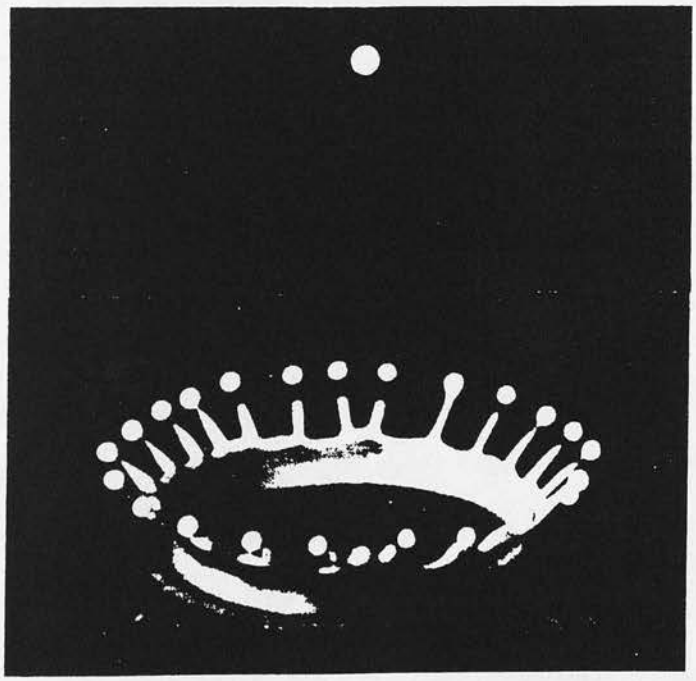


Fig.2-2-11: Sudden transformations

2-4-1 ELEMENTARY CATASTROPHE

One of the strengh of this theory is that it is capable of showing, under certain circumstances, the discontinuity in the behaviour of very complex systems which can then be classified according to a small number of relatively easy ways. As Thom said:

"*In any system governed by a potential and whose behaviour is determined by no more than four different factors, only seven qualitatively different types of discontinuity are possible*".

What this means is that while there exist an infinite number of ways for such a system to change continuously, there can only be seven structurally stable ways for it to change in a discontinuous fashion. Thom also indicated that other ways are conceivable but they are unstable; they are unlikely to happen more than once and lack the "recurrent identifiable elements" that they need in order to establish themselves in the language of scientific theory.

The elementary catastrophes are shown in fig.2-2-12. Each graph has one dimension or axis for each control factor that determines the system's behaviour. It also has one or two additional axes to represent the behaviour itself.

The simplest of the elementary catastrophes, the "fold", has only one control axis and one behaviour axis and,

	CATASTROPHE	CONTROL DIMENSIONS	BEHAVIOR DIMENSIONS	FUNCTION	FIRST DERIVATIVE
CUSPOIDS	FOLD	1	1	$\frac{1}{3}x^3 - ax$	$x^2 - a$
	CUSP	2	1	$\frac{1}{4}x^4 - ax - \frac{1}{2}bx^2$	$x^3 - a - bx$
	SWALLOWTAIL	3	1	$\frac{1}{5}x^5 - ax - \frac{1}{2}bx^2 - \frac{1}{3}cx^3$	$x^4 - a - bx - cx^2$
	BUTTERFLY	4	1	$\frac{1}{6}x^6 - ax - \frac{1}{2}bx^2 - \frac{1}{3}cx^3 - \frac{1}{4}dx^4$	$x^5 - a - bx - cx^2 - dx^3$
UMBILICS	HYPERBOLIC	3	2	$x^3 + y^3 + ax + by + cxy$	$3x^2 + a + cy$ $3y^2 + b + cx$
	ELLIPTIC	3	2	$x^3 - xy^2 + ax + by + cx^2 + cy^2$	$3x^2 - y^2 + a + 2cx$ $-2xy + b + 2cy$
	PARABOLIC	4	2	$x^2y + y^4 + ax + by + cx^2 + dy^2$	$2xy + a + 2cx$ $x^2 + 4y^3 + b + 2dy$

Fig.2-2-12: SEVEN ELEMENTARY CATASTROPHES describe all possible discontinuities in phenomena controlled by no more than four factors. Each of the catastrophes is associated with a potential function in which the control paameters are represented as coefficients (a, b, c, d) and the behaviour of the system is determined by the variables (x, y). The behaviour surface in each catastrophe model is the graph of all the points where the derivative of this function is equal to zero or when there are two first derivatives, where both are equal to zero.

therefore, is two-dimensional (fig.2-2-13). The most complex elementary catastrophe, the "parabolic umbilic", has four control axes,and two behaviour axes and thus is six-dimensional (fig.2-2-14).

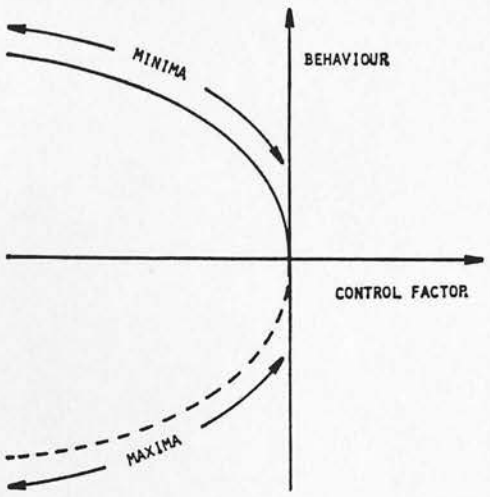


Fig.2-2-13: The fold catastrophe

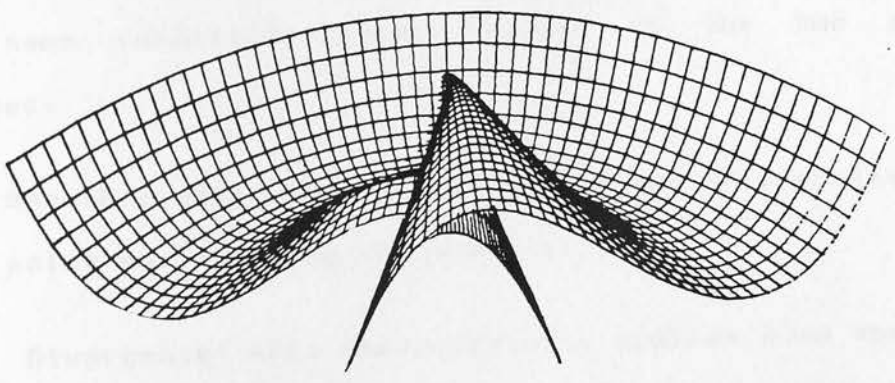


Fig.2-2-14: The parabolic umbilic catastrophe

The "cusp" has three dimensions and can account for a high enough level of complexity for it to be applied to our problems (fig.2-2-15). The "cusp" has six main characteristics:

a)- Bimodality

b)- Smooth change

c)- Divergence

d)- Sudden transition

e)- Hysteresis

f)- Inaccessibility

a)- Bimodality: for certain combinations of values of the control factors, there are two possible stable states: one on the upper surface of the pleat and one on the lower surface, beneath the pleat. The behaviour of the system under these conditions is called "bimodal", meaning that the same conditions permit either of the two stable states.

b)- Smooth change: all smooth changes can be visualised as one point moving along the surface.

c)- Divergence: this characteristic applies when the cusp shows how two close behaviours of the system could become apart while undergoing the same conditions (fig.2-2-16).

d)- Sudden change: This characteristic occurs at the point where the cusp suggests the possibility of discontinuous change in the system. This possibility is present when a

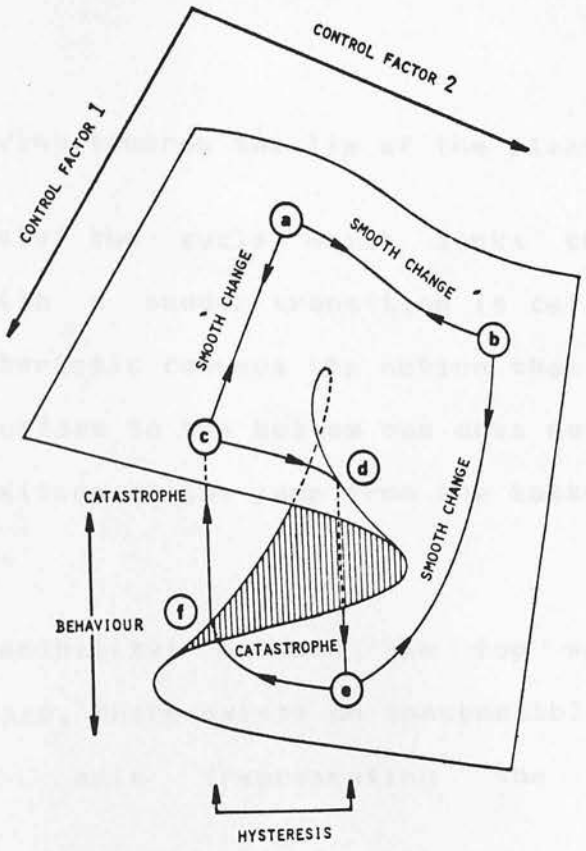


Fig.2-2-15: Cusp catastrophe

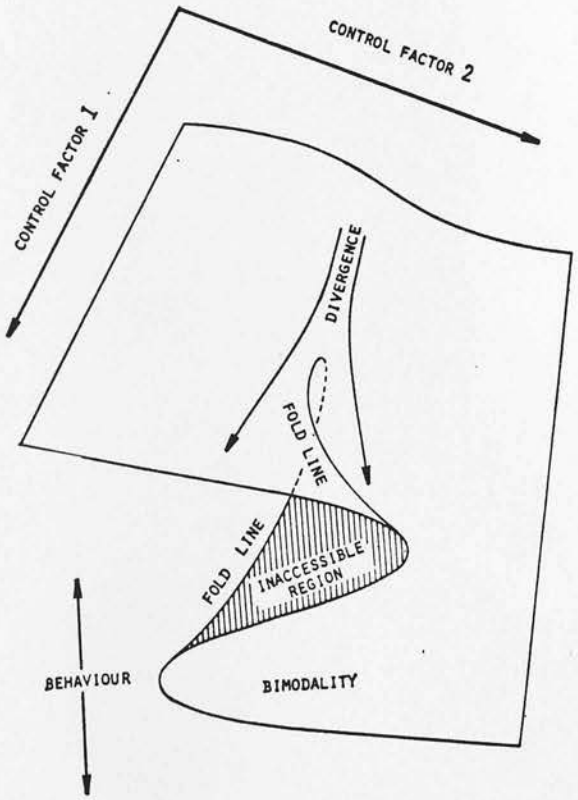


Fig.2-2-16: Cusp and divergence

point is moving towards the lip of the pleat.

e)- Hysteresis: the cycle which links the two smooth portions with a sudden transition is called hysteresis. This characteristic conveys the notion that the jump from the top surface to the bottom one does not take place at the same position as the jump from the bottom surface to the top one.

f)- Inaccessibility: between the top surface and the bottom surface, there exists an inaccessible zone on the behavioural axis (representing the least likely behaviour).

NOTES

(1) Topology is the branch of mathematics concerned with the properties of surfaces.

(2) Thom R. (1975).

(3) Wilson A.G., "*Catastrophe theory and bifurcation*"

(4) See Woodcock A. (1978), for different approaches.

(5) Wilson A.G., op. cit, p12.

(6) This was previously used to explain the continuity of the class of organisms in time and similarly in space. See Hillier (1984), p43.

2-4-2 APPLICATIONS OF CATASTROPHE THEORY

Catastrophe theory can be applied in different ways to different situations. On one extreme side, it can be used as a mathematical method in the physical science or, on the other extreme side, as a metaphor or descriptive tool to metaphysics.

In the middle of the spectrum are the applications to the study of systems whose mechanisms are not known in sufficient details (e.g biology). This theory has already been applied to biology, chemistry, sociology, politics, psychology and physics for the description of different events (4). Its application to urban and regional systems has been done by Wilson (5). As these studies are based on discontinuous change, here it is an attempt to present out the finding through this theory.

2-4-2-1 CHANGE IN URBAN FORM

One of the processes for which the catastrophe theory could be applied is the study of change in urban form, especially in situations of sudden change. As the form of cities shows a good deal of stability, continuity and divergence, a cusp catastrophe seems to be ideal to represent it.

For this purpose, the stable states of the surface of the graph can be assumed to represent the situation when an

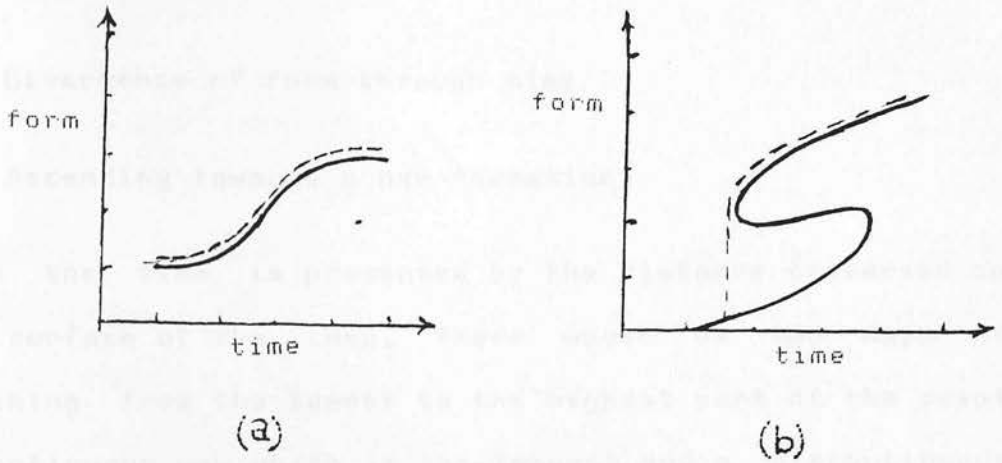
urban form becomes acceptable to society. Therefore, each point of the surface of the graph presents a particular form. One way of achieving this stability is, as we mentioned before, through the consideration of the temporal dimension of life: the linkage between past, present and future experience when a sudden change disturbs such a continuity of life. Therefore, an urban form is recognisable as far as it contributes to such a continuity of experience. this does not require a physical similarity; a form may be accepted by a society in spite of the multiplicity of its manifestations. This process is comparable with the "local description retrieval mechanism" mentioned before, but here, it is assumed that this mechanism is not the property of a society but a mechanism between a society and its spatial formation. Whenever this mechanism is maintained - i.e the surface of the graph - the system is stable even if society or urban form undergo revolutionary changes. When this mechanism is not in operation, the system becomes unstable, moves away from the surface of the graph and is unrecognisable by society.

To demonstrate the revolutionary and evolutionary change of form, initially it can be assumed that this mechanism is reached through a simple "description centre" (6). As a result of such assumption, there are common physical characteristics between each form with the form in its

vicinity which leads to its recognition. In this sense, those forms which are next to each other, present different variations of the same basic form, while those far from each other - i.e the lowest and the highest part of the graph - present two different urban formations.

This, in turn, presupposes that these arrangements are the effect of certain combinations of control factors of the cusp catastrophe (horizontal axis). Therefore, as the behavioural axis (vertical axis) demonstrated the change from one form to another, the control factors are the generators of such changes.

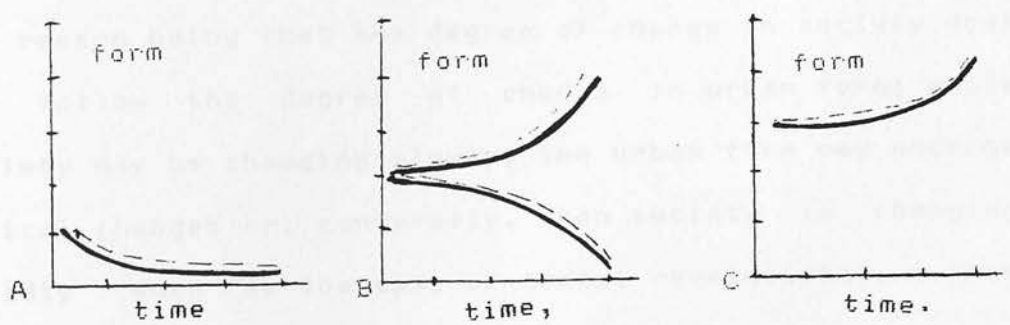
If the control factors (I) assumed to be of time, two most distinctive cross sections of the cusp present two ways of changing the form:



a)- Evolutionary change: the graph suggests that continuity in form can be achieved by having some common elements with its previous state.

b)- revolutionary change: the graph anticipates a radical change of form through time. The continuity could be achieved without a physical continuity with the past state.

The reason behind taking one of the positions depends on factor II. If factor II itself assumed as time, three distinctive positions may occur:



a)- Descending towards the previous state of form

b)- Divergence of form through time

c)- Ascending towards a new formation.

When the time is presented by the distance traversed on the surface of the cusp, there would be two ways of reaching from the lowest to the highest part of the cusp: a continuous way which is the longest and a discontinuous way which is the shortest. Therefore, we can now leave the two control factors just to present the different forces acting on form. Control factor I is the reason behind the continuous and discontinuous way and control factor II is the reason behind the selection of those situations. If, for instance, the aim is to construct a model presenting the urban form under the effect of social change and the designer awareness of this change and his creativity, the social change can be assumed to be presented by factor I and the designer's choice of form by factor II (the two horizontal axes), whereas the change in form would be represented by the behavioural axis (fig.2-2-17).

The reason being that the degree of change in society does not follow the degree of change in urban form; while society may be changing slowly, the urban form may undergo radical changes or, conversely, when society is changing rapidly (such as the case of social revolutions), a form may change smoothly.

However, social change is a factor of change in urban form but not as a direct force. This may give freedom to the designer to choose a form and as this choice is one stable state on the surface of the cusp is acceptable. Therefore, control factor II refers to the designer's awareness of social change and the degree of the creation of the image of past and future.

In fact, in the context of stability of form, it is the designer who acts directly on changing the form

a)- Evolution of form: this happens when the degree of change in society is greater than the designer's attitude towards change in form. The increase in the rate of change in society can somehow be traced in the urban form (point 1-2). In its critical point (point 2), the symbolic expression of change increases by the slight change in the designer's attitude, there would be the possibility of creating a futuristic form.

b)- Sudden change in urban form: This usually happens when the designers' attitude towards changing the form is greater than social changes (points 1-3-4). the designer's choice of a futuristic form at the same time, social changes create a great possibility of a radical change in form. However, this may happen through passing an unstable condition (points 4-3), as novelty could not be accepted during a very short period of time.

CONCLUSION

There are some controversies surrounding the applications of this theory. The basic problem is on the grounds that it often seems to provide only a description of the systems and no explanation about the mechanisms involved. This shortcoming also applies to our particular area of interest. Issues such as description and explanation do, however, involve some unsolved , and perhaps unsolvable, fundamental questions about the nature of knowledge and science.

Obviously, we should accept that it is not the ultimate explanatin for everything and, thus, none of our theories can accomplish more than the arrangement of our knowledge into an orderly system. This is also the aim beyond the creation of of this theory. As Thom himself recognised, the aim of catastrophe theory is to find a way of reducing the arbitrariness of description, especially in the "soft" sciences (the human sciences).

In architecture, as there is no well-established laws or precise quantitative observations, there is a need for a qualitative model to present different ideas. In fact, there is a shortage of qualitative models for the study of problems at local levels or for the study of sudden events such as architectural creativity. What one can propose, here, is that catastrophe theory could be the first step

towards eradicating this shortage.

In relation to the study of the relationships between changes in the environment and changes in urban form, it was able to predict different behaviours such as divergence, sudden change. It also demonstrated that sudden change in form is not always the result of a radical change in one factor. Smooth change in one factor may also lead to radical changes in urban forms and, conversely, a radical change in one factor is not a guarantee of sudden change in form.

Cities change, over relatively long periods of time. It is on the basis of such slow accelleration of change that cities are usually studied. However cities also change radically. This change could happen in the structure of societies e.g. as the result of a revolution, or through the migration of a group of people with past experience of a different physical form which they bring to the new situation. Although serious social and psychological problems may arise from such environmental changes it seems that these problems are not determined by the physical form of city . In such situations societies and spatial formation appear to act in some way independently from each other. For example it can be seen that revolutionaries use more or less the old container of cities over a long period of time. Their social revolution is not paralleled by a physical one. Furthermore migrants might often conserve their old social structure in a new environment.

Although a clear link between social change and physical form can be rejected, there may be more subtle weaker relationships at work. If this is the case therefore it is important to indicate a way in which designers could understand this relationship and appreciate their potential contribution towards this problem.

Briefly, the main problem presented by sudden environmental change is found to be conservation of the direction of the goals of individuals and groups . This direction is best explained through a temporal dimension which differs from time as normally conceived as division in the physical world. The time which is implied by physical form and the events happening in cities may have a relationship to the central concept of time used in this study, but it is important to emphasise a difference from more ordinary concept of similarity and continuity. In this sense the explanation of The change in urban form and its relation to society requires a new model which takes account of discontinous transformation in time.

The study of the nature of sudden change in urban form and human problems as the result of environmental change shows that there are two human characteritics involved ; cultural and biological. Culture is found to be a changing agent through which man is able to shape his surroundings, control unwanted events and create new possibilities. Culture changes through interaction with the environment, but these changes are not done passively. Man himself is a creator of radical change in his surroundings and the formation of cities is a demonstration of his abilities.

While human beings change their environment radically through the power of mind, the biological consequences of increase in the acceleration of change in the environment may lead to serious problems. These problems are the result of limitations in sensory organs and neural systems in receiving the external information. Past experiences are important in acceptance of novelty. Confrontation with an environment which has not been previously experienced or which disconnects one from the past leads to psycholgical problems of discontinuty. The extent of the problems and the process of the adaptation depend on the nature of change, its context and the characteristics of individuals.

Therefore while man is able to change his surroundings radically through the development of culture, at the same time he suffers from unwanted changes. Increase in complexity of the environment and confrontation with unexpected situations cause mental disorder. The power and potential of change and its associated dangers become the basis on which cities are shaped. So it is important to recognise the following factors in designing and in the study of the effects of sudden change in the formation of the cities on man.

The first factor is that cities are built to act as a shelter against unwanted changes. Shelter is a basic need which is essential in all situations. For example buildings can be assumed to be a filter to control light and noise or generally as a means for avoiding sensory overstimulation. This concept also contains the assumption that physical factors such as climate and ecological conditions are effective in shaping the cities. These factors, however, are secondary factors and are not deterministic of forms. Different alternatives may arise through these restrictions. Therefore radical changes in these forces do not neccessarily lead to sudden change in the forms of cities.

The second factor is that the act of designing is something that no other being but man is capable of doing. The variety of forms which are created by man are initially related to the power of imagination, development of mind and consciousness. Cultural aspects are assumed to have a great effect on forms. As man sees the world in a different framework at each particular time and place, the urban form may express the prevailing condition of that situation. Social change may lead to change in the physical environment but this happens over a long period of time and this physical change is not, in any case, the complete picture of social change. However change in

physical form may be a result of social change but sudden change in form is not created by radical social change. Indeed it is found to depend more directly on a designer's creativity.

Designers could not contribute to solve the problems of sudden enviromental change through continuity of form. This is because radical change in the formation of cities does not have serious effects on society. As the result there is a need for more effective ways rather than the continuity of physical form in which designers can better play their role. This can be explained as followings.

The main issue raised by sudden change is the stability and continuity of the society. This stability is created in each person through a link between his past experience,his present feeling and his future expectations. This can be better explained through a subjective concept of time.

In this thesis we define continuity as an inner psychological aspect, a direction which man gives to discrete elements and events. This is a temporal dimension but it differs from time as conceived as artificial division in the physical world. The direction of time

arises when there is a goal, it is the idea of past, present and future which relates to events and goals of an individual or group.

Time can always be perceived in cities through events and physical forms. Each group and individual arranges time according to different situations. When the change is smooth one can perceive a continuity between different sections of time. For example; tradition follows its norms in modern life. In the case of sudden change there is no such harmonious perception. For example, old and new become in contradiction with each other, therefore one can feel a gap between past and present. It is in these cases that the arrangement of time is critical. The main point here is, there is no need to fill this gap with an artificial continuity, as is assumed in its physical sense. What is important is the goals of people during those periods of time. These goals are applicable in particular sections of time and not in the whole range of history. In fact to achieve such continuity one should even eliminate some parts of past and future. In the other words stability can be achieved by disconnecting part of past experience and by placing emphasis on other parts.

For example in the situation of a revolution there is

always a strong goal. To change the direction of the existing situation a break must be made with the connections of recent past experiences. Instead a new goal will be emphasised which contains some aspects of the deeper past and which generates a new revived goal. The physical forms of such cities will also become the symbol of this process. The buildings which accomodate and symbolise the previous way of life are destroyed and new buildings to give the new images are created. Although the symbolic change happens in a short period of time , the process of change in structure of cities happens over longer time.

In situation of migration the future would come out of the immediate surroundings. Migrants dispose some aspects of the past to encourage a hopeful beginning. They welcome any physical changes that would accelerate the realisation of their goals.

This process of disposing the time is also visible in the reconstruction of cities after disaster. Rebuilding in these situations is a kind of historical reconstrution ; re-creation of the same meanings and images of the past.

There is no common way in which the time in cities can be arranged regarding different situations of sudden

change. This arrangement is highly dependent on the local situations. All we can say is that the temporal continuity is important to achieve. Although this in turn may be reflected in spatial dimensions of cities this does not require similarity in its transformatoins.

Therefore in order to explain the factors involved in the process of sudden change in society and in urban form one could not use a universal model. This is why this thesis attempts to develop a model based on local problems which demonstrate discontinuous behavour. Constructing such a model, however, has been always a difficult task in all branches of science. Rationality requires a kind of objective continuity in science.

In general architects have been the users of biological models in order to study form and its relation to the factors involve . This assumption implies a continuous behaviour. The concept of a city as an organism which grows and decays and is in equilibrium with its context is a familiar example. Although these models are capable of explaining smooth changes which may happen in cities, they are unable to explain sudden changes. What is proposed here as a catastrophe theory could be the first step toward such model. While there are still some controversies around a general application of this theory, e.g. being descriptive and acting as a tool for

presentation of events rather than to explain a process, at least it is able to reduce arbitrariness in disciplines such as architecture where there is no well established body of knowledge.

In the case of a study of sudden change in society and urban form this theory demonstrates different behaviours which may occur in such situations. It shows that the sudden change in form could be the result of smooth change in some factors such as designer's action and society. It also predicts the possibility of a divergence in process of growth of form as the result of changes in one factor such as society. Finally it enables us to draw a picture of a relationship between radical change in society and sudden change in form. However, as is mentioned, the purpose of this theory is not a universal explanation of events; each case needs to be studied on its own. This should be done by considering the factors and variables in the appropriate catastrophe model.

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