ENVIRONMENTAL INFORMATION AND COGNITIVE NEEDS

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Contemporary architectural and urban design have been vigorously criticized for being monotonous, impersonal and poor in content. The discussion which has subsequently developed on the question of the man-environment relationship has succeeded in elucidating certain aspects of the issue and in influencing the work of many designers. Still, it has up to now failed to produce the distinct paradigmatic guidelines needed for a drastic change in the way designers approach design problems.

The present study is concerned with man's cognitive experience of man-made environment. Its aim is to explore man's cognitive needs (ie. the need to know and to understand) in relation to the environment's potential informational content in order to establish a theory as to the information our surroundings should embody so that they meet our needs.

For this reason, the environment's potential content (ie. the object of cognition) is firstly examined. Our surroundings are found to be exceptionally rich in information that is stored in them in the process of their shaping. This content is ordered and represented in a model.

The exploration of the nature of man's cognitive needs, on the other hand, shows that man often decodes more environmental messages than what is usually assumed. Such cognitive activity, which may be independent of the primary functions performed in space and may even refer to the entirety of the environment's content, is complementary to man's overall understanding of the world.

To rephrase the functionalist dictum, not only "form follows function" but also form itself functions through cognition. Designers, who can thus be seen as the editors of environmental messages, must acquire a deep understanding of this function and its qualities. They must constantly try to make the best out of an environment's own potential content so as to meet the demands of the users'cognitive needs for the given setting. This content should be transmitted legibly and in an organized manner following the afore-mentioned model.

By examining the requirements set by cognition both in a holistic sense as well as in terms of their particular complexities and varieties, it is believed that the present study will contribute substantially to the theory and practice of design.
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INTRODUCTION
0.1. The Reasons Which initiated this Study

It is a sad fact that the condition of our cities is continuously deteriorating while their image is becoming increasingly fragmented. This is particularly so in inner city areas and the districts where the low income groups live. Writers such as Jane Jacobs, Theo Crosby and Robert Goodman have described this convincingly nearly two decades ago.

Mainly because of this and partly because of the natural evolution in society's priorities, researchers and theorists have studied the man-environment relationship vigorously in recent years. Writers, like Constance Perrin, pointed to the multi-dimensional nature of environmental issues and placed an additional emphasis on man, the user. A new field of studies, usually referred to as Man-Environment Studies, has emerged; it is centered on the systematic study of the mutual interaction of people and their built environment. According to Rapoport, discussion and research in the field has revolved around three major issues: The way people shape their environments, the way they are in turn affected by them and the mechanisms through which this link is expressed (Rapoport, 1911, pp. 1-7).

The discussion so far has suggested that, apart from being functional in the conventional sense, the built environment must satisfy additional requirements. Contemporary designers are now becoming increasingly aware that the image of the environment plays a significant role in non-verbal communication between people who are exposed to it.

It seems reasonable to suppose that the growing interest in the human aspects of the man-environment relationship has enhanced designers' perception of the social implications of what they design.
Nevertheless, it appears that research in the field and its major areas of concern is still at its beginning. This is apparent from the simple fact that, although the issues are currently being widely discussed, new developments in design practice do not seem to have been influenced significantly. Apart from a few notable exceptions of buildings and housing complexes, such as, the Pompidou Centre in Paris or the Byker Housing Scheme in Newcastle, modern design has not as yet experienced a significant shift towards the satisfaction of man's deeper psychological needs.

There are several reasons for this:

a. First, although the context in which designers operate enables them to take a close interest in the discussion, the harsh facts of everyday life and the economic priorities set may not allow the luxury of such theorising. This is further inhibited by the lack of a clear conceptual framework and by the growing specialization that characterizes the literature in the field. The discussion, will remain incapable of influencing design practice significantly so long as it also fails to receive the feedback it needs thus becoming increasingly theoretical.

b. Secondly, in epistemological terms, it is arguable whether theoretical and empirical advances in the field have been capable of initiating the novel overall statements* which are needed to change the designers' conception of the problem. Although the discussion has questioned the modernist principles and has already identified a series of new perspectives for design theory, it certainly has not natured enough to allow paradigms similar to le Corbusier's "une maison est une machine

* "paradigms", according to Kuhn, 1970.
there is nothing to suggest that the essence of design theory will be summed up in a simple paradigm such as "form follows function"; it is evident however that a concise set of statements, similar in nature with the functionalist principle, still need to be formulated.

At the present stage of the development of design theory, the statements which may serve as paradigms appear to be either too practical or too distant from the actual design problem. Cullen's perceptive guidelines of the early 60's as well as the more recent designs and studies of the Post-Modernists fall into the first category since they tend to act as blueprints to be repeated while they lack the precise theoretical background that could have determined their general applicability. On the other hand, Hillier describes a building as a climate, behaviour, cultural and resource modifier (Hillier et al, 1972) and Rapoport views design as having four properties, namely, the organization of space, meaning, time and communication (Rapoport, 1977, pp.10-12). Both these statements are well aligned with recent advances of research but are too theoretical to guide designers in detail as they provide an all-embracing description of the function of design.

Between the practical guidelines and the theoretical description there is a space in which a new set of paradigms should fit. Since these paradigms must be applied to each design problem, their formulation will have to be based on a full understanding of the needs. Additional research will be required to identify formulations which will command as wide acceptance as that of "form follows function".

The fact that the man-environment relationship involves many disciplines is an additional problem. Although research is mainly
concerned with the human aspects of the issue, there does not as yet seem to be any prevailing theory as to what man requires from his environment and how it affects him. Several holistic approaches that have been attempted in relation to design theory (e.g. Norberg-Schulz) did not prove able to provide a basis for the discussion. As a result, the discussion remains fragmented both as regards the theory-practice axis and as to whether the emphasis is placed on the production or the use of the built environment. The additional requirements that design has to fulfill are only being sporadically identified.

c. The third reason why design practice has not been influenced significantly by the discussion is to be sought in the nature of the prevailing approaches to the issue. A notable number of such approaches and theories are concerned with a particular range of human needs which are to be satisfied by the built environment. In as much as man's cognitive experience of his surroundings is concerned, these theories view cognitive activity as being directly related to foreseeable action. For example, as direct communication like stopping at a red traffic light, or in relation to finding one's way in complex urban environments using landmarks, paths, identity areas and so on, or as forming the basis which enables people to choose between different environments for their shopping or residence. It could be argued that even the findings of the cognitive approaches in psychology are often being used to explain how people behave in their physical settings (i.e. how their attitudes vary with respect to particular commercial products) rather than what the experience of their surroundings means to them.

(1) This is often apparent in the writings of semiotologists.
(2) This is implied in the work of Kevin Lynch and the subsequent studies on the image of cities.
(3) This has been extensively analysed by Rapoport.
The bias towards overt behaviour must surely be attributed to the long tradition of behaviourist thinking according to which "people tend to be regarded as organisms merely responding to external stimuli rather than persons in their own right" (Laing, 1965, p.20). Such a departure clearly entails the danger of depriving man of a significant part of his most enduring characteristics (eg. basic needs, past experience, motivation, etc.). An approach, which takes into account the complexities of man's perceptions and reactions appears to be needed for two reasons, namely: to identify possibilities of cognitive activity which do not fall into the "cognition-foreseeable action" pattern, and to restore our view of the totality of the manner in which man cognize his environment.

0.2. The Scope and Aims of the Study

Contemporary architectural and urban design has been vigorously criticized for being monotonous, impersonal and so on. It has been suggested that it has contributed to the loosening of bonds between people leading to ever-increasing alienation. A wide range of social problems ranging from loneliness to juvenile delinquency have been recognized as being reinforced by bad design.

As noted above, much of the blame vests with the failure of current design theory and practice to take notice of a number of basic human needs.

The aim of this study is to explore a set of these needs, namely man's cognitive needs, i.e. the need to know, and to find ways of incorporating this human aspect in architectural and urban design.
Cognition* is one of man's most essential needs, yet there is little evidence that it has been taken into account by planners and architects.

To achieve the above aim, we must firstly explore the potential informational content of man-made environment. Based on the findings of this, we must then explore the limits and assess the significance of man's cognitive needs.

The synthesis of these two will lead to a set of conclusions which will be used in a twofold manner: It will firstly provide the basis against which relevant design approaches and theories will be tested in the hope that this will cast some light on the man-environment relationship and reduce the fragmentation of the discussion. Secondly, the conclusions will be examined independently so that we arrive at a set of criteria and guidelines for design. This will constitute the theory of what design must incorporate in order to satisfy man's cognitive needs.

0.3. The Structure of the Study

The development of the argument will cover the whole of the man-environment relationship with regard to the question of environmental cognition so as to safeguard the study from becoming yet another fragment of an already fragmented discussion. Consequently, and in accordance to Rapoport's threefold division mentioned in the opening section (Rapoport, 1977, pp.1-7), the first part of the present study examines the way people shape their environments and aims at the exploration and classification of the potential informational content of man-made environments. The second part concentrates on the way man is affected

* According to the dictionanies and psychological literature, cognition is defined as "Knowing and awareness (including sensation but excluding emotion)".
by the cognitive experience of his surroundings. The aim is to assess the significance as well as to explore the complexities of environmental cognition based on the findings of the first part.

The third and final part of the study is concerned with the mechanisms through which the production-use of man-made environment is expressed, in this case: design theory and practice. As noted above, the aim is to re-organize the knowledge on the subject by testing existing design theories and approaches against the theoretical foundations of this study and to arrive at the theory concerning the way design will satisfy man's cognitive needs.

0.4. Limitations of the Study

At this point it is essential to note that there are several conceptual limitations mainly imposed by the lack of universal agreement on the question of how man acquires his knowledge of the world. Eighteenth century empiricist philosophers, like Locke and Hume, assumed that the mind is in a "blank state" condition at birth and that knowledge of reality is built up from successions of sensations imposed upon it. On the other hand, rationalists, such as Leibnitz and Descartes, started from the opposite contention that knowledge is given immediately as an innate idea before experience (see Bochenski, 1966). Contemporary developments in science and epistemology have suggested that the issue is more of a question of the degree to which experience proceeds knowledge. Philosophers like Kant, who differentiated between the "form" and "matter" of knowledge, have contributed to this view by providing the ground for a more interactive position to be taken (see Moore and Colledge, 1976, pp. 13-16).

* To follow Rapoport's wording.
Yet, the argument is still alive, particularly so in an extremely controversial discipline like psychology. For example, a researcher who is leaning towards empiricism will view external and visible stimuli as more fundamental than that which is internal and not directly observable.

The present study, like all research on the human condition, cannot claim to be impartial to the above argument. Its area of concern, however, covers both the way potential information is stored in environmental forms and the way this information is integrated within man's mental world; that is both an external and an internal condition as regards the individual. To the extent that both opposing philosophical attitudes give a fair explanation of different aspects of reality (see, for example, Arndt, 1974), it is essential that this study does not exclude any of them from being taken into consideration. Because of this, the development of the argument in this thesis must primarily concentrate on the issues in question and then refer to the way each philosophical position affects the discussion.

Additional limitations arise from the nature of cognition which is a typically inner human function. This does not allow the researcher to adduce empirical evidence as to the exact amount of information experienced by people, especially since a part of this experience occurs below the person's threshold of consciousness (see: second part). Thus, it is not accidental that the issue has remained a taboo for researchers until fairly recently. In the context of the present study, the problem will be overcome by acquiring a picture of the potential content of a particular environment in all its complexities and combining this picture with an understanding of what way be cognized.
PART ONE

THE CONTENT OF MAN-MADE ENVIRONMENT
1.0. Introduction

The man-made environment consists of numerous objects. These objects are made in order to satisfy human needs. Some of the objects relate to basic needs such as a house to provide shelter while others responded to needs which are less pressing such as ice-cream or an ash-tray. The sum of these objects forms the man-made environment and can be thought of as conveying messages or providing sources of information. For example, the appearance of a house offers innumerable messages including not only the materials used but hints as to the kind of people living in it.

The purpose of the first part of the study is to represent this content in a simplified but meaningful manner using a model. This model will constitute the basis for the development of a theory that claims to redefine the role and potential of designers.

1.1. An Overview of the Relevant Approaches

The question on the volume of information stored in man-made environment has attracted the attention of various authors. In the following paragraphs we examine some of the approaches proposed to date.

One such approach that is relatively recent and has gained substantial popularity lately is that of architectural and urban semiologists. The basic arguments of the theory can be found in the writings of Eco, Broadbent, Krampen, Jencks and others. In short, semiologists describe the environment in terms of its ability to operate as a system of meaningful signs. Developing models out of the study of natural language, their aim is to show how the environment can express social meanings in the same way as natural language does.
With respect to the latter, however, it is questionable whether there is a direct analogy, or even connection, between the rules of natural language and those that govern the making of the built environment*.

But apart from this general argument there is another more significant reason to regard semiology with scepticism. Until now semiologists have focused their attention mainly—and sometimes exclusively—on the study of the object per se (i.e. in relation to what it stands for) and on the study of the relation between more than one object. By doing so however, they neglected an area that is in our opinion of primary importance, namely the origin, use and effects of environmental information. When an object is seen in isolation from its origins and use, the informational content that can be derived from it appears substantially less than the dynamics of environmental change have stored in it originally. This loss can be crucial for a study such as the present one which seeks to utilize the widest body of environmental information.

Historians of architecture and the arts offer a second, more orthodox appraisal of the informational content of man-made environment. The aim of authors such as Giedion or Mumford, however, is to examine how "Zeitgeist" i.e. the spirit of the time, is reflected on design. Thus, the main body of knowledge that can be derived from historians refers to society and social change through the evolution of forms. Such information is useful but cannot account for the entirety of the environment's content.

* Krampen, a German semiologist suggests that "There is no evidence to sustain the hypothesis that since all languages are made up of words and all words are signs, all things made up of signs are languages" (Krampen, 1979, pp. 34-36).
The idea that society is reflected in the environment is common to another line of thinking that is generally known as anthropology. Through lengthy and detailed studies researchers such as Levi-Strauss, Hall and Rapoport examine the way culture is projected in environmental form. The exploration of the environment with emphasis on the communicative needs of people has proved to be beneficial. It has brought out a vast amount of information regarding the way in which people in different parts of the world and in different periods organize their social life and find ways of expressing and satisfying their needs. The anthropological approach tends to focus on the conditions of production of environment and to question the intentions of man in respect to the organization of space and, for this reason, appears less superficial than that of the historians. Nevertheless, its interests do not include the development of a model which will claim to utilize all bits of information contained in the man-made environments.

In order to clarify the discrepancies between the three approaches mentioned and the aim of the first part of the present study it is useful to employ a specific illustration. Let us consider, for example, a typical Gothic Cathedral. This building provides a place for man to express and satisfy his religious and spiritual needs.

The historian would view the cathedral as an expression of the society that created it and he would compare its features (eg. plan, windows, vaults, etc.) with those of other cathedrals similar or dissimilar in style and period. The anthropologist would examine the way the cathedral is currently used both as a place of worship and as a cultural symbol. Lastly, the semiologist would at first view the building as a symbol in its own right. By concentrating on its appearance irrespective of origins, he would proceed with the analysis of its features and the
way they are interrelated.

Our interest here lies in constructing a framework for deriving and classifying environmental information which will be used by designers. This is clearly aligned with an effort to examine as many bits of information embodied in the environment as possible. Consequently, the more the aspects of the wide and deep domain of man and society which are studied the better. The previously discussed approaches, useful though they may be in their own right, concentrate on specific aspects of the environment's content. Thus, if the problem is to be studied in its full dimensions, a new approach is needed.

1.2. The Generator of Environmental Forms

The information man receives from man-made environment is derived from noticeable differences in the forms of objects. By contemplating a house*, for example, man distinguishes its entrance, floors, windows, its overall shape, size etc. -to say nothing about its existence as a whole. Apart from identifying such individual features man may receive further information regarding the occupants of the house, their psychology, their position in society and so on. For example, the size of the house or the way the entrance is designed and decorated may convey messages as to the social status of the occupants, windows with window-boxes reveal a more inviting and welcoming disposition than austere or neglected windows of the same type and so on. Thus, in our search for a method of deriving and classifying environmental information, it would be useful to examine what causes differentiation in form-in other words, we must study the reasons behind the variety in forms.

* As we shall see in the second part of this study, man does not have to compare two different houses in order to draw information since what he contemplates is juxtaposed to the images stored in his mind from prior experience.
Architects have often questioned themselves over the amazing variety and complexity of environmental forms. Clearly, man changes his environment in order to satisfy his needs. For example, a house is constructed in response to man's housing needs, a traffic signal to direct and safeguard pedestrians and motorists and so on. All existing objects can be seen as a result of man's attempt to satisfy his needs. The basic needs account for the majority of objects. Yet, it must be acknowledged that a notable number of them result from needs which are less pressing (an electric can-opener is intended to make man's life easier while graffiti on a wall is the result of somebody's instantaneous urge for expression).

The question that arises at this point is whether the needs that initiate environmental change—and hence generate forms—are responsible for all the features of the end product. If we consider the need for housing, however, we immediately notice the tremendous variety of forms (eg. a hut, a block of flats, a mansion etc.) that man employs to satisfy it. Similar abundance in forms corresponds to each need that demands environmental change. This is so even for the commercially produced objects such as pens which mainly because of their size offer limited possibilities for variation; nevertheless, pens abound in shape, colour, image and specification.

The issue is further elucidated if we take a closer look at the need which generates environmental forms. This need never stands on its own. Instead, it typically arises within a situation that involves a particular person or group of people. A family of four, for instance, will need a different house* as soon as the children become too old to share the second bedroom of their present one. They will have many

* In modern societies, many primary needs are satisfied indirectly because of the division of labour and the fragmentation between the production and use of objects. Thus, modern man can often select and purchase the object he needs from those existing in the market, his decision again being based on his particular requirements.
requirements for a new residence which will include the need for two separate bedrooms for the children.

Thus, the moment the need for a particular change in the environment arises, it is immediately amplified by an extensive set of "by-needs" which act as specific requirements and affect the form of the end product. Evidently, the need for housing involves many "by-needs" such as the need for a place to sleep, cook, dine etc., the need to allow air and light to come in, the need to provide safety, warmth and comfort and so on. The illustration given above indicates that "by-needs" can be expected to be specified further.

Finally, the end product does not only correspond to the original or "primary" need but must also conform with a long list of "by-needs" or "secondary" needs. Thus, the end product will function both with regard to the primary need (ie. primary function) and in response to all secondary needs (ie. secondary functions). This widened concept of the need that governs environmental change and comprises both the primary and secondary needs we will call the "composite" need.

"By-needs" appear singularly important in the shaping of man-made environment. Let us examine them, therefore, in order to test whether they can be held accountable for the variety and complexity of forms.

From the illustrations given above with respect to the need for housing it follows that "by-needs" result from the combination of the nature of the primary need and the characteristics of those who will use the end product. Thus, the additional requirements that a house is expected to satisfy will be hierarchized and specified depending on the person or group of people who will use it. A middle-class family, a pensioner, a couple of young artists or an ambassador with his family
will all express different "by-needs" with regard to the place of residence they look for.

Studies like the design methods that were formulated during the last twenty years (eg. Alexander, 1966; Riba, 1965; Matchett, 1968; Broadbent and Ward, 1969; Jones, 1970) are helpful in unfolding the constituents of the composite need, especially in relation to the nature of the primary function needed. These studies aim at the systematic analysis of design problems whether industrial, urban or architectural in nature. Alexander's approach proved to be highly influential for a significant period of time. According to him, when the design problem is broken down to its constituent parts we arrive at the shape of an inverted pyramid which starts from the function or activity needed and ends up in listing all "by-needs" in the form of requirements that the end product must satisfy. This analysis of the requirements involved in the primary function of a kettle are outlined in figure 1.

![Diagram of Kettle Function and Economics](image)

21 requirements such as;
- it must pour clearly
- it must not cost too much
- it must not be hard to store in the kitchen
and so on.

FIGURE 1
Even in societies where considerable amount of time is spent in life-sustaining tasks, there is a great amount of time devoted to "non-functional" tasks, such as ornamenting objects like this Maori boat from New Zealand. Here, environmental change was a direct result of the users' basic human needs.

**FIGURE 2**

Further research on the issue, however, has suggested that the body of knowledge offered by design methods is incomplete as it mainly focuses on the activity needed and the apparent characteristics of the user (see, for example, Daley, 1969, and Colquhoun, 1969). Contemporary developments in research have suggested that in order to complete our picture of the composite need certain notions of the users' basic human needs must be taken into account (fig. 2). Thus, Lynch, as early as 1960, referred to the "by-need " for clarity in the environment in
response to man's need for orientation (Lynch, 1960, p.7), Norberg-Schulz postulated that forms must contain existential meanings* (Norberg-Schulz, 1963, 1971, 1980), Rapoport stressed the significance of the "by-need" to keep complexity in accordance to the users'need for a balanced rate of perceptual input (Rapoport, 1969, pp. 141-2; Rapoport and Kantor, 1967; Broadbent, 1973), Smith emphasized the need to design for the unconscious (Smith, 1974, 1977) and so on.

We thus arrive at the complete picture of the composite used, i.e. of what is required by a specific environmental change. Whether these requirements are operational or instrumental to the primary function (eg. a house must have an entrance) or whether they derive from the users' needs and characteristics (eg. the users'aesthetic needs demand their house to be aesthetically pleasing), they all somehow affect the shaping of the end product. The question is whether the composite need, in its most widened form, accounts for the variety in forms. In other words, do the constituents of the composite need explain the entirety of the features of man-made environment or do additional parameters play an important role in its shaping.

1.3. Social Environment and Environmental Change

To answer the question let us for a moment consider the way environmental change is generally conducted. The composite need may well act as a guide for what needs to be altered in the environment. Yet, the people who undertake the production of forms do not always coincide with those who will use them. An architect, for example, may design a villa or an office block in a number of different ways and still be within the

* In other words, man's experience of forms should enhance his sense of existence.
requirements of his client's composite need*. There are many examples of office blocks which vary largely in design and appearance although they all obey the same composite need. Therefore, the "doer", i.e. the person or people who create environmental change, can act as an independent factor as he may affect the shaping of the end product in ways that are beyond the users' requirements.

In addition to the doer's personal input, the production of environment is also affected by a set of parameters which stem from the wider context in which change occurs. Thus, the climate and topography, the availability of materials, the existing level of technology, legislation such as building regulations are all reflected in the end product. The height of a building, for example, must not exceed what planning requirements dictate for a specific area even if its owner and user wish so.

Thus forms are bound to incorporate projections of the doer and the wider social context while at the same time they must conform with the limitations of the physical environment. All these factors and parameters affect the shaping of the final product and act independently of the primary need that initiates change.

To acquire a clearer picture of this point it would be useful to think in terms of the following simple diagram:

* It was the belief of functionalists that "not only the form of an object should express its function, but the form should be inevitably and uniquely determined by that function" (Brolin, 1976, p. 36). Yet, even in technical objects which according to Bense require the highest degree of specificity (Krampen, 1979, p. 10) this determination is unattainable. Even if the requirements of the composite need appear extraordinarily extensive (as described by Lawson, 1980, p. 71), there still remains enough freedom as regards the final shaping of the form (Colquhoun, 1969, p. 270).
Transformation of the physical environment

Social Environment

Noticeable differences in Man-made Environment convey information about what caused them

FIGURE 3

The circle at the left-hand side represents the variables involved in the making of the environment, namely: the user and his needs, the doer, and society with its laws and restrictions. These three factors are interrelated; for example, the composite need, like all human needs, is to an extent a product of the society in which it arises, the designers' attitudes towards the environment are greatly influenced by the type of education he has had and this cannot not be seen outside the social context and so on.

Thus, man-made environment can be regarded as the imprint upon the physical environment of the interaction between individuals and their needs, on the one hand, and the aggregate need to live together in an organized society on the other. In this, the physical environment entails its own peculiarities and resulting restrictions.

In the process of environmental building therefore, elements of the social environment are materialized in the end product. On the other hand, man, the eventual user of the built environment, should in principle be able to recognize these traces and transform them into
information about their origins. In the above diagram, this process is depicted by arrows which travel from "man" via the noticeable differences in the "Man-made Environment" to the data about man and society in the "Social Environment" that caused them. We must be reminded, however, that in the first part of the study we are only concerned with the informational content of man-made environment. The question of what information people actually experience in the environment will be reserved for the second part of this study.

In the following sections, we will examine the informational content stored in man-made environment in the process of its making. Based on the relation between the social environment and man-made environment, we will explore the way data from the former are embodied in the latter. To ensure that this relation is studied in its full dimensions, we will first scrutinize the primary need and the "by-needs" of the composite need and then the doer and the wider context in terms of the information they store in the objects produced. The aim of this search is to establish a model for deriving and classifying environmental information.

1.3.1. The Primary need

As noted earlier, the primary need is of singular importance since it initiates environmental change. This is because the overall purpose in the existence of objects is to facilitate the function or activity required by the primary need. Therefore, the end product as a whole constitutes the materialization of this need and thus represents it. For example, a house represents the need for housing, a kettle represents the need for boiling water and so on.

Primary needs, however, are not simply accidental wishes that are
randomly expressed. Instead, they are consistent with, and sustained by man's nature, and especially his motivation at a given moment. The motivation of the eventual users of the end product will be based on their past experience in life, their values, ideals and attitudes, the specific society, culture, or subculture they belong to and so on. Whether the environment will change or not will depend on their priorities and determination in view of the inevitable costs involved in this action. In any case, the primary need will be the result of the above extensive set of conditions and data that concern the users, the situation and the wider social framework.

Thus, environmental objects do not only embody information about the need that led to their existence in an abstract sense. They also constitute the materialization of all reasons and conditions that sustain this need. For instance, the informational content which is embodied in a specific house by the sea through the primary need, will be as wide and as deep as to include all data that answer the question "why has this particular house been built?" (fig. 4). This information therefore ranges from "man needs a shelter", or "it has always been important for man to be protected against adversity", to "a place to stay by the sea provides a relaxing and healthy living", or "Englishmen would rather pay the price of commuting to work than live in the city", or even "the Thomsons have finally managed to buy their second home". Clearly, the volume of this information covers everything that sustains the primary need to the last detail.
Evidently, the whole amount of information embodied in an environmental form through the primary need is conveyed by its mere existence. Thus, the object as a whole stands out in the environment and act as a "noticeable difference" which is a carrier of information. This quality spreads all over the environmental form and penetrates all its features.

This is made clearer when we observe the production of large scale environments like, for instance, the New Towns in Britain. The main reasons that led to the existence of Cumbernauld rest with the requirements for industry, the condition of Glasgow inner city areas and so on. These have emerged within the context of a growing society which aims at the maximization of its scarce resources for the benefit of its members through careful and often heavy-handed planning. This complex set of social conditions is embodied in all forms it gave birth to, and in the totality of their features. This information is therefore
Cumbernauld New Town as a whole, as well as any feature in it, embodies information about the reasons which led to the emergence of the town.

FIGURE 5
carried not only by the whole layout and image of Cumbernauld New Town but also by all individual houses and structures it incorporates — even by the buses introduced to service the area, the spot that appeared in British maps to indicate where the town is and so forth (fig. 5).

Finally, it is interesting to note that through the evolution of time, man's primary needs have not always been universal or eternal. It must be acknowledged that although the primary needs which relate to man's basic needs (e.g. physiological, safety needs etc.) have basically remained the same, others have evolved dramatically. Man's need to entertain himself has led in the past and today to the construction of theatres. Yet, the same need has nowadays become so diversified (e.g. the need for an opera hall, a cinema, a video machine etc) that modern man has at his disposal an immense variety of environmental forms to satisfy it, means that did not exist in the past.

It seems clear that as man evolves through the ages, his impact upon the physical environment is becoming more noticeable, both in quantitative and qualitative terms. Thus, in as much as primary needs are concerned, the volume of information transmitted to us through the man-made environment is far greater today than used to be a few centuries ago and there is no doubt that it will increase even more.

1.3.2. "By-needs" of the Composite Need

a. Operational "by-needs"

Let us now proceed with the scrutiny of the rest of the elements of the composite need in terms of what they allow to become materialized in the environment.

We have already discussed how primary needs are furnished with
"by-needs" which derive from the nature of the primary function and the characteristics of the users. Thus, the primary need to sit will not just produce a chair. Instead, "by-needs" will specify the object further and will lead to the production of a kitchen chair, a dentists' chair or even an "electric chair"(fig. 6). Differentiation of form among these chairs conveys information about the specific primary functions, on the one hand, and the characteristics of the users and the situation on the other. A substantial amount of the content of man-made environment (ie. information which relate to the complexity and specification of objects) is embodied in it through the "by-needs" of the composite need.

Furthermore, it must be noted that apart from being subsidary to the primary need, "by-needs" retain their character as needs in their own right. Thus, they also allow data similar to those of primary needs to become materialized in the environment. Windows in a unit such as a house, for example, are the result of a particular "by-need" of the need for housing. Yet, they can also be seen as autonomous units which satisfy the need to let air and light through and not to isolate the inside from the outside. Thus, the existence or absence of openings in the walls is the result and, hence, represents the owner's views as regards seclusion and isolation (fig. 7). George Megas refers to houses in Thrace which have mere openings in the roofs for security reasons (Megas, 1969, p. 22).
All the objects above were produced to satisfy the need to sit. Yet, they differ in the way this is done. The design of the two chairs on top aims at a certain degree of relaxation. The stools in the Bauhaus canteen (Dessau, 1925) with the painted wooden seats, below left, are austere and less comfortable since the function needed was "to sit and eat." A certain austerity also characterizes Tutankhamen's throne (c.1350 B.C.), below right; the need "to sit in regalness" covered the chair with gold, precious stones and symbolic adornments.

FIGURE 6
Windows and openings are scarce in the tower-like structures of Vatheia, Greece. The settlers' adverse relations with neighbouring villages demanded that the need for security becomes more important than ventilation and lighting needs.

Complex environments provide perfect illustrations of the fact that operational "by-needs" are both steps towards the overall function or activity needed as well as primary needs in their own right. Environments like a house, a city or even a student's room (fig. 8) are places that exist because of an overall need which is broad enough to contain an extensive set of "by-needs". Thus, they abound in environmental forms which convey information about the users' characteristics both in relation to the overall need and with regard to their existence as individual entities.
The existence of particular objects like a pair of scissors, a specific book, a tape recorder etc. in a student's room depicts the user's characteristics by conveying messages about the reasons he keeps them.

FIGURE 8

In addition to this, it becomes particularly interesting to observe environments, and especially living environments like the ones cited above, as they change through time. The users' changing attitudes, beliefs and motivation as a whole demand different solutions to be given to "by-needs". Moreover, "by-needs" and even needs themselves are expected to evolve through time. In the past, for example, leading a religious life was an unquestioned must for the average middle-class western man. Yet, this state of affairs has now changed, church-goers are fewer than they used to be and, in general, religious feelings are not dominant in people's lives. Because of this, churches are becoming less prominent features in cities. This changing environment conveys information about the social and psychological conditions that have affected the nature of the need to lead a religious life (figs 9 and 24).
Athens abounds in unfinished churches. The fact that the money is expected to come from people in the parish denotes that people do not value the significance of the need as high as they used to.

**FIGURE 9**

b. "By-needs" which relate to basic human needs

Let us now examine how the "by-needs" which relate to man's basic human needs allow social information to be embodied in the environment. These components of the composite need exist regardless of the overall function or activity needed as they express what man requires from every environmental form.

At the purely physiological level, these "by-needs" can be held responsible for the dimensions, shape and texture of forms. Thus, a person needs an area of about 40 cm X 45 cm to sit on, corridors must be at least 60 cm wide and so on. These features convey information about the merely physical characteristics of the users and have been readily codified in handbook manuals like Neufert's (1950).

What is interesting to note however is that, although they appear
as standards, in reality these features fluctuate and by so doing they allow a number of social and psychological data to become represented in concrete form. For example, a spacious bathroom and a soft and stylish armchair are on the luxury side whereas a bed carved in rock is not. In a similar sense, the spacing of tables in French cafés is different to that of English ones although manuals would only have given one measure for the distance between the backs of two chairs (fig. 10). Hall's (1961, 1966) and Gehl's (1978) theories on physical and psychological dimensions indicate the role of the users' personal data in this. Thus, the fact that the Englishman's conception of personal space is different from the Frenchman's has caused the difference in distances between tables in the cafés. Apart from this, additional data are also embodied in the particular environment; data like the relationship of the individual with other members of his culture as a whole, the threshold beyond which his personal tranquility would be threatened and so on.

The crowded spacing of cafe tables in France indicates the dominant conception of people's personal space in this country.
There are numerous illustrations of discrepancies in dimensions, shape and texture of forms as a result of the users' varying social and psychological characteristics. Differences between Spartans and other citizens of Ancient Greek cities or between the Incas and the Pueblos as regards standards of comfort (Rapoport, 1974, p.91) or differences between Americans and others as regards noise levels (Baranek, 1966), all these along with their materializations in observable form illustrate this point.

As "by-needs" move from the physiological to the purely psychological however, the absence of concrete dimensional standards makes this materialization hard to trace. This can be seen in the problem caused by the "open door" policy of an American firm in Germany as regards the safety needs of the people involved. "In this company", Hall writes, "the open doors were making the Germans feel exposed and gave the whole operation an unusually relaxed and unbusinesslike air. Closed doors, on the other hand, gave the Americans the feeling that there was a conspirational air about the place and that they were left out". The difference between the two cultures is further represented in the environment by the fact that Germans tend to produce heavier chairs and more solid doors than Americans (Hall, 1966, pp.127-128).

Another interesting illustration of "by-needs" which relate to the basic human needs can be seen in the way doors open (fig. 11). It has been observed that in Britain doors tend to be designed so that the person who enters a room faces the nearby wall. Presumably, this solution, which is typical of older buildings, is a response to the occupant's need for privacy as well as the need to shelter the room against draughts. In other cultures, as for example in Greece, these needs are not considered important as to demand any particular design
requirements; the operational need of attaining maximum space when the door is held open determines the solution. In each case, different social, psychological and climatic data set different priorities, all of them being embodied in the resulting noticeable difference in form.

The way doors open in Britain (left) and in Greece (right)

**FIGURE 11**

Furthermore, there are many ways with which people satisfy their need for identity in relation to their homes. This "by-need" appears stronger in housing complexes in which dwellings appear identical. In Greece, residents of working-class estates often colour the walls of their balconies in unusual tones, wherever the law allows (fig.12). This requirement for individual flats to stand out results in a confusing set of patches of different colours as though there was a secret competition amongst families to outdo one another. The end product embodies social information about the users' need for preserving, transmitting and re-experiencing their identity as well as the fact that this need has been suppressed by the housing scheme. These people felt that the need for housing involves more "by-needs" than the designer thought.

The users' basic human needs do not only affect components or aspects of the end product but they are also capable of shaping its overall design. The illustration of this point is based on Levi-Strauss's
These illustrations from Athens show how the need for identity can be satisfied by means of a painted wall, a flower pot by the entrance or by features such as the imposing dome of the impressive suburban villa on the right.

FIGURE 12

observations. In his writings, Levi-Strauss maintains that many native societies have consciously chosen to project into space a notion of their institutions (Levi-Strauss, 1963, pp. 331-332). It seems reasonable to suggest that these societies have to some extent realized the role of the image of objects and acknowledged the need for the overall layout of their settlement to attain symbolic meaning.
The village plan of Omarakana in the Trobriand Islands of North Western Melanesia, for example, shows such an organization (fig. 13). The chief's hut is located in the middle along with certain important communal activities such as the dancing ground and the place where the dead are buried. Around them, in a neat circle, are the yam storehouses which are elaborate, sacred in character and the object of many tabbos. Beyond a circular street and in the same concentric pattern, the huts of the married couples form the outer edge of the village. It is interesting to note that although food is stored in the inner ring, cooking and consuming it takes place only in and around the family dwellings of the outer ring (Levi-Strauss, 1963, pp. 136-137).

The significance of this illustration in the present context does not lie in observing what characterizes the culture as such but in the
fact that the villagers felt the need to turn it into symbols in space. The overall layout of the settlement, which reflects the villagers' view of the world, is the result of their need for safety and identity. Similar illustrations, relating to houses the image of which functions as the users' "imago mundi" in a smaller scale, are found in Rapoport (1974, pp. 76-87).

c. Conclusion

The discussion in the preceding sections has shown that the "by-needs" of the composite need allow a substantial amount of information to be embodied in environmental forms. This information describes the user, the situation and the function or activity the form facilitates. It is interesting to note that "by-needs" do not only embody information about the users' apparent characteristics (e.g. number, weight, age); instead, they often depict deeper social and psychological data which often tend to be ignored (e.g. the users' past experience in life, their overall and specific motivation, their position in society and attitudes towards it, the specific development of their basic needs such as the need for safety, privacy, identity, cognition, belongingness and so on).

All this information can be embodied in any feature of the end product starting from a detail like the colour of a wall and ending with the whole layout of a village plan etc. It must be noted however, that the noticeable differences produced by "by-needs" can be responsible for the basic dimensions, shape and texture of forms.

1.3.3. The External Factor (exogenous variables of environmental change)

As noted earlier, the composite need alone does not explain the
variety of forms. The complexities that remain inexplicable appear to be sustained by a series of parameters and variables that have little or even nothing to do with the need. In 1.3.3. and 1.3.4. the aim is to examine the information stored in such noticeable differences in form.

The interfering parameters and variables can be approached by shifting our attention from the users and their requirements to the doer* (i.e. the person, or people who produce environment) and the wider context in which change occurs. In this section, we will examine the information stored in the environment by the latter, which we will call the External Factor.

a. The Natural Aspect of the External Factor

It is apparent from the start that in a strict sense the elements of the natural environment (eg. available materials, climate, topography, natural phenomena) and devoid of any social information. For example, wood, rain, volcanoes, the lapse of time and so forth do not convey any information about the society of man.

But if this is so, what social information does the natural aspect of the External Factor contain?

To answer the question, let us observe a few cases of production of environment which were somehow constrained by the natural environment. For example, let us take a close look at Stonehenge (fig. 14). There is evidence to suggest that the primitive builders of the shrine had to travel far (by their standards) to find and collect the stones they used (Fletcher, 1961, p.3). Hence, it appears that they had developed a certain

* When user and doer coincide, we will examine the person's influence as a producer of environment.
Stonehenge (c.1500 BC).
Not only does the final design obey cosmic rules but also, for some reasons, the site had to be the one chosen while the stones had to be transported from elsewhere.

The temple of Athena at Delphi. The ravine between the two mountains in the picture offers a breathtaking view.
system of values which forced them to overcome the limitations of the original site. In a similar sense, the Greeks chose Delphi, which they called the "navel of the world" (fig. 15), as the location for their most sacred shrine representing "a combination of the unconscious and an open-eyed intelligence" (Mumford, 1979, pp. 170-198). Their choice of the particular breath-taking site has embodied in the environment their values as regards the landscape and the human mind (Scully, 1979, p.4).

It follows from the above that there are two ways in which the natural aspect of the External Factor embodies social information in environmental forms. Firstly, materials and natural phenomena are eventually soaked with social information following the way their qualities relate to society's needs. The stones and the Delphi landscape fitted the needs of the shrine and were thus imbued with sacred meaning.

The second way to embody social information in the environment is related to the degree of freedom allowed by the limiting factors. The limitations the natural environment exerts on the doer can be so drastic that the view that topography and materials determine forms like those of primitive villages has often been expressed (as f.i.by Evans-Pritchard, 1960, pp.63-69). Yet, it appears that there still remains some degree of choice for the doer*. It is exactly how these limitations are treated that embodies social information in the end product. In the above illustrations, the end products convey social information about the value systems and priorities of the people involved.

* In his book "House, Form and Culture", Amos Rapoport presents a remarkable body of illustrations as a criticism to the determinist views (Rapoport, 1974, pp.38-73). A similar approach referring to topography, the limitations of the Greek landscape and how they are tackled is offered by Kyriakidou-Nestoros (1974, pp.16-24).
The abundance of timber in Scandinavia and its socio-economic implications register in many ways in the Swedish environment.
Let us now examine a few more illustrations in the light of the above. A Scandinavian timber house is a direct consequence of the abundance of timber in the land. Yet, since the value of timber is high in the world market, such a house is also a consequence of (and, hence, reflects) the land's economy and the country's social and economic priorities both today and in the past (fig. 16).

Similarly, the peaceful and continuous natural phenomenon of the ageing and deterioration of buildings with time (a facet of the natural aspect of the External Factor which is often ignored) means different things and is treated differently in different social contexts (fig. 17). Old building artefacts and settlements do not only convey information about their age. Instead, they are particularly dense in social information about the society that created them, the attitudes of other societies that used them as well as today's society taken both as a whole and at the level of individuals. Thus, environments of the past are respected, ignored or even electrically treated by the present users depending on their overall and specific motivation, their values and priorities and so on.

b. Technology

Let us now shift our attention from the natural to the social aspects of the External Factor. Their influence is expected to leave in the end product traces which are denser in social information. The reason for this is that limitations of the social environment are products of society and, hence, contain social information themselves.

In the case of technology, for example, the level of scientific knowledge that the particular society has achieved is reflected in the end product, especially when this is a technical object (fig. 18).
The way an ageing building is treated is a function of the users' characteristics. The illustrations on top are taken from the commercial centres of York (left) and Athens (right). In the first case the users tried to make the most of the building by preserving its image while the owners of the Athenian neoclassical building found the absence of strict conservation laws handy and allowed it to decay. The entrance of the Architectural School in Athens, below, is covered in political posters the years following the fall of the military dictatorship thus signifying that student politicization was stronger than any feeling of respect to the past.
FIGURE 18  The British Isles, in the first printed edition of Ptolemy's "Geographical" with maps, Bologna 1477. Both the designer's and researchers' effort and the inefficiency of instruments at the time are characteristically portrayed.

TREASURY OF ATREUS

FIGURE 19  Plan and sections of the tomb of Agamemnon (The Treasury of Atreus) at Mycenae.
According to a recurrent theme in modern architectural theory, the level of existing technology determines the production of forms in the sense that the doer can do little else than employ the most efficient solution available. Yet, this is so only in cases of artefacts which because of their nature depend on the maximum exploitation of the doer's resources. Otherwise, nothing forces the doer to follow the latest technological advances; he just chooses the technical means he wants in order to arrive at the product he wishes (Rapoport, 1974, p.46).

Although the Greeks were aware of dome structures for example, they reserved them for tombs (Orlandos, 1960, p.393) (fig. 19). Thus, not only the dome structure itself reveals the level of scientific knowledge of the society but also its conditional application denotes the existing values and priorities. Furthermore, this particular use of dome structures attaches special meanings to them.

The way people behave as regards the tremendous technological achievements of our age has drastically changed the image of cities. FIGURE 20

* This choice also allowed a certain vocabulary of codes to emerge in respect to the technology and shapes employed. A similar observation has been expressed for differences in the employment of the circle, the square and other shapes when dealing with churches, civic and other buildings (Eco, 1980, p.26; Zevi, 1957, pp.187-190).
If one takes an overall look at technology in modern societies it becomes apparent that recent socio-economic trends have led to the development of impressive transportation and telecommunication systems (fig. 20). Such changes which are typical of our century can vary so much in scale that they range from the prominent positioning of the television set in modern living-rooms to the dispersal of large scale activities as current trends in population and land use show (Holliday, 1977).

c. Legislation

Legislation is another way in which the social context affects building form. Building regulations are issued to help society cope with problematic situations and they are characterized by a certain philosophy stemming from the values and ideals of the particular society. This can be seen both in over-protected areas as well as in cases where state control is practically non-existent. Thus, the anarchic Manhattan skyline is the manifestation of the omnipotence of the free market forces (fig. 21).

Building law did not always exist in the rigid written form of today. In societies of the past, people followed certain unwritten codes, a product of agreement between villagers based on experience over the ages. Rapoport refers to indian rules in Latin America concerning the need for narrow lanes and areas of shade and to chinese codes in Peking with regard to the hierarchy of the colours used in buildings (Rapoport, 1974). In the Greek island of Naxos,a traditional code sets building height limits to ensure access to the view, exposure to the winter sun and ventilation for all houses. It also establishes the practice of floor ownership allowing a person to own the ground floor while someone else owns the first floor and still a third party
The image of Manhattan skyline opposed to Nash's Park Crescent. The difference between American and English societal values and priorities of different eras, as well as between the countries' respective histories, has produced building regulations responsible for this dramatic contrast.
Top: Santorini. The view to the sea
Bottom: Skyros. Roofscape.
The massing of houses in the Aegean settlements reflects the bonds developed among the settlers when the villages emerged.

FIGURE 22
may own the terrace (Polychroniades, 1974). The feelings of kinship and belongingness that existed in the community for a long period of time are registered in built form through such common codes that the builders agreed to follow (fig. 22).

d. Economy

The economy of change is another facet of the External Factor which poses limitations on the doer and affects the end form. It has already been noted that Alexander considers it highly significant in his definition of the composite need (see 1.2). It is no wonder that amongst the most fundamental social information embodied in the so-called International style in architecture is the struggle to achieve maximum returns at minimum costs. There is no need to explain how drastic this limitation may prove to be. Nevertheless, producers of environment often decide* to go for a more expensive form to achieve something particular, whether this is personal status or the satisfaction of as many of the users' needs as possible. The more the doer deviates from the norm, the more social information will be embodied in the end product (fig. 23).

e. Culture

There appears little doubt that culture effects environmental change and should, therefore, be included in the External Factor, although several writers have expressed different views (as f.i. Kubler, 1962, p.9, who denounced the importance of analyzing culture when dealing with the history of architecture). The prominent anthropologist Ruth Benedict maintained that in different cultures the emphasis may be put on different aspects of life, as for instance economics, religion, sexual relations, maternity and so on (Benedict, 1952, pp. 15-32). The difference in religious attitudes between our

* Naturally, this decision is mainly a function of the client, if any.
In an attempt to avoid building a drab housing estate, like the one on top, Erskine employed his ingenuity along with a mixture of mainly cheap materials and the consultation of the community of Byker, Newcastle (bottom). The result portrays both the designer's values and motivation as well as the users' individual needs.
The fact that il Duomo dominates the skyline of Florence is consistent with the importance of religion at the time the city took shape as well as with society's present respect for the country's cultural and architectural heritage. This latter fact, which may have something to do with tourism, is not often seen in modern western environments.

FIGURE 24
society and medieval society has been materialized in the prominent position of the church in a typical town of earlier times (fig. 24).

But even within contemporary society, there are many discrepancies in form which represent cultural differences (see 1.3.2. and Hall, 1961, 1966). An interesting study of the American bathroom as an environment which conveys information about the particular society's views for the body, privacy and comfort, has been presented by Kira (1966, p.7).

Thus, culture restricts environmental change in the sense that it forces the doer to obey certain norms which are, then, embodied in the end product. The way individual doers counteract on the socio-cultural aspect of the External Factor will be reserved for discussion in the following section.

f. The particular conjuncture (timing)

It would be an omission to ignore the effect of the particular temporal context of change. The element of time acts on the production of environment in a number of ways. The continuous ageing of built form and man's reaction to this have already been discussed. In the present context, the temporal aspect of the External Factor is seen as the outcome of a combination of circumstances (in the form of synchronicity of events) which occur either before or at the time of change.

Man-made environment can be marked by events as varied as somebody's accidental death which left an object unfinished or changes in society's trends that affected the doer's philosophy (fig. 25). There is still a debate among historians as to whether Zeitgeist (i.e. the "Spirit of time" in a particular society seen as a whole) determines architectural
Reflecting changes in society's standards and values, the painter is characterized by different attitudes in the way he regards both natural landscapes and his relation to his paintings.

In the painting on top, he tries to capture nature within a measured orderly framework ("Landscape with the Burial of Phocion", by Poussin, 1648); in the one in the middle, he tries to portray nature's vitality without losing control of its underlying structure ("Lac d'Annecy", by Cezanne, 1896); Finally, he uses nature as a source of plastic forms that can be liberally transformed to fit into his vision of the universe ("Nudes in the Forest", by Leger, 1909-10).
production and many writers have adopted a deterministic viewpoint (as f.i. Pevsner, 1979, p.17). Admittedly, in the afore-mentioned cases the timing of change may have marked the end product in ways that could not be avoided by the doer. One expects this to vary depending on the nature of the conjuncture. In any case, it lies beyond the scope of the present study to adopt a stance as regards the question of how Zeitgeist influences environmental change. The interest in the present context lies in examining the relationships between society and form as such, rather than in coming to generic conclusions about the various influences.

Since environmental change is influenced by established models and prototypes (Rapoport, 1974; Broadbent, 1973, p.418; see also Duncker, 1945, for the idea of functional fixation), end products contain traces of solutions that preceded them. For example, the form of Edinburgh New Town is not only the consequence of the fact that the aristocracy and the professional classes wished to improve their living standards. It was also marked by the particular time in history that this happened and the prevailing attitudes of contemporary designers and policy-makers.

Thus, change was firstly influenced by their appreciation of French city-building of the time. The French influence led to Craig's inspiration from the development of Nancy accomplished in the years between 1751 and 1755 (Adams, 1978, p.76). It registered in the environment in the form of the overall layout of wide boulevard-like streets. As in French architecture of the time, the emphasis is placed on the street and the elevations facing it, while interior spaces are merely fitted in the general plan (fig. 26).

Furthermore, it is interesting to note the tight link that had
The drawing above left depicts Fleshmarket Close in Edinburgh Old Town before the expansion. Living conditions were similar to those of a number of residential quarters in Paris. An exaggeration of the solution adopted for the French capital is given in the drawing above right. Although Edinburgh's problems were treated by expansion and not renewal, the design of the New Town (below) was clearly influenced by the French principle.

FIGURE 26
developed between the Scottish upper middle class and England, especially following the 1745 Rebellion. The materialization of this bond can be seen not only in street names (Rose Street, George Street, etc.), but also in the kind of living the New Town was asked to promote and which, as Smout puts it, was like London (Smout, 1969, p.348).

In cases like the one above, altered environments embody social information about the people involved and especially their motivation, values and attitudes. It is also expected that they contain information about the social environment in which the solution adopted firstly emerged.

g. Conclusion

It has been shown that every aspect of the External Factor (whether natural, societal or temporal) poses its own limitations on the doer.

The informational content embodied in the environment through the External Factor can be described as follows:

a. the social and psychological characteristics of the people involved (user or doer) and especially their values, attitudes, motivation and so on. These characteristics determine the priorities according to which they overcome the limitations of the External Factor.

b. The social meaning, significance or history embedded in the limiting factor itself. As the limitations of the social aspect are products of the society of man, they are dense in social information. On the other hand, the limitations of the natural aspect are likely to contain less social information; the content that is embedded in them is merely the outcome of their use-value and significance to man.
In a holistic sense, the effect of the social aspect of the External Factor in built form is the materialization of the fact that there exists a world of man, in all its norms, rules and complexities, and any production of man-made environment occurs therein. Accordingly, the natural aspect signifies the natural environment, the raw materials to which man adapts. And these can only be limited at least in some respect, whatever the scale of environmental change*.

Lastly, let us consider the features to which social information of the External Factor correspond. It is clear that the External Factor operates at a different level from the composite need: it does not generate forms and it does not set the standards of their shaping; still, it may influence any of their features. In many cases, this influence has been so drastic that writers have expressed the view that the External Factor determines the shaping of forms.

1.3.4. The Doer's Personal Input

To conclude the analysis of the environment's content we must consider the influence of the doer. Apparently, this term includes all those who shape forms, whether they design them or whether they actually construct them. What matters in the present context, however, is the person or persons who are in control of the form of the end product. For this reason, the embodiment of social information in the environment will be seen as originating from the designers of environment rather than the executors of instructions in drawings -although the latter may often influence the shaping of forms independently.

* Precisely these statements are embodied as bits of information in all environmental objects the production of which has been somehow constrained by the External Factor.
Thus, the doer is the person or persons who conduct environmental change and who, by doing this, are in fact embodying social information in the environment.

The discussion in the preceding sections however has shown that the doer can not be held responsible for all this content. For some of the embodied information he is not responsible at all; he simply cannot do else but allow to materialize*.

For another body of information he is partially responsible as he treats the problem according to his values and experience. In this case, along with information about the limiting factors, his own social and psychological characteristics are materialized in the end product.

Finally, there appears to be a third body of information, the outcome of the doer's purely personal imput; i.e. what has not been dictated by the above limitations. Designers have often given explanations about what they wished to achieve in a particular project. Bernini, for example, said that when he designed the Piazza od St.Peter in Rome, he aimed at conveying the image of the mother-like church embracing Catholics who are united in their faith (Norberg-Schultz, 1980, p.150). His design materialized his deep religious feelings as well as his view of the role of the church (fig. 27).

Evidently, few designers find it necessary to reveal and analyse their intentions with respect to a particular scheme. Moreover, it appears reasonable to argue that there may be a body of information which stemms from the doer himself but which he unconsciously stores in the environment (eg. as an expression of his personality).

* When, for example, he is asked to build a kitchen, the end product will somehow resemble a kitchen.
Our interests therefore demand that instead of examining the comments of named designers, we focus on the general case of a doer as a person in his own right; i.e. a person with a certain past experience of life, who belongs to a certain culture, social group and so on and who is characterized by a certain overall and specific motivation in life.

As these characteristics differ between different doers, individual approaches are also expected to differ*. It can be argued that, at least in theory, there is always a personal dimension in this. Saussure's distinction between "language" and "speech" (Barthes, 1967, pp.13-22) stems from the uniqueness of different individual approaches.

Let us now proceed with the examination of the doer's personal input in environmental forms. In view of what has been discussed so far, the production of environment can be divided in two stages, as far as the doer is concerned. The first stage comprises the interpretation of

* In cases in which the doer is more than one person, a combination of the characteristics of the people involved is in effect.
the situation and the definition of the composite need (analysis) and the second is the process of designing the environmental form (synthesis).

a. The analytical stage of environmental change.

Up to a point, what needs to be done in a situation is dictated by the situation itself. When the client asks for a four-bedroomed villa, the designer has to design a four-bedroomed villa. And, as noted in 1.2., this specificity covers the whole range of "by-needs". Along with the limitations of the wider context, all these act as constraints on the doer, some of them being negotiable while others are immovable.

Let us now consider the doer who is asked to solve a particular problem by altering the environment. Provided that he agrees to be responsible for environmental change, he has first to analyse the problem so that he becomes aware of its requirements. Based on his prior experience and motivation, he will interpret the existing situation and he will define the composite need.

It is expected that most elements in the composite need will be defined correctly, i.e. in accordance with the user's background and needs. The doer's understanding of the user however, is not always complete. The result is that the situation is misinterpreted and certain "by-needs" are ill-defined or even ignored. The differences in the way different people interpret a given situation can be considerable.

An example of what can result from such a misunderstanding can be seen in what happened in a new housing estate for the rural population in the south of Italy. The toilet bowl (fig. 28) was being used as a cleaning tank for grapes; the peasants suspended a net inside the bowl and then flushed water at the grapes until they were clean (Eco, 1980;
In this case, the end product (toilet bowl, net and grapes) conveyed social information about the doer's past experience and attitudes as regards the situation, and especially his ignorance of the peasants' understanding of the world. It also portrayed the fact that the peasants showed notable flexibility of mental structures by converting the unknown object in their bathroom into something useful.

In the main village of the island of Kea in Greece, the steeply rising major street curves into a well kept square with a statue in its centre, one side of it offering a very good view of the village which spreads over the hillside (fig. 29). The appearance indicates that two or three houses were recently knocked down to form this space. Despite the spectacular view, the square is left empty of people who do not even use the chairs of the nearby cafe. Instead, they congregate around the corner of the approach street where a few steps lead to the other side of the village. Some villagers sit on the steps and others on chairs facing the street. They are not interested in the view offered from the veranda of the cafe at the square but in observing movement and activity and socialising with passers-by. The way the beautiful (but unnatural in this context) open space is used reflects the misinterpretation of the situation by whoever decided to form the square—presumably a higher administrative official with little contact with the village.

Such a misunderstanding was also made evident in Chandigarh, and especially its commercial and housing quarters (Hall, 1966, p.101). Brolin provided an interesting description of how the designers' and policy-makers' definition of the composite need would not suit the demands of the real situation (Brolin, 1976, pp.88-103) (Fig.30). Apart from the obvious social and psychological characteristics of the user and the doer, what is further represented in the end product is the
Kea, Greece. The square (above left), the view from it (below) and villagers sitting on the steps opposite the cafe (above right).
A number of the users' needs were not defined correctly by the designers of Chandigarh. Thus, the lack of provision for a family shrine forced the Indian family to use the closet (left). Furthermore, windows are often papered over to assure the privacy needed (right).

FIGURE 30

doers' insistence that the culture he is propagating is to an extent "better" than the one that exists. The fact that these misconceptions occur in a project of such a size involving much responsibility, is added to the social information about the doers' attitude.

An interesting case of misinterpretation of needs is often apparent when doer and user coincide. One does not have to go far to illustrate this. The way people dress, the way they decorate their living-rooms or their front gardens is, among other things, a function of how they
The house on the right employs elements which are taken from midde-class houses (elaborate metal front door, French shutters, orthogonal overall design with smooth finishing) and, by doing so, it attains an authoritative image that does not blend with the street, and the district in general. Most houses in the district are like the adjacent one on the left of the picture.

FIGURE 31

interpret their own needs. Many houses in Athens contain living-rooms which are decorated to the last detail and are practically never used as intended, as the main room for the family. The occupants often feel as though they were sociable families and try to preserve the room for the occasion which, in reality, seldom occurs. Thus, the room is not used as a proper living-room but it is maintained as a symbol. The occupants' ill-defined needs as well as their disposition towards the rest of society is portrayed by the locked living-room.

Similarly, it is common practice in squatter-settlements in the outskirts of Athens and Salonica to decorate the external appearance of a house with a variety of elements. Research has suggested that
In many projects such as "the City of Towers" by le Corbusier (above) and the House for the Elderly in Philadelphia by Venturi and Rauch (below), the particular intension has been the portrayal of the designers' views on design theory. Later, both le Corbusier and Venturi used the above designs to illustrate their points.

FIGURE 32
squatters tend to dissociate with their neighbourhood mainly because of
the area's social position as regards the rest of the city. It is not
surprising that the architectural elements employed usually belong to
the vocabulary of a typical middle-class suburban house (Malaspinas,
1983; see also Duncan and Duncan, 1976, for a similar study in Hyderabad)
(fig. 31).

Finally, let us examine the case in which the doer, apart from
the satisfaction of the composite need, is personally interested in the
end product for different reasons. In this case, the doer's personal
needs combine with the original need and the end product is required
to function at an additional level.

For example, many designers criticize certain trends in design as
a contribution to design theory. When the opportunity arises, the need
to come to a definite paradigmatic statement appears to them as important
as the original composite need. Architects, such as le Corbusier and
Venturi, clearly saw their work as functioning at this level and referred
to it in their writings (le Corbusier, 1947; Venturi, 1977). Their
overall and specific motivation is represented in the exemplary form of
the end product (fig. 32)*.

b. The synthetical stage of environmental change

An environmental form is never created magically
immediately after the designer identified the need for its existence.
Although the definition of the design problem is very important, the
actual implementation of its solution (both in space and in paper, if
needed) is at least of equal importance.

* This observation is not meant to be an underestimation of the role of
design artefacts in enriching and changing the language of architecture
but is merely pointing to the additional needs which the end product
must satisfy and which stem from the doer.
As time passes and the doer concentrates further on the situation, he identifies an increasing number of "by-needs" (Lawson, 1980). At this stage, while he is making up his mind upon their relative significance, an image of what the end form may be starts to loom up (Hillier et al., 1972) (fig. 33). Such an image usually starts from specific yet random elements and ends up in a whole. These two generally go together and demand a compromise*.

At this point, the doer starts disentangling himself from the dominance of the composite need and enters the field of synthesis which conceals new qualities. Evidently, analysis and synthesis are not divided by a temporal gap. We can consider them as two distinct functions which are complementary to each other; the main bulk of analysis precedes that of synthesis.

Einstein Tower in Potsdam, built in 1920-21 by Eric Mendelsohn (now destroyed) and an original drawing by the designer revealing his somehow sculpture approach.

FIGURE 33

* As noted earlier, this generally tends to follow certain existing models or prototypes as ways of achieving compromise. Citroen designers however claim that they design in a "tabula rasa" state of mind (Schmittel, 1979, p.61). What they mean is that they attempt to do so in as much as existing models and prototypes of car designs are concerned (see Barthes, 1981, pp. 80-81, for an appraisal of their designs)
It is in the process of synthesis that expressions of the doer's personality are allowed to come to surface. The reason is that at this stage of environmental change the centre of gravity is shifted from "the need arisen within a situation" to "the designer who expresses himself". This behaviour is largely unconscious (Maslow, 1970; see also Goffman, 1969). As Jung has argued, creative processes involve the unconscious activation of archetypal images and their integration in the design (Arndt, 1974, p.271).

Thus, the doer's personal input can be as extensive as that of any factor that interferes in environmental change. Let us not forget that until fairly recently historians of architecture and the arts tended to describe environmental forms solely in terms of the psychological characteristics of the individuals who designed them. Clearly, such an omnipotence of designers over what they design is no longer accepted*. Nevertheless, the fact that this once was the dominant view of historians indicates the extent of the impact the doer may have on the end product.

Evidently, the informational content of the doer's input includes a notable amount of his social or psychological characteristic, eg. his values and how strongly he believes in them (see fig. 27), his position in society and his aspirations (see Fig. 31), his attitude when he approached the design problem (see fig. 23) etc. In many cases, the final design may convey messages about the doer's personality traits like his daring disposition, the clarity in the way he approaches the problems he faces and so on (fig. 34). If nothing else, the personal touch of certain designers is often characterizing environmental forms (eg. the paintings of Picasso or the architecture of Mies van de Rohe). Thus, the designer's mere identity can be reflected in what he designs as it does in his personal handwriting.
Below: Tucker House, by Venturi and Rauch, Katonah, N.Y., 1975

One cannot expect that obvious womb-like and bird-like design followed by Saarinen and Yamashita, or the original blending of disparate elements by Venturi and Rauch had been dictated by the composite need. Yet, they are added to the informational content of the forms along with data from the designers' psychological composition; Saarinen is the established architect still willing to try new forms, Yamashita, on the other hand, attempts a breakthrough while Venturi and Rauch appear singularly original although they conform with traditional codes.
The information that the doer's personal input stores in the environment is not only limited to what concerns him as a person. Instead, designers often furnish their designs with a variety of widely shared images. The motherly embrace in Bernini's colonnade, the image of the womb and the face designed by Saarinen and Yamashita respectively, and many more schemes belong to this category.

The question that arises at this point is the extent to which the doer's input reflects data, beliefs and values shared by a wider group of people. If the relationship between the individual and society is regarded as a two-way relationship in which there is a reciprocal interaction between its two elements (as, for instance, argued by Fromm, 1955), then the doer's input can be seen as fluctuating between two ends: it may originate from his broader social framework as this has been experienced, understood and, consequently, sustained by him or, alternatively, it may be his own very personal, individual and perhaps idiosyncratic reflections, thoughts and evaluations on the subject. Poulantzas's concept of "people being carriers of ideologies" (Poulantzas, 1973) may serve to illuminate the first leg of the above distinction. Such shared ideologies range from values and beliefs limited to a small group (eg. a family) to the Zeitgeist seen as a whole. Thus, the doer's input may consist of messages that are not strictly personal but are shared by a wider group of people. For example, Bernini's religious convictions were presumably shared by the majority of his society.

The distinction between societal and purely personal input offers an interesting insight at the informational content of the environment by elucidating certain aspects of it that are usually ignored. The most important of these concerns the way individual designers embody in their
designs ideas and beliefs which although they have not been clearly expressed before, they are somehow shared by a wider group of people. An illustration to the above is offered by de Ventos's explanation of how the, what he calls, "objective-idealistic" Hellenistic style in architecture was transformed into the "effectivist-illusionist" Roman one. "In Rome", he writes, "the formal Greek repertory is used but its syntactical organization varies. Its elements are no longer used for their objective value but for the effect they are able to create on the observer... And the reason is obvious. Roman buildings and banners have to speak now, not only to a polis of cives who share its code, but to the barbarians in Gallia or in Hispania who are controlled by the ius gentium, who are entertained by the spectacles and who are impressed by its imperial 'image'. Its style has to be, then, more clearly decodable, more effectivist and more symbolic. Since the message must travel very far away, classical forms are transformed into Roman symbols". (de Ventos, 1980, pp. 186-7, his emphasis) (fig. 35).

It is unlikely that any scholar of history will maintain that the transformation of classical forms into Roman symbols was the consequence of an intentional "act of will" at a given moment in time. Instead, it is more probable that designers or decision-makers, or both, felt the gradually changing social framework (the increasing power of Rome). This understanding enabled them to design for a wider public using easily decodable symbols*. Thus, the end product conveys information about a number of social data of the time (eg. the role of the image, the magnitude of the empire, the education of the peoples it contained etc.).

* It is interesting to note how this particular analogy is reflected in other expressions of the Roman culture. It has been noted, for example, that Seneca's tragedies which were adapted from the Greek showed, amongst other things, an excess of declamation (Harvey, 1969, p.390).
The fine features of the Athenian Parthenon (below) were succeeded by the effectivist symbols of the Roman Pantheon (above)

FIGURE 35
The embodiment of such information in the environment was made possible by the fact that designers and decision-makers had "digested" the philosophy of what it means to be a member of an empire, this fact being also included in the forms' content.

In his book, "Gothic Architecture and Scholasticism", the historian Erwin Panofsky offers a fascinating, if not convincing, explanation for the solution of a problem posed to the architects of High Gothic Cathedrals (Panofsky, 1957, p.674). The question that had arisen was how the rose window should be incorporated in the western facade of the building. There were two different solutions to that: the designers would either inscribe it in a square or they would have consistency in the horizontal and vertical lines of the facade. The discrepancy between the dimensions of the rose window and those of the central vault did not allow them to do both. As Panofsky writes, "they were faced by two apparently contradictory motifs, both of them sanctioned by authority, one could not simply be rejected in favour of the other".

But, as Panofsky further explains, they were heavily influenced by scholastic argument at the base of which lies the doctrine of reconciling the seemingly irreconcilable. Things had to be worked through to the limit and to be reconciled in the end. Thus, after several attempts (in the construction of the cathedrals of St. Denis, Notre-Dame de Paris, Mantes, Laon and Amiens) they finally arrived at the solution needed in 1240-1250 in the cathedral of Reims. "The rose was inscribed within a pointed arch of a huge window, thereby becoming elastic as it were" (fig. 36).

Panofsky does not state whether the architects of these cathedrals were consciously seeking to apply the philosophical doctrine in their
The Cathedrals of Laon (1160-1225), Notre-Dame de Paris (1163-1250) and Reims (1211-1290). In the first two, the rose window causes asymmetries in the lines of the western facade. The problem was solved in the case of the Reims Cathedral which is considered one of the finest examples of Gothic Architecture.

FIGURE 36

work or whether they were so much influenced by scholasticism that it unconsciously affected their approach. Nevertheless, he explains how the particular philosophy was materialised in the form of the final solution and the preceding quest for it. All different solutions reflect the designers' attitude and ideology.

A third illustration shows information of shared ideologies which is replaced by information of different ones following changes in the social framework. It concerns the Aegean island settlements. When these were first built in the form that we still see them today (14th, 15th century A.D.), their settlers' occupation were fishing, small trade and a little agriculture. The limited resources and the common fear against adversity (pirates, drought etc.) produced remarkable unity among the
settlers. This unity was reinforced by the fact that there were very limited possibilities for somebody to become rich. This fact, combined with the unavoidable diversity in the characteristics of individual settlers, produced villages in which, although no house is prominent, no two of them are alike. As the settlers had acquired a deep understanding of their society's values, minimal building regulations were needed (see p. 46). Shared feelings about fellow-villagers also resulted in a very interesting elaboration of semi-public and semi-private spaces which is characteristic of such settlements (figs 22 and 37).

Later developments allowed villagers in certain islands to become successful traders. This disrupted the socio-economic basis of the islands' unity and resulted in specific changes in their built form. The merchants could no longer identify with their modest houses. They built bigger ones and, in many cases, they erected high walls around them and replaced their front doors with imposing, heavier ones (Sapounakis, 1978) (fig. 38). These doers materialized their own personal status which, no longer accorded with the once shared ideology of unity. Thus, the image of the village has changed substantially. Along with the data concerning the settlers' shared convictions, this image conveys messages of the merchants' altered status and their new relation with their fellow-villagers.

But even when one observes the way a single individual shapes his environment, similar contradictory features can become apparent. In Saudi Arabia, for example, the conflict between traditional and western ideologies has led owners of old houses, which used to be ventilated by ingenious traditional methods, to install air-conditioning units next to existing systems (fig. 39). The doers in this case carry more than one ideology since they are in a stage of reforming some of their values
Private and public space in a typical village section. Streetscape is characterized by smooth transitional elements.

FIGURE 37

Houses, like the prominent one in the small harbour of Spetse, belong to rich families. Apart from their impressive size they are characterized by their distinctive front doors and the wall that surrounds the land they occupy.

FIGURE 38
and convictions. Thus, the end product embodies information about conflicting ideologies as well as the doer's personal stance with respect to them.

A house in Jeddah, Saudi Arabia, using both traditional and modern ventilation systems.

FIGURE 39

The city as a whole can be seen as containing a collision of different ideologies expressed at various levels. As Peter Smith points out, "the urban system, in its pure phenomenology, epitomizes and magnifies human tensions and paradoxes" (Smith, 1974, pp. 114-5). Thus, the social environment with all its contradictions tends to be projected in concrete form through the actions of individual doers.

c. Conclusion

It is evident that the embodiment of social information
in the environment is initiated by the doer for the simple reason that the doer produces the forms. Yet, it is also evident that he is not in complete control of the situation since environmental change is to a certain extent dictated by a composite need and is liable to the limitations set by the External Factor. As regards these constraints, the doer can do little else than allow the social and psychological data discussed in 1.3.1., 1.3.2. and 1.3.3. to become materialised in the end product.

It has been shown, however, that the doer can be held responsible for a significant amount of additional environmental information. This includes his past experience in life, his values, ideals, beliefs and convictions, his understanding of the design problem he faces, his overall motivation in life, his particular interests and attitudes to design or ideology and so on. It may also involve information about characteristics of his personality or elements that are deeply rooted in his unconscious such as archetypal images. In addition to the above, the end product may convey information about the mere identity of the particular doer who produced it.

It has also been shown that the doer can be responsible for materializing a number of the users' social and psychological characteristics, depending on the way the doer defines the composite need. Furthermore, and as the doer's input refers to ideologies he shares with other members of his society, a notable amount of information about the wider social environment is also materialized in concrete form.

1.4. Conclusion

The evidence examined in the preceding sections reveals that an extensive amount of information is stored in the environment in the
process of its shaping. Indeed, the variety of environmental information examined suggests that the environment's content can often be immense. A certain type of information, that we can term "deep", relates to man and society in a holistic sense and is thus embodied in all objects. For example, the facts that "people have needs" or that "there is a social and natural context which limits all environmental change" are stored as bits of information in all human artefacts. On the other hand, another type of information (which we will describe as "wide") is so specific that it can be found in only one object. "This is the chair that he designed", "the money I inherited allowed me to built this house", "Mr. Smith's departure left this project unfinished" are all bits of information of the latter type.

All environmental information, the result of the social environment's reflection on the man-made environment, correspond to noticeable differences in the latter. These noticeable differences which carry information can be as varied as one object seen as a whole (eg. a house with a garden), or a distinct feature in it (eg. its chimney or the texture of its walls) or even a large set of similar and dissimilar objects which stands out against its background (eg. a whole city). It is possible that a specific differentiation in form is loaded with more than one bit of information so that, in the end, certain noticeable differences are denser than others in the meanings they embody.

Furthermore, analytical observation has shown that environmental change is not determined by any single factor (eg. topography, technology, the doer's personality etc.), at least in as much as the entirety of the features of the end product are concerned. Admittedly, certain factors often appear dominant (i.e. the Zeitgeist or the primary need which
generates objects). It is clear however that the entirety of the environment's features cannot be explained in terms of any one of these factors alone. Indeed, it seems reasonable to suggest that the approach which examines the effect of the need, the doer and the wider context and all factors involved therein (i.e. the approach followed in 1.3), provides an adequate explanation for the variety and complexity of forms.

It can be argued that certain large parts of the content which sustains this variety and complexity (e.g. a number of aspects of the doer's societal input, information relating to generic qualities of man and society, the requirements of psychological "by-needs" etc.) are often ignored by designers and design theorists. In addition to this, as we all know, designers are not always responsible for all information they allow to be embodied in their schemes. It is needless to argue however, that their awareness over all dimensions of this content is an important prerequisite for design.

For this reason, and based on the evidence examined in this part of the study, we will now establish a method of representing the content that is stored in the environment in the process of its shaping. This model of deriving and classifying environmental information will later be used in a twofold manner: it will, firstly, provide the means to analyse and understand the content of environments, whether these are currently being shaped or exist, and, secondly, it will constitute the basis for the development of the theory in the present study.

According to Barthes, when one contemplates the environment, "the first degree of intelligibility (below which one would perceive only lines, forms and colours) corresponds to the level of the identification of an object. But" he argues, "anyone from a real society
always disposes of a knowledge superior to the merely anthropological and perceives more than just the letter " (Barthes, 1977). These higher levels of intelligibility allow the information described in the preceding sections to be experienced.

Based on the above, as well as on the primary need's ability to cause environmental change, the remaining content of an object can be further distinguished in two levels. Thus, the second level comprises all information which relates to the primary need; that is all information which helps to answer the question "why has this object been produced. The third level contains all information which corresponds to the question of "how has it been produced", or "why has it been produced in this manner". Apparently the third level is the most extensive of all three since it is the outcome of all factors which are somehow involved in environmental change once the primary need has initiated it. Thus, information that relates to the user's "by-needs" (f.i. large family, hence many bedrooms), to all limitations of the External Factor (f.i. much snow in the area, hence pitched roof) and the doer's input (f.i. a trace of oriental influence in his design), all this refers to the way a specific object is finally materialised. For this reason, the information described in 1.3.2., 1.3.3. and 1.3.4. is third level information.
The following table is based on the evidence examined in this study and explains what information is stored in the environment in the process of its shaping. Furthermore, by analysing and structuring this content, it provides the means to derive and classify environmental information.

<table>
<thead>
<tr>
<th>FIRST LEVEL INFORMATION</th>
<th>SECOND LEVEL INFORMATION</th>
<th>FIRST LEVEL INFORMATION</th>
<th>THIRD LEVEL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>information that answers the question: WHAT is it.</td>
<td>information that answers the question: WHY has the object been produced.</td>
<td>information that answers the question: WHAT is it.</td>
<td>information that refers to and helps to answer the question: HOW has the object been produced or WHY has it been produced in this manner</td>
</tr>
<tr>
<td>i.e. information which relates to the identification of the object or feature (description of form)</td>
<td>i.e. information about the reasons behind the primary need-function of the object</td>
<td>i.e. information which relates to the identification of the feature (description of form).</td>
<td>This level contains:</td>
</tr>
<tr>
<td>This information relates to:</td>
<td></td>
<td></td>
<td>a. Information which relates to the composite need, i.e. information about the user, the &quot;by-needs&quot;, and the manner in which the primary need is satisfied,</td>
</tr>
<tr>
<td>a. the user</td>
<td>b. the situation in which the need has arisen</td>
<td></td>
<td>b. Information for which the External factor is responsible, i.e. information contained in the External factor (e.g. materials and technology, climate and topology, legislative, economic, social and cultural data etc.) and information about the user and the doer.</td>
</tr>
<tr>
<td></td>
<td>c. the wider social framework to which the user belongs</td>
<td></td>
<td>c. Information for which the doer is responsible, i.e. information about the user (through the analysis of the problem), the doer and the wider social framework.</td>
</tr>
</tbody>
</table>

TABLE 1.4.
In the above table, first-level information is the indispensable step towards both the second and the third-level content.

Furthermore, the fact that second and third-level information answers different questions bears an effect on the features this data corresponds to. Since second-level information refers to data that caused the object's existence, it is embodied in the object as a whole. On the other hand, third-level information relates to specific aspects of both the overall primary need and the final solution.

Clearly, these two sets of information are to an extent overlapping since a body of data may influence both one's decision to satisfy a primary need and the way one chooses to do it. For example, the fact that a person is rich enables him to build a house while it also affects the way he will have it built. Thus, the same fact will both be reflected in the house as a whole as well as in the large reception areas it contains, the high quality of finishing and so on.

Let us now use table 1.4. in order to examine the informational content of a specific environmental form, namely: the house originally used by the Tombazis family in Hydra built at the end of 18th Century (fig. 40). In this case, the form in question consists of the plot of land and all structures that stand on it, i.e. the house, the fence that surrounds it, the gates, the garden and so on.

First-Level information:

housing complex as a whole, house, surrounding plot, colonnaded yards, gates, windows, storeys, roof, garden, entrances, rooms, stairways, water reservoir (A), fountains (B, C), floors, ceilings, inner and outer walls, arcs by the entrances, doors, handles, wood, stone, marble, tiles, all
The house of the Tombazis family in Hydra, Greece

FIGURE 40
dimensions, colour and texture of surfaces etc. as well as all relations between these features both with regard to themselves and the surrounding physical context. For example, a big house that stands out in the environment; the outer wall of the loggia is coloured white whereas the rest of the house is left with the stone's natural colour; the two top storeys have more and bigger windows than the bottom ones; some rooms are bigger than others; only one room has a fire-place (room 6A); the ceilings in certain rooms, like for instance the front rooms and main rooms in the top two levels, are more elaborate than those of rooms 3A, 3B, 4A and 4B which again are much more elaborate than those of the bottom levels; the floors in all five front rooms of the top floor and the living-room at level B are covered with expensive ceramic tiles imported from Venice whereas in the rest ordinary marble tiles have been used; the water reservoir collects rain-water from the roof and distributes it to the two fountains B and C and its nearby garden and so on).

Second-level information:
(carried by the housing complex as a whole)

a. (in relation to the users) "a specific family in Hydra needed a house", "the family had become wealthy", "the family employed a number of servants, cooks, footmen, and other employees who had to live in the same house".

b. (in relation to the situation that had become problematic) "the house in which the family used to live was not big enough", "there was not enough room to house the needs of all members of the family and the people working for them".

c. (in relation to the wider social framework) "Hydra is an island which is inhabited although mostly infertile", "man has needs", "it has
always been important for man to protect himself against adversity", "people need houses for shelter", "wealthy traders do not live in two-roomed huts", "the place of residence can be a symbol of status".

Third-level information

<table>
<thead>
<tr>
<th>carrier in relation to the user and the composite need</th>
</tr>
</thead>
<tbody>
<tr>
<td>- housing complex involves many different structures</td>
</tr>
<tr>
<td>- all entrances to the complex</td>
</tr>
<tr>
<td>- discrimination between the entrances (main entrance clearly at level A, other entrance at level B very different in form, auxiliary entrance at levels C and D)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>information carried</th>
</tr>
</thead>
<tbody>
<tr>
<td>- the composite need for housing for the particular users involves many by-needs which differ in nature</td>
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<tr>
<td>- users have many needs</td>
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<tr>
<td>- the need to enter the complex.</td>
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<tr>
<td>- the particular users needed direct access to more than one sections of the complex</td>
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<tr>
<td>- a single entrance would make the users'and visitors'movement system disfunctional.</td>
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<tr>
<td>- discrimination in the manner the users viewed the various entrances (entrance at level A most important, used by guests, as well as the head and other members of the family; entrances at level B, most esoteric of all, forms a covered corridor that leads to the main bulk of the house, used by the family's auxiliary</td>
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entrances, unobtrusive, used as "back doors" by the family's employees and for servicing).

- along with the rest of society of this period, the family believed in social discrimination. Furthermore, they avoided contact with their servants and employees unless necessary. Guests, on the other hand, are honoured not only by the distinctive shaping of the main entrance but also the spectacular views to the harbour offered by their approach to the house.

- the by-need to defend the house
- the entrance acquires the strong identity needed by its function as a main entrance, while at the same time it is incorporated smoothly in the whole complex.
- the family needed a garden to keep flowers and to cultivate certain crops and a place to sit outside drinking coffee and watching the harbour. The big tree provided shade even at mid-day while the surrounding walls kept the place cool while sheltering it from strong wind.
the yard was used only by certain members of the family and the occasional visitors. One or two tables and a few chairs would be permanently placed along its edge facing the harbour without obstructing movement in the paving.

the tidy manner in which decision-makers (probably the head of the family himself) had the yard designed, reveals tidy people.

the yard not only expresses the users' need to sit in the open and in visual contact with the harbour but also constitutes the "heart" of the complex as it is situated right on top of the white-washed loggia of level B. It is reminiscent of the bridge of a ship (the users are merchants and ship-owners).

e entrance and loggia at level B
e the need for members of the family who reside at level B, to enter the complex without climbing another floor or using service doors. Entrance also used in rainy weather.

e the house is stretched up to the
point where the entrance is.

Entrance and Loggia are thus part of the house.

- the by-need to defend the house shaped the wall at the beginning of the corridor and allowed only one window, which again had to be situated high.

- dome structure and white-washed colonnade reveal the significance that the users attached to the loggia as semi-private space. It is the only shaded balcony of the house and the needs it covers are similar to those of the yard above it, although less outwards oriented.

- certain members of the family, like perhaps younger and older women, would use this place to sit in the morning and afternoon under total protection from the sun, isolated from the goings-on and decision-making of the prominent men of the family seated in the yard on top.

- entrance at levels C and D

- of minor importance, used by servants and other employees (eg. sailors).
- 95 -

- the need to defend the house is carried out by bars placed behind the doors. staircase at the northern side is formed as a watchtower with a terrace on top. This colonnaded tower has no space for sitting outside, thus merely sheltering access through the stairs and allowing employees to watch the goings-on in the street and harbour.

- terrace at level B

- uncovered, yet sheltered space used by women and children and, above all, by the servants for the demands of the household (eg. airing and drying mattresses and clothing, food and crops).

- it faces north so that people are not exposed in the southern sun all day, yet it clearly extends towards the harbour so as to catch the sun safely when needed.

- although long and cool, the terrace can still provide warmer areas and corners where the servants would rest and the kids would play.
• fence surrounding the southern, western and northern sides of the complex

• the need to defend the house as well as the need to provide adequate privacy with respect to what goes on in the yard and terrace.

• seclusion and austerity with regards to the rest of the villagers. This is compensated by the expression of warm feelings of friendliness evident in the white-washed line along the top of the fence.

• the family viewed their need for housing as being directly related to their aesthetic needs; their image to their fellow-villagers, as described above, clearly plays a role in this.

• the application of white colour is reserved as the only means to decorate the complex (apart perhaps from the two colonnades which were also not demanded by functional requirements)

• the fence and cornice surrounds the complex clearly but gracefully while the loggia with the yard on top as well as the openings express the warmth and
friendliness that presumably characterizes the residents. The watchtower at the north-eastern side that is left unaffected appears impersonal and business-like (people rushing up and down the stairs) and provides an interesting contrast to the rest of the complex. The image of the latter is thus strengthened.

- the appearance of the main bulk of the house
- the need for identity
- the need for most activities to be sheltered against climatic and other adversity.
- distinct differentiation between upper and lower structure reveals that the upper structure is used by those who initially had the house built, while the lower structure is used by those who are employed by them as well as for storing purposes.
- the house is built like a fortress, among other reasons for defense purposes. Its overall shape also reveals seclusion and austerity (compensated, as noted, by the use of white colour).
• the members of the family, residing in the upper structure, are better protected than their employees who, in certain difficult occasions may even have to come out and fight.

• plans and elevations of the upper structure

• the family was large enough to need two floors.

• both top floors have bedrooms and reception areas. The people living at level B were somehow independent from those living on top (the head of the family included). The staircase that links them is almost unobtrusive.

• although the entrance halls of both levels had an arc, the upper floor with its huge hall and wide access to the living room is more significant than the floor beneath. The upper floor would house the head of the family and the most significant receptions. Perhaps, the original family that had the house built included more than one sons or brothers with a certain hierarchy between them.
• the fact that bedrooms relate directly to living-rooms (the main rooms of both floors) suggests that, on the one hand, the activities contained in the living-rooms acquired a homely character while, on the other hand, the image of the family must have been strong enough to allow its members to use the bedrooms even during receptions of not-so-familiar guests. On the whole, such receptions would not be very noisy and if they were, they would dominate the house and other members of the family would have to conform with this.

• kitchens and bathrooms were originally situated at the back of each level while some functions might originally have taken place in some structure at the back of levels A and B. Most such facilities were somehow primitive and did not leave many traces in the built form of the end product.
plans and elevations of levels C and D

- the need to house all people who work for the family (e.g., servants, cooks, gardeners, sailors and other employees) and to store the goods used by the family (e.g., foodstuff, wine, masts for the boats etc.).

- goods were stored in the rooms with no windows whereas people were housed in the other areas. Servants must have used the rooms at level C, whereas the bottom floor must have been reserved for sailors when not sailing.

- the way the employees of the family lived was of little significance for the family and this was presumably accepted by the employees themselves. Not only the housing needs of these people were not ordered or divided in space, but they must have also suffered from poor lighting and ventilation. The scarcity of openings in the lower structure is also due to defense purposes.
the surface of the floors of the house and discrimination between them.

- the need to attain a flooring surface of good quality, which will appear pleasant to the eye while being easily serviced.

- all five front rooms at level A and the living-room at level B are covered with Venetian Tiles, probably the most expensive way to cover a floor at the time. This reveals the significance of these rooms both in relation to other rooms of the same level and in relation to the rest of the house.

- all other areas are covered in marble slabs of good quality which are somehow colder than the tiles. A number of rooms in the house, whether covered in marble or tiles, must have demanded carpeting during the cold winter months.

- ceilings and discrimination between them

- most ceilings of the upper structure are of very high quality (living-rooms, bedrooms, halls, and entrance halls). They are made of wood in a diagonal pattern and in some cases (as for example in the main hall at
level A) the cornice is 50cm high. This shows the relative significance of these rooms and especially the main hall which thus contributes to the image of the complex's interior spaces to the public. Accordingly, the living-rooms at both levels, covered in warmer tiles and related directly to the bedrooms, clearly provide the more intimate side of this image.

- rooms 3A, 3B, 4A and 4B as well as rooms 5A, 5B and 6B have less elaborate ceilings in a horizontal pattern. Presumably, children and the less prominent members of the family occupied these rooms.

- the need to provide fresh water for the residents and to water the garden

- at both levels water is distributed from the reservoir to two elaborate fountains situated at central points in each level. Thus, not only the fountains are incorporated in the overall aesthetic requirement
of the composite need, but also the use of fresh water occurs in public.

- the need to keep the family warm. This room might have originally been used as a kitchen although its relation to the main hall and its expensive ceiling suggest that it has been used as an office by the head of the family.

- one fire-place would not be enough to keep the whole house warm. This would be compensated by the use of carpets.

- the need to store clothing and other items is not so apparent in built form. True believers in the maritime tradition, the owners preferred trunks to immobile closets fitted in the walls.

- the need for lighting and ventilation as well as the need to be in contact with what goes on outside.

- for reasons of defence, the windows of the lower structure could be secured by bars from
the inside. Other windows simply had an iron frame fitted at its outer side. For the same reason, the elevation facing the harbour bears fewer openings than the others.

- the need to divide two spaces and to link them by opening the doors.
- outer doors are heavy and impressive without being particularly ornamented. They reflect the family's position with regards to the rest of the village.
- inner doors of the upper structure are also impressive and, apart from being functional, contribute significantly to the overall image of interior spaces.
- in the lower structure there has been no need to retain such an image. Although doors are of good quality, they are only functional.
IN RELATION TO THE EXTERNAL FACTOR

B1: TOPOGRAPHY

- positioning in relation to the harbour
- positioning and massing in relation to the contours of the site

B2: MATERIALS AND TECHNOLOGY

- materials

- most privileged position because it shelters the house from the evening sun while it offers spectacular views to the harbour.
- rich and influential owner.
- main structure does not follow contours. It stands out impressively dominating the harbour. Its extensions, however, were skillfully adapted to the gradient of the rock, revealing a competent designer. Thus, decision-makers managed to produce a cozy garden and yard.
- grey stone from the islands is carved the way affluent families can afford.
- marble from the island of Tinos.
- expensive ceramic tiles from Venice.
- impressive wooden cornice for the ceilings imported from Western Europe.
- although the family respected the area's potential, they expressed their status and occupation (merchants, ship-
owners) by importing certain materials which were used peripherally.

- all the above materials are soaked in information about the societies that produced them and used them.

- good, solid construction built by labourers from Epirus, situated in the north-western side of the Greek mainland. For this reason, the house resembles the architecture of that area. Many of the labourers have stayed in Hydra after finishing the Tombazis house.

- house built in the traditional way which involves many working days and is therefore very expensive.

- its significance forced decision-makers to use a structure of repeated domes to cover it, by no means a common practice in Greece. The task must have been carried out under Italian supervision.

- the owners of the house had to transport specialists from the island of Tinos for the marble floors.
ceilings and woodwork

joiners from the forests of Mount Pelion in the mainland of Greece had to be employed for this task. Wide gaps were often bridged using masts from the boats, thus denoting the family's occupation.

All the above decisions reflect the costs that the family was willing to spend so as to achieve a standard of high quality. It is interesting to note that some of these decisions relate to purely functional requirements while others concern the family's other needs (eg. image, aesthetics, identity).

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B3: CLIMATE

- Location

- Yard at level A

- Entrance at level B and loggia.

- Windows and shutters

- House sheltered from the evening sun.

- Good microclimate. Sheltered from the sun and wind.

- Sheltered from the rain.

- The sun can be very bright in Hydra and the users may often wish to keep interior places dark. Openings are relatively small for the same reason.
- thickness of walls

- the interior of the house stays relatively warm in the winter whereas it cools off in the summer.

B4: LEGISLATION
- deviation from building regulations

- the owners succeeded in having the house built although it blocks the vista of those behind it.

- influential family.

B5: ECONOMY
- quality of the construction and value of the site

- the owners spared no costs in order to arrive at an end product that satisfied their needs. The fact that specialists and materials were transported from other parts of Greece and abroad and that these people were sustained entirely by the family, raised the house's expenditure significantly.

B6: SOCIO-CULTURAL CONTEXT
- overall image of the house

- typical traditional Greek house for rich and prominent families. The owners conformed with the dominant ideologies of the era
and aimed at a "good", traditional form.

- Although Greece was under Ottoman occupation at the time, no Turkish influences are apparent.

- The fact that the house resembles those of the mainland is not only due to the builders employed but to the fact that the Tombazis family, along with most settlers of Hydra, originated from the neighbouring Peloponese.

- The family's view of life which was aligned with the dominant ideologies of the time for that matter is reflected in the manner in which they viewed the composite need for housing outlined earlier. By structuring their house in this manner, the family showed that they wished to conform with such ideologies rather than radically oppose them (as, for example, they would have done if they wished the servants to stay in the same storey with the head of the family).
- House fits well in the overall image of the village of Hydra.

- Imported materials and technology.

- Even though differences in the owner's status allow the Tombazis house to stand out, this is only relatively so since the house was built at a time when there was a notable degree of unity and solidarity between settlers, against external threat (eg. pirates, Turks).

- The economic and cultural rise of Western Europe during the 17th and 18th century and its appreciation by the Greeks. The family used imported goods mostly for the value contained in them; showing off was not important once the family's true image had been established.

- Overall appearance of the house.

- House built at the time when Turks ruled Greece, when the settlers main occupation was sailing, fishing, trading and a little farming, when there was no electricity, no automobiles, no telecommunications and so on. (Just by the fact that the house was built at a certain period, it is reminiscent of
all characteristics of it even though these may have not influenced directly the shaping of its form).

- the way the composite need has been interpreted
- the fact that there are no noticeable misfits in the way the design problem has been interpreted and carried out suggest that decision-making mainly rested with the owners of the house, i.e. the head of the family, and not an outsider.

The traditional form employed clearly simplified things while specialists were asked to fulfil specific tasks.

- typical traditional Greek architecture for rich and prominent families. Thus, the house is a symbol.

- there must be a certain need to follow existing prototypes and typologies (based perhaps on what psychologists call "functional fixation"). The origins of this need, which goes beyond the availability of materials and similarity in the composite
need of different settlers, may range from respect to one's society and its predecessors, to plain convenience.

- decision-makers took few risks in the design of the house.
- the design of the house followed models from the mainland of Greece (builders from Epirus).
- woodwork
- specialists from Mount Pelion left traces of their techniques in built form.
- marble floor
- specialists from the island of Tinos
- loggia
- Italian supervision
- roof
- the builders and the owners were closer to techniques and influences from the mainland of Greece than other Aegean islands where flat roofs are more common.
- water-system
- brilliant exploitation of scarce rain-water from the roof. Perfect positioning of the reservoir.
• the extensions of the complex in relation to the main house (especially: entrances at levels A and B, yard at level A, loggia, fence and attitude for decoration).

Although the main bulk of the house is consistent with existing typologies, its extensions are unique. Their careful but imaginative shaping has allowed the loggia and yard on top to stand out as the "heart" of the complex, the two entrances to attain distinctive image and so on. They all reveal doers and decision-makers who apart from being neat and tidy, appear daring and confident.

Lastly, it is apparent that the more knowledge one possesses over the conditions of production of a form and the context in which it occurred, the more messages one can derive from it. For example, out of all messages represented above, someone with little knowledge of Greece would have only recognised a few, whereas, on the other hand, the ship-owner Tombazis himself would relate his house to an endless list of environmental information.

Furthermore, it is clear that the content laid out above is what has originally been stored in the form in question. In spite of the lapse of two centuries, the house is, by and large, kept intact (in 1900 it became a School of Housekeeping and in 1935 it became a part of the School of Fine Art, the kitchen and bathroom at the back of level A were added during the 1950's). The fact that it generally retains its original form has embedded additional information in it as, for example, "its structures are of such a good quality that they withstood the ages", "wars did not
destroy it and it therefore provides a measure of the impact that wars had on the island,"today's society is keeping it in immaculate condition and, in this sense, it provides a measure of society's present values with regard to its heritage"and so on.
PART TWO

ENVIRONMENTAL COGNITION
2.0 Introduction

In this everyday life, man wanders around a variety of environments satisfying his needs and performing his tasks. Such settings range from living-rooms and offices to villages and down-town areas. The findings of the preceding sections suggest that although some of the places in which we find ourselves may be richer in content than others, the majority of them appear rich enough to require much time and effort to analyse.

But where does all this information go? Is the materialization of social and psychological data an accidental or peripheral phenomenon amidst the complexities of society or is it somehow utilized? And, finally, if it is utilized, how does this happen and how important is it to man?

In order to answer the above questions we will explore the dimensions and significance of environmental cognition in accordance with the findings of the first part of the study.

Environmental cognition has been the object of many researchers and theorists originating from many disciplines and, especially, psychology. In the present context, we will consult the existing literature and apply it to the variety of information stored in the environment so as to elucidate the following three issues:

a. What initiates cognitive activity. In this, we will examine what drives man to cognition, i.e. the nature of man's cognitive needs, by reviewing the writings on the issue.

b. How does the reception and initial processing of environmental stimuli occur. This synchronical view of cognition comprises all momentary complexities involved, like expectancy and selectivity, as well as all
possible varieties of cognitive experience. Its study is essentially based on the application of psychological theory on the findings of the first part.

c. How does cognition affect man. The study of the diachronical aspects of cognition will allow us to assess the way it affects man in the long run and to redefine its significance. The core of the issue is the relation between environmental cognition and the development of man's enduring characteristics and, above all, the development of his mental world.

Before getting involved with the discussion on the main issues, there are certain items that must be clarified. The first item is concerned with the nature of cognitive experience and especially its relation to man's affective or evaluative experience of the environment. According to psychology, cognitive and evaluative experience occur and form a whole that cannot be temporally separated (P.E. Vernon, 1961, p. 37). In the present context however, we are only concerned with the study of cognition. For this reason, the two modes of experience will be considered as being theoretically different*

The definition of several terms which are persistent all through this part of the study must be discussed.

The first two are the "personal parameters" and the "stimulus" or "environmental parameters" which are present in virtually any situation

* It is interesting to note that this theoretical division is compensated by the fact that a person's awareness of what he felt with regard to a particular environmental stimulus can still be seen as cognitive experience. Thus, apart from the actual decoding of environmental information, cognitive experience also includes cognitions of the emotions provoked by external stimuli.
that man finds himself and affect the way the environment is experienced.*

Personal parameters provide a measure of who the person or group of people who experience the environment are. These parameters comprise all their enduring and momentary characteristics such as their motivation and past experience in life on the one hand, and their state of mind on the other. In cases of groups of people, personal parameters form an aggregate of factors and variables which is difficult to identify in all its dimensions.

Environmental parameters provide a measure of the amount and nature of environmental information as well as the way this information is embodied in the environment. We may thus talk of a clear or a confusing environment, of a place that is poor in information or an object which is rich in symbolic meaning. These parameters describe environments both in figurative terms and in the information they contain.

Another term that needs explaining is the term "schema"**. Bartlett first used the term in the 20's (although the notion originated from Kant) and described it as referring to "an active organization of past reactions, or past experiences which must always be supposed to be operating in any well-adapted organic response"(Bartlett, 1964, p.201). The term was then taken over by Piaget who used it extensively with basically the same meaning. They both implied that a schema is a sensory-motor response to a particular set of environmental cues. This response

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* Several anthropologists have expressed the view that a third family of parameters, namely: cultural parameters, must be considered (Rapoport, 1977, p.108; see also Tyler, 1972, for the discussion on the identification of such variables). Without overlooking the role of culture in cognition, we believe that the notion of a single individual's personal parameters (and especially his past experience of the world) can be considered as being broad enough to include them.

** Plural: Schemata
helps to structure behaviour by being stored in memory to be re-activated when a set of similar cues comes into view. In the present context, motor schemata are not taken into consideration. Furthermore, it must be noted that mental cognitive schemata are not only seen as referring to vision but also to the other human senses (e.g. tactile, olfactory schemata etc.).

Closely related to the idea of a schema is the term "image" which, in the literature, tends to be used in a confusing manner. Boulding defines it as subjective knowledge - "what we believe to be true" - all the accumulated, organized knowledge that the individual has in respect to something (Boulding, 1956, pp.5-8). A momentary image can be regarded as the entirety of a person's perceptual experience at a given moment in time. Such a construct which is both conscious and unconscious in nature comprises many different cognitive and evaluative schemata.

Finally, the last term which requires some clarification is that of a person's intelligence for which the literature is replete with a series of definitions (see Wright et al, 1970, p.482). The interest in the present context however, lies in exploring the relation between perceptual input and the process of man's intellectual development. For this reason, there appears no need for an exact definition of intelligence as such but merely in as much as it relates to the development of mental schemata. We will therefore note P.B.Vernon's statement that "intelligence corresponds to the general level of complexity and flexibility of a person's schemata which have been built up cumulatively in the courses of his lifetime" (P.B.Vernon, 1961, p.37).

2.1. The Nature of Man's Cognitive Needs

Let us now examine the reasons behind environmental cognition; in other words, what initiated cognitive activity. As we all know, we have
to look for (cognize) the handle of a door in order to enter a room, we have to look for the right bus-stop and then the right bus in order to be transported to a different part of a city and so on. Our needs and purposive behaviour determine the environmental information to be cognized in our everyday lives.

The question is whether our cognitive needs are always dependent upon such purposive behaviour or whether other factors may also impel man to decode environmental information.

Reviewing a part of the literature on the subject, Gordon Allport, a prominent psychologist, wrote that "some theorists—such as Schopenhauer, Kempf, Freud and others—have held that cognition is essentially the servant of our needs and drives" (G.E. Allport, 1961, p.259). This also applies to early behaviourist writers, such as Watson and Thorndike, and even later ones like Skinner. Bruner criticized their views by stating that they regard cognition as being incorporated to other forms of goal striving. Bruner said that these writers would accept that cognition corresponds to a more autonomous "need to know" only in cases in which the individual is confronted with novel stimuli (Bruner, 1956, p.16).

Theorists who tended to follow the rationalist philosophical tradition (and hence ascribed more qualities to the human mind than the blank state condition and inertness at birth), found it difficult to conform with such behaviourist views. Karen Horney, for example, declared that Freud's conception of cognitive processes is applicable only to the neurotic. Instead, she maintained that man's higher mental processes exist in their own right and are not "at the beck and call of his impulses" (Arndt, 1974, pp.270-1). Similarly, Gordon Allport argued that "there is nothing secondary about cognition. The hunger to know, to
comprehend our environment is a basic motive in life" (G.B. Allport, 1961, p. 274).

Abraham Maslow, a prominent American psychologist who is noted for the existentialist origins of his approach to the study of personality, has developed the idea of man's cognitive needs further. Maslow said that the reason we know little about cognitive impulses, their dynamics and pathology, is that they are not important in the clinic. However, Maslow based his research on cognition upon evidence from his clinical work (see also Beck et al., 1979) and argued that "the overcoming of obstacles,... the wider spread occurrence (cross-species, cross-cultural), the never dying (though weak) insistent pressure, the need of gratification of this need as a prerequisite for the fullest development of human potentialities, the spontaneous appearance in the early history of the individual, all these point to a basic cognitive need". He, then, observed that this need escalates in two ways as, "even after we know, we are impelled to know more and more minutely and microscopically on the one hand, and on the other, more and more extensively in the direction of a world philosophy". Thus, along with his five sequential stages of basic human needs*, he postulated the existence of a smaller hierarchy of cognitive needs in which the desire to know is stronger than the desire to understand. These cognitive needs, however, are not separate from the basic needs because "the desire to know and to understand are themselves

* This hierarchy comprises: physiological needs, such as hunger and thirst; safety needs, such as security and protection from physical and psychological harm; belonging or love needs, which concern the relationship of responsive and authoritative needs; esteem needs or those needs of an individual to be held in high esteem by others; actualization needs, representing the desire to fulfill one's total capacities. Maslow suggests that most people are partially satisfied in all their basic needs at the same time. Still, physiological needs emerge first and are required to be satisfied first; then follow man's safety needs, love needs and so on (Maslow, 1968, 1970).
conative, i.e. having a striving character, and are as much personality needs as the basic needs" (Maslow, 1970, pp.48-51).

Thus, Maslow incorporated in man's cognitive needs both the instinctive need to make sense out of one's environment as well as "the need to know for its own sake, for the sheer delight and primitive satisfaction of knowledge and understanding per se" (Maslow, 1968, p.63). This latter impulse, which is clearly associated with unique affective states and is described by Bruner as leading to a "Eureka" experience, has been used as the basis for inferring the presence of a generalized cognitive need by a number of theorists (Bruner, 1956, p.17).

However, not all contemporary psychologists would accept the existence of autonomous cognitive needs such as the ones described by Maslow. On the other hand, it appears that the main bulk of current thinking on the subject has also deviated from the early behaviourist doctrines according to which cognition is determined by man's purposive behaviour. Studies such as Bartlett's (1932; 1958) and Tolman's (1943), where the "effort after meaning" was stressed, proved to be notably influential in this shift as they introduced Gestaltist cognitivist elements in behaviourist thinking and provided the initiative for research in cognitive psychology.

Although this body of research is not aligned with Maslow's holistic formulations, it still explains cognition by relating it to human needs that are more basic and more generalized than is required by the particular activity in which man is engaged at the time. It is interesting to note two influential theories from the field of cognitive psychology, namely the theory of cognitive dissonance postulated by Festinger (1959) and the attribution theory which originated from Heider (1958). Festinger's main point of departure has been the
formulation that the presence of dissonance in man's mental world gives rise to pressures to reduce that dissonance (Festinger, 1959, p.263). One way of coping with such pressure is through further cognition. Heider, who is more directly concerned with cognition as influencing action, adds to the discussion on cognitive consonance (or "balance" as he calls it) by maintaining that "of great importance for our picture of the social environment is the attribution of events to causal sources" (Heider, 1958, p.16).

Although these theories clearly point to a certain need-state which arises from man's mental world, it must be acknowledged that there is still some doubt as to the nature of this need-state - i.e. whether it leads to a motive, drive or desire (see Davies, 1968, p.330; Weiner, 1972, p.293 and pp.301-7) and the extent of the pressures it sets (Wyer, 1974, pp.139-140). Still, as the cognitive structures in a person's mental world may rarely be in complete consonance (Festinger, 1959, p.16), it seems reasonable to assume that, for every person, there will always be a tendency for such a need-state for cognition. In this sense, exploratory activity may be seen not only as resulting from the accidental encounter of novel stimuli but also as being initiated by the very complexities of man's mental world (Hunt, 1963, p.399).

Lastly, an interesting overview of the reasons behind environmental cognition is provided by writers like Piaget (1971), Waddington and Lorenz. According to them, life processes in general, and evolutionary processes in particular, are fundamentally involved with the acquisition of knowledge about their environment. In general, the greater the knowledge an individual member of any species has of the environment, the greater are the chances that the individual will survive and reproduce in that environment (Fishbein, 1975, p.132). A similar generic approach, which arrives at the same conclusion based on cybernetics, has been expressed
by Herbert(1972,pp.101-6). Such biological or mathematical approaches are pointing at the importance of the need to know and to understand as deriving from the very fact that man finds himself in a world in which he must adapt in the most efficient way in order to survive.

The review of the literature has shown that there are a number of reasons which initiate cognitive activity. Apart from being an obvious requirement for our everyday purposive behaviour cognition has been attributed to basic needs, such as man's need for safety or adaptation, the need for a certain balance in man's mental world, the need to know for the sake of knowing and so on, Thus, we may reasonably assume that the handle of a door will not only be cognized in response to its primary function, i.e. the means to open the door. Instead, it can well be expected that a certain cognitive need may force somebody to look for a specific set of information about its owner or designer (e.g. elaborate handle, hence eccentric owner). Similarly, the development of somebody's mental schemata or simply the need to know per se may initiate the cognition of deeper third-level information (e.g. the culture that has marked the handle, the era it perhaps symbolizes etc.).

We must therefore conclude that although operational cognition appears to be the commonest mode of environmental experience, it is not the only one. There exist a variety of other causes for cognition.

2.2. The Reception and Processing of Environmental Stimuli

Environmental cognition is a part of the broader function of perception. It is therefore important that some fundamental aspects of the latter are considered so as to attain a clear picture of how cognition occurs and the complexities it involves.

The term perception, as used in the literature, embodies a multitude
of definitions and meanings either referring to the actual process of perceiving or to the end product of this process. These definitions are often implied rather than explicit. It is interesting to note that the "International Encyclopaedia of the Social Sciences" takes over fifty pages to discuss the meaning of perception.

In the classical and strict sense, perception relates to situations where stimulus is present. Perception is the middle step in a hierarchical process of sensory awareness between sensation which is the initial, unorganized response to a stimulus and cognition and evaluation, which represent a general awareness based on some form of a summary of all previous stimuli.

Awareness or interaction with the environment is achieved primarily through visual experience, although it is clearly an amalgam of other sense experiences, such as auditory, olfactory, tactile and so on. In the present context, however, perception refers to more than direct apprehension of the senses, as the perceived environment is significantly more than the sum of sensory experiences. Perception, therefore, is used neither in a physical and neurological nor in a strictly literal sense but more extensively. Such a definition, incidentally, is in keeping with the Latin origin of the word "percipere", to comprehend.

Thus, perceiving the environment is divided in three fairly distinct stages: sensing, cogniting and evaluating. Reacting could be regarded as a fourth stage only that it does not refer to the experience of the environment but to the overt response to it. These three stages (and, in some extreme cases, all four of them) are drawn together in a continuum by the forecasting and the unconscious reception and processing of environmental stimuli.
2.2.1. Expectancy

Even before the sensing of environmental stimuli occurs, one is generally prepared for it. Kelly saw this element of anticipation as being critically central in his "Theory of Personal Constructs" (Kelly, 1955, and especially pp.46-50) while a similar attitude is found in writers in the Gestalt tradition like Lewin and Tolman. Piaget wrote that previously acquired information causes anticipatory reactions to the extent that one of the essential functions of knowing is to bring about foresight (Piaget, 1971, p.91).

Thus, man always tends to anticipate the dynamics of the places in which he finds himself. The need for this generally stems from his safety (or reassurance) needs and is sustained by the fear that something might spoil his course of action.

Whatever the situation, therefore, man automatically grasps its basic components, ie. "the feel of the place", while being simultaneously aware of what may happen. This "awareness" however is usually only literal as there is evidence to suggest that a major part of this anticipatory function occurs unconsciously (Kaplan, 1970; Dixon, 1971).

Whether conscious or unconscious, expectancy is based on the comparison of the particular situation to previously acquired information about similar circumstances. For example, when a person enters a room (and perhaps even before this) a number of schemata of various kinds which relate to the idea of a room are activated from his memory banks.* He therefore anticipates to cognize a particular kind of room (eg. bedroom, business office, etc.)

* It is interesting to note that anticipatory schemata may form so accurate a fitting with the existing situation that, in extreme cases, they may result in what is psychiatrically defined as "déjà vu" or "jamais vu".
living-room etc.), decorated in a particular joyful or austere manner with objects like chairs, tables, carpets, lamps and so on. Such schemata are inevitably paired with information contained in table 1.4 such as the social and psychological characteristics of the users or designers of the room, the culture they belong to, the way he expects them to rest, listen to music, watch television and so on. The feeling of expectancy can be so strong that a person may "know" beforehand how exactly he will cognize the room or certain elements in it.

The fact that, even in fairly early developmental stages, people somehow manage to anticipate and grasp "the feel of the place" suggest that there will always be a certain anticipatory set of mental schemata in the human brain. This ability for adaptation may not only characterize children but also people who find themselves in non-familiar settings.

The fact that certain perceptions are expected while other are not is related to two important characteristics of environmental cognition. Firstly, it provides an explanation for subjectivity in perception since one tends to relive one's own schemata, the product of one's own past experience, rather than to adapt them (see Boulding, 1956). This can be seen in the experiment in which several species of birds attempt to escape when a certain model (the model of a large bird with short neck and long tail) is passed overhead. Birds that were occasionally attacked by a hawk were used to the idea that this may happen again. Consequently, they responded strongly to the hawk silhouette passing overhead which they did not wait to cognize as a mere paper model (Buss, 1973, p.145) (Fig.40).

Secondly, anything unexpected tends to draw more attention than normal; in other words, low predictability increases the level of arousal (Shannon and Weaver, 1949, pp.108-9; Mehrabian and Russell, 1973). Thus, higher levels of arousal and attention are evoked by environmental
information which the perceiver would not expect to find in a given context. If in the afore-mentioned illustration the man who entered the room came across a motorcycle or a lion all his attention would be focused on the intruder, the information it contains and the contexts which would have suited it better. Invariably, the perceiver will activate additional schemata that will enable him to reassess "the feel of the place" he thought he mastered (Fig. 41).

When the paper model is moved to the right, the birds mistake it for a hawk and feel that they are in danger

**FIGURE 40**

Although surprise and novelty contributes to an exciting environment (eg. Japanese garden, open-air market, and even Carroll's "Alice in Wonderland"), designers must note that it involves certain weaknesses. Firstly, not all unexpected encounters are pleasing; indeed, as arousal and attention are increased so are people's expectations which finally become difficult to satisfy. Secondly, nothing ensures that what is surprising to the designer is equally surprising to the user. To overcome these problems, designers must acquire an understanding of the personal parameters of the users and especially their past experience in life and their interests in the particular situation.
Top left: "Object" by Meret Oppenheim, 1936.

Top right: One of the buildings of "Best" Products.

Bottom: The roof of Gaudi's Casa Mila, 1905-10.

Stimuli which do not fit with what man expects from a particular place or situation evoke higher levels of arousal because of the attempt to identify the intruder and the reasons behind it as well as to reassess "the feel of the place".

FIGURE 41

2.2.2. Sensing the Environment

Man perceives the environment through his senses. Stimuli are received by human sensory organs where they are transformed into neural
impulses so that they can be carried through the nerves to the brain. Each kind of receptor has its own neuron path to the cortex. The nerves from the eye to the brain, for example, convey impulses only about light whether they are electrically stimulated or are stimulated by light or even by rubbing the eyes. Furthermore, there is point-to-point projection of the retinal image on the occipital lobe of the cortex. Thus, different kinds of sensory images are kept separate by being sent along distinct and specific routes from the receptors to the sensory areas of the cerebral cortex which is the final part of the sensory neural circuit (M.D.Vernon, 1962, pp.12-13).

This initial phase of perception is essentially figurative in nature (Piaget, 1969), involves all the senses and is needless to comment on its necessity. Our interest in the present study however demand that we focus our attention on two specific aspects of the way man senses the environment.

The first aspect of interest relates to the distinction between cognition which is operational to man's purposive behaviour and cognition which is freed from it. Based on an impressive series of experiments, Piaget has argued that at the initial stage of perception the eye focuses on certain elements in a form. This function, which Piaget calls "centration", explains perceptual deformation, as in the case of primary illusions. Compensation for this, he argues, is derived from the co-ordination of multiple centrations, a co-ordination which he calls "decentration" (Piaget, 1969). He then related this process to the exploratory drives of the human mind. Bruner later suggested that a process which operates in much the same way as Piaget's decentration may be what frees cognitive activity from the domination of man's particular goal-oriented behaviour and allows more environmental information to come into view (Bruner, 1956, p.16).
Secondly, it has been mentioned that the question of defining exactly what properties of the incoming array are informative is not settled yet for psychology (Ittelson, 1976, p.146). Accordingly, the exact point of transition between sensation and cognition remains obscure. Both for methodological and substantial reasons it is important that in the context of the present study the process of sensing the environment is confined up to the moment that intelligent brain interferes.* Thus, the distinction between sensing the environment and cogniting it is approached as being qualitative in nature since sensing is regarded as a more or less mechanical procedure**. In any case, it is evident that sensory perception constitutes the vital and indisposablen"doorstep" of environmental experience.

2.2.3. Environmental Cognition

As soon as stimulus reaches the brain, it triggers several*** relevant schemata, generally out of those already energized, and is juxtaposed to them. This process, which constitutes the essence of cognition, is by no means a simple one, a reason for this being the operation of the unconscious part of the brain (see Smith, 1977, pp.32-5).

In a strict sense, it is only when stimuli are juxtaposed to mental schemata that they become informative. It is only at this stage that they

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* Evidently, this is a theoretical distinction since schemata are activated in advance as a result of expectancy. What we do not know as yet is which schemata will be used in cognition.

** It must be noted that Rapoport follows a different distinction since he includes first-level cognition (i.e., identification) in his first phase of sensory perception (Rapoport, 1977, pp.30-4). This discrepancy is bound to have certain repercussions in the development of the argument as Rapoport's initial phase is no more universal but culturally conditioned. Thus, the issue will require further attention at a later stage of this study.

*** Bruner has shown that this is not a one-to-one relationship, i.e., one stimulus is usually matched to more than one schemata (Bruner, 1956).
are attired with meaning, even when this meaning is the mere identification of an object. Indeed, discrepancies in people's personal parameters, and especially their past experience in life, may lead to different identifications of the same object. Von Uexkull cites an example in which a native from a primitive village who had not seen a ladder before identified it as a strange pattern of pieces of wood (Von Uexkull, 1934). The incident with the toilet bowl described in 1.3 shows that such discrepancies can occur even amongst people who, by and large, belong to the same culture but still differ in mental schemata.

The Selective Organization of Perceptual Input

Apart from providing a measure for the varieties of schemata that exist in a person's mental world, personal parameters are also related to selectivity. This aspect of perceptual experience occurs at three levels, all of them having to do with the way cognition takes place.

Firstly, as the early Gestaltists have pointed out, people cognize objects as organized Gestalten. Although retinally an object is represented by a mosaic of pinpoints of light of varying wavelengths, the fact that cognition is based on juxtaposition of schemata makes people experience chairs, buildings, landscapes and so on. Secondly, among all features of an object only certain ones are experienced. Concepts from information theory like redundancy and channel capacity explain why the cognition of only a few characteristics of an object is enough to lead to its identification as a whole (see Rapoport, 1977, p.196). Finally, only certain objects, or features of objects, among all that exists "out there" enter a person's experience of the external world. Other items either play a minor role or are not included at all for reasons other than redundancy and channel capacity. This selective activity is partly attributed to expectancy and partly to a phenomenon which Gordon
Allport described as the projection of the person's "mental set" on the perceived situation (G.E. Allport, 1961, p.259).

The selective organization of perceptual input is determined by both personal and environmental parameters. Thus, when one wishes to make a telephone call, phone booths become brighter and clear; so does one's favourite corner shop, a particular bench or tree. Humans are therefore regarded as active perceivers in the sense that they consciously or unconsciously select and organize their perceptual experience.

Possible Varieties of Cognitive Experience

Most psychologists would agree that what people tend to "see" in the environment is objects in the broadest sense of the word (see, for example, Seymour, 1979). According to the findings of the first part, the information thus received would be identificational, i.e. first-level cognition (see table 1.4.) (Fig. 42).

Cognitive activity however is not confined to this. As Gregory suggests, perception involves a lot of conscious and unconscious inference, "a kind of problem solving, a kind of intelligence" (Gregory, 1970, pp.30-31). For this reason, and in view of Heider's argument (see p.123), it is reasonable to expect that cognition can cover the whole range of information which is stored in environmental forms.

Thus, provided that the necessary schemata exist in the person's mental world, he can also cognize second and third level information (see table 1.4). We will call this type of experience second and third level cognition depending on whether what is cognized refers to "why something exists" or "why it exists in this manner". Section 1.3 is replete with illustrations of second and third-level cognition experienced by the writer of the present study or the authors quoted.
Top: "Brillo Boxes" by Andy Warhol, 1964.

One should not assume that first-level cognition is an easy task as there may be several overlapping entities that function as "objects" (e.g., the pipe, the painting, the canvas etc.).

FIGURE 42

Finally, as a person gets actively involved in perception, cognition can go beyond the three levels mentioned. Depending on personal parameters, cognition may disentangle itself from what is literally "there" to be perceived. Thus, it may range from a tangential associational experience* to a completely different meaning being attached to the stimulus received. Arthur Koestler had said that activities like listening to music or even reading Kant can lead to the experience of a whole series of apparently

* For example, an event that is stored in a person's memory may force him to associate big country houses with a particular relative of his who lived in a similar place.
irrelevant schemata (Koestler, 1964, p.325). In addition to this, the "effort after meaning" may be so strong that, as Lawson wrote "we find pictures in the clouds and the coals of the fire almost as readily as we recognize the faces of our friends and relatives" (Lawson, 1980).

Fourth-level cognition, in which the projection of a person's mental set on external stimuli is clearly in operation, is related to what Sartre called "the imaginative transformation of the image", evidently a crucial notion of phenomenology (Fell, 1965; see also Sartre, 1971, pp.63-96). This mode of experience can reach the same depths as second and third-level cognition; yet, it often does so in an disorderly manner as it is no longer based on concrete external data.

Charles Jenks presents a series of cognitions of le Corbusier's Ronchamp (top left). Out of all these associations, le Corbusier admitted that he aimed at the "crab shell" form of the roof.

FIGURE 43
It has been suggested that certain environmental features are more prone to evoke fourth-level cognition than others. Agrest's analysis of shifters* (Agrest, 1976) and Jencks's of metaphors (Jencks, 1981, pp.40-92; Fig. 43) elaborate in this. It must be noted however, that such cognition is not entirely as idiosyncratic or associational as it appears to be. Doers often materialize in their designs data from a different context and notions of archetypal images which are capable of receiving a variety of interpretations. For this reason, such experience is both third and fourth-level cognition.

What actually occurs

The first three modes of experience outlined above explain the type of environmental information involved in cognition. To these, should be added fourth-level cognition which is characterized by the individual's idiosyncratic reflections on the subject rather than the decoding of information embedded in it.

Such cognitive experience can only be tentative since its occurrence can not be tested experimentally. The nature of cognition, which is an internal process always poses this difficulty to the researcher who wishes to conduct such an experiment. The issue is further obscured by the fact that a certain portion of cognitive experience tends to occur below the threshold of consciousness, especially in cases of familiar environments (see Smith, 1974, p.33). Although there is evidence to

* Environmental features which are particularly dense in meaning may operate as shifters in the sense that they may initiate many different readings (Barthes, 1967, p.22; Agrest, 1976, p.61). The built environment can thus be turned into an infinite text.
suggest that subliminal stimuli may even determine ongoing perceptual experience (Dixon, 1971, pp.29-64), it is highly unlikely that any interviewee can give a clear account of how this happened.

In view of the above, it appears that a report of what actually occurs can only be provided by a more phenomenologically inclined approach to the issue. In this, we will consider subjective experiences of particular individuals with reference to specific objects.

Roland Barthes, for example, unfolds his cognitions of the launching of Citroen's DS model (Fig. 44) by commenting on the manner the car was produced. Barthes experienced its smoothness as being so perfect that it contradicted the technical and typically human operation of assembling (Barthes, 1981, p.88). In a similar sense, Jencks discussed his cognitions of Beverly Hills star houses and referred to the sign of status transmitted to him by the style of most houses. He received further third-level information, like the seclusion of a rich yet "human and homely" star in view of an "ordinary" public domain, through smaller elements of these mansions (Jencks, 1981, pp.56-8; Fig. 45).

Historians' experiences are also bound to contain environmental information which lie deeper than what is normally regarded as the surface. A measure of Panofsky's interpretations has been presented in the preceding part of the study. Another prominent historian, Lewis Mumford describes in his book "Art and Technics" three paintings, three nudes painted in different epochs (Middle Ages, Renaissance and 19th century). He comments that such artefacts contain the maximum of meanings

* As the interest lies in examining what environmental information is experienced, we will not be concerned with fourth-level cognition. It is clear, however, that this separation is not always feasible. As people project their "mental set" on environmental input, the outcome will theoretically contain at least some fourth-level cognition.
Lucille Ball's mansion and Jenck's comments on his experience of it.
deep second and third-level information) with minimum materials. "In these condensed aesthetic forms", he writes, "we find three different ways of looking at the world, three different philosophies, three cultures not just three women" (Mumford, 1952, p.20). It is not surprising that, in view of such cognitions, another historian, John Cloagg, proposed an architectural interpretation of history. What he found of particular interest was the understanding of how specific forms managed to survive through the ages by means of the changing significance of their existence. Deep second-level cognitions in a cross-cultural and cross-temporal perspective are persistent throughout his study (Cloagg, 1975).

As cognition is to an extent a learned process*, it lies beyond any doubt that the above writers have been trained to decode the representations of social and psychological data in the environment. A similar remark can be passed with respect to artists (fig.46) and writers of imaginative literature (like those examined by Eco, 1972, and Tuan, 1976) who are noted for the variety and complexity of their cognitions. The experiences of such individuals indicates that, given the circumstances and the agreement of personal and environmental parameters, it is possible for the widest and the deepest dimensions of the environment's content to be cognized.

Yet, it would be erroneous to assume that everybody is trained to decode environmental information. In order to see how "ordinary" people experience their surroundings, we should take a look at the way intentional communication takes place in everyday life. In Malaspinas's (1981) and

* The views of psychologists with regard to this issue remain unresolved since the problem lies at the core of the argument between the two philosophical traditions. However, the stance that a large part of cognition, rather than all, is learned is not in dispute.
Top left: "Street Scene", by George Grosz, date unknown.
Top right: "Terror in Brooklyn", by Louis Guglielmi, 1941

Although there is no verbal statement involved, it is clear that the painters experienced and then depicted third-level information and especially the fact that these environments were not built to be pleasing, a fact that gives rise to feelings of alienation. It is interesting to note how, along with features of the built environment, people are used to strengthen the point.
Duncan and Duncan's (1976) studies, it has been shown that particular elements had been incorporated in houses of lower class areas so as to communicate the users' aspirations with regards to their class and group memberships. These elements were most probably experienced as containing third-level information by other inhabitants of the area (see 1.3.4. and Figure 31).

FIGURE 47

Similar observations are drawn from other forms of everyday communication, such as advertising. Promoters of car stereo equipment put in their advertisement features like luxurious clothes, a fast cosmopolitan car, and, above all, an impressive entrance to a building appropriately lit and reminiscent of the Monte Carlo Casino (Fig. 47). Without any verbal clues referring to status, advertisers are almost certain that anybody in the western world will cognize the connotations they wish to convey.

The above illustrations of multi-level cognition along with those
incorporated in the first part of this study, point at the fact that people may and often do cognize the information outlined in table 1.4.

Environmental Cognition in View of Man's Cognitive Needs

This is further elucidated when we examine the varieties of cognitive experience in relation to man's cognitive needs. In the case of operational cognition, for example, man is in need of a particular set of environmental information. This comprises first-level information (so that man identifies what is there to be used, avoided, negotiated and so on), certain bits of second-level information (relating to the use-value of specific objects) and, finally, the third-level information which relates to the particular quality of an object in which man is interested. Evidently, the information required by operational cognition is determined by the activity that man is engaged in at the time. For this reason, there will be no tendency for man to cognize the entire content* of the environment (unless of course the activity is sight-seeing).

The scope of cognition is widened significantly when we consider other needs that induce cognitive activity, and especially man's need for reassurance, belongingness and so on. Grasping the "feel of a place" is an example of the way in which man's safety needs are gratified. As noted earlier, this involves a variety of multi-level information. Similarly, man's need for belongingness, an adverse effect of which is the feeling of alienation, may demand the cognition of the motives and philosophy behind a particular form. Thus, second and third level information which

* In many cases, operational cognition may refer to the entirety of features of a particular environment. When one is studying, for example, one must cognize his room as peaceful and relaxing enough to allow him to concentrate. However, this only involves a specific bit of environmental information even though this is carried by the entire array of environmental features.
answers the questions "who built" or "who uses what" and "for what reason" will be useful in view of the perceiver's need to identify with his environment.

Similar observations apply to cognitive activity which arises from dissonance in a person's understanding of the world or from curiosity which is initiated by the development of his mental schemata. Evidently, such cognitions depend heavily upon people's personal parameters and cannot be forecast by the designer. It is reasonable to suggest, however, that their scope is much wider than that of operational cognition as they can refer to any bit of environmental information.

Lastly, in cases in which cognitive activity is initiated by an autonomous need to know and to understand there is a distinct tendency to cover the entirety of the environment's content. Based on a thorough analysis of the issue, Maslow suggests that when cognition is dominated by our basic needs, it focuses on specific aspects of the environment's content, thus becoming sterile and classificatory.

On the other hand, he argues that when people have reached a stage in which they have gratified their lower basic needs (and are thus considered as "self actualizers"), cognition becomes need-irrelevant. Experience, then, exceeds the limits of what is useful or relevant to the person involved. In this case, there is no attempt to force the object of experience into preconceived segments, but its content is fully attended to with a receptive attitude. Attention floats freely, so that the unique, the ideographic can be perceived. Thus, the world is explored through the content of individual objects and environments; cognition, then, can be regarded as providing the basis for "peak" or "mystic" experiences (Maslow, 1968, pp. 74-96 and 213-4)*.

* A similar formulation has been advanced by Fromm (1947, 1959) who proposed two ways in which a person perceives the world, reproductively (only what is "on the surface" is experienced) and generatively (the world is
We can therefore conclude that when cognition is not operational, its potential is broadened. The reason for this is that it becomes disentangled from the requirements of the particular activity performed and can thus relate to a much wider range of second and third-level information. In addition to this, it has been shown that when cognition is initiated by the need to know for the sake of knowing, it aims at the entirety of the environment's content.

2.3. Cognition and Intellectual Development

Up to this point, we have been concerned with the study of cognition in a synchronical sense, i.e. with the way specific environmental stimuli are received and decoded by means of the existing schemata in a person's mental world. For this reason, the latter has been viewed as an arsenal of already attained schemata which are used to define external input. However, as we all know, man's knowledge of the world does not remain unaffected by cognition; if nothing else, it is enriched by the newly acquired bits of environmental information. But let us examine the effects that cognition bears on the development of man's mental world.

Early behaviourist theorists believed that our picture of the world develops through a succession of experiences in which novel cognitions are added to the already attained ones. The whole process would appear to be a mechanical procedure of cumulative storage were it not for the operation of Piaget's functional factors of assimilation and accommodation (Piaget, 1971, 1971a, 1972)*.

Assimilation consists of taking in stimuli and "translating" them by means of relevant schemata. Thus, environmental input is being "altered"

* It is interesting to note that although several aspects of Piaget's impressive body of research and findings were met with criticism (f.i. Flavell, 1978), the notions of assimilation and accommodation were left uncriticized.
(i.e. cognized, defined, appraised) by the structures in the person's mental world while, on the other hand, these structures and consequently mental world in its entirety are being altered by input; the latter function constitutes accommodation. The two functions characterize all cognitive activity.

Assimilation ensures continuity and stability in the face of a complex and changing world, while accommodation leads to changes in inner structures needed for adaptation to new circumstances. Thus, when one views the effect of cognition over longer periods of time, accommodation of experience shapes the individual's mental world and, through this, many more enduring characteristics of his, like his value system, his motivation and aspirations in life and so on.

But let us start with an illustration showing the two processes in operation. When one perceives an object of which one has no previous experience, such as a collapsible chair or a dentist's chair (fig. 48), several schemata are activated from the memory banks. During cognition, the object is assimilated by being "altered" into multi-level information such as "chair", "specialized use", "probably very expensive", "a lot of human thought and effort in it", "lush high-tech design", "the reclining position is handy for the dentist's job" and so on.

All this novel cognitive experience does not stay inert but is fully integrated within the activated schemata. For example, the schema of a chair is now widened and enriched with new evidence. This change ranges from partial readjustment (as in the case of the widened and enriched schema of how a chair looks) to severe modification or complete alteration of established beliefs.*

* For example, chairs are no longer considered as solid and inarticulate, it is acknowledged that dentists need a considerable investment to start their own private practice and so forth.
The full qualities of accommodation, however, are brought to surface when the issue is approached over longer periods of time*. Let us think of a person who lives for a certain period of time in a new environment; not as a tourist, because this would imply that he would approach the environment as a "spectacle", but as an ordinary person. As is generally the case, schemata like "a town", "people in the street", "the social environment of a given place", or simply "buildings", will have been fairly developed in terms of accuracy. On the other hand, schemata relating to the new environment, its people and customs and the person's cognitions may often take long before they are "properly" assimilated and accommodated. Bartlett referred to patterns of schemata which underwent re-patterning when tested against novel stimuli (Bartlett, 1964, p. 196).

* Cognitions may often take long before they are "properly" assimilated and accommodated. Bartlett referred to patterns of schemata which underwent re-patterning when tested against novel stimuli (Bartlett, 1964, p. 196).
attitude towards it are expected to be abstract because they are based on information "about" the environment rather than on first-hand experience.

Invariably, operational needs will force the person to identify his place of residence and work, as well as bus stops, eating places and so on (i.e. basically first, but also second and third-level information).

But experience does not stop there. Once the person becomes familiar with the codes by which data is materialized in the environment, he will be expected to experience wider and, especially, deeper second and third-level information*. Such information may include the local's attitude to God, work, or entertainment, the bonds they develop with each other and their feelings towards foreigners, the degree of freedom present in their social system and so on. As assimilation and accommodation occur in a reciprocal manner, some bits of experience will take considerably longer than others to become consciously accommodated. In the long run, the person is not only expected to enrich and diversify his mental schemata but also to strengthen or review them. Thus, repeated experience of a variety of apparently trivial information may effect in deep structural changes in a person's mental world (f.i. people who have stayed abroad or travelled a lot tend to be more open-minded and receptive than others).

The fact that schemata which vary in significance become less abstract and more accurate by cognition is the cornerstone of the link between cognitive experience and the development of man's mental world. In view of the above, it is reasonable to conclude that knowledge of the

* The degree to which this will happen is a function of both personal (i.e. cognitive needs, the person's ability and interest in assimilating and accommodating and so on) and environmental parameters (e.g. data materialized in the environment in a monotonous or confusing manner will not be enthusiastically perceived).
world is not simply attained by experiencing environmental information bit by bit and accumulating these bits in the brain. Instead, it is the result of a rather tedious, enduring process of intellectual development. In this process, trivial and apparently superficial cognitions, which often occur unconsciously, may have a substantial impact as they become fully integrated in man's mental world.

2.4. Conclusions - The Significance of Environmental Cognition

Motivated by a number of different cognitive needs, people are continually decoding environmental information. It has been shown that this process exceeds the identification of objects and the recognition of their elements. Instead, it often covers the plethora of second and third-level information embodied in our surroundings. In order to reach this conclusion, it has been essential to re-examine the supposition that cognitive activity merely refers to man's operational needs.

Furthermore, cognition not only allows people to receive new knowledge but also affects their already existing mental schemata. The latter are strengthened, modified or reviewed by input, thus becoming less abstract and more accurate representations of reality. The fact that this property of cognition relates to information and schemata which vary tremendously in nature, suggests that environmental cognition plays an important role in our understanding of the world.

Naturally, man's picture of the world is not only acquired through the experience of the built environment as this has been analysed in the present study. Other types of experience, like learning through everyday life are also contributing towards this end.

For example, let us consider a typical working-class housing estate and children who are brought up there(Fig.49). The findings of the first
part of this study suggest that the appearance of the estate is not accidental but incorporates the traces of a variety of factors and social data which have been involved in its production. It is probable that the estate has been the outcome of a governmental project on a restricted budget. This limited capital, which is due to the government's priorities in the allocation of financial resources, is reflected in the manner the scheme was designed and built. It is reasonable to suggest that the amount of expenditure granted for the project is, among other factors, related to the way the government (and, perhaps, society as a whole) views the particular social group, to the image the latter are presenting and so on.

The children's understanding of society and their position in it will develop through a variety of channels such as inter-personal relations in which they are themselves involved, exchange of ideas and views with other people like their parents and friends and so on. In addition to these channels, they will be expected to come to an understanding of the above set of social data by cognizing its projections in built form, especially when their estate is compared to other residential areas. Apparently, it is unlikely that this understanding will occur as an instantaneous enlightenment, a "eureka" experience of something that was unthought before. Instead, it is more possible that the accommodation of a variety of similar multi-channel experiences in their mental world will have paved the ground for such a cognition. If already existing mental schemata of these social data are consistent with what is perceived, then cognition will strengthen them. If they are not, then perceptual input will place them in doubt and it is expected that they will be modified or even altered to suit incoming evidence.

It lies beyond the scope of the present study to specify the relative importance of environmental cognition compared to man's overall
understanding of the world. The nature of the issue involves the scrutiny of internal processes in relation to all other channels through which this understanding is attained and this appears an exceptionally complex ground for measuring.

It is however clear that environmental cognition does constitute such a channel the impact of which is complementary to that of all other channels. Furthermore, it can be suggested that this channel involves a certain peculiarity that other sources of information do not have: because of the relative immobility of the built environment (i.e., the domain of information), people are constantly and continually exposed to its content. In our example, the children will be living amongst the projections of the afore-mentioned data for a considerable part of their lives and on a day-to-day basis; they simply cannot avoid it. Without disregarding the dynamics of subliminal perception, it is reasonable to suggest that this repeated exposure increases the possibilities for the particular bits of information to be consciously decoded and understood.

The fact that the built environment is continually acting upon people's mental schemata has not been acknowledged by designers and theorists*. Among the reasons that account for this is the overestimation of operational cognition (a result of the bias for functionalism) and the underestimation of the impact of momentary and apparently trivial experiences on the development of our mental world. In addition to these the role of subliminal perception is often ignored. Yet, research has shown that while our attention is consciously directed to certain bits of

* In the following part of the study we will elaborate further on this issue by reviewing the relevant design theories.
environmental information, a much wider portion of our surroundings' content is also received without our noticing it. In this manner, a notable number of schemata, and our knowledge of the world in general, is continually tested against evidence from the environment. This mode of cognition becomes apparent when environmental input contradicts our activated schemata and threatens them with modification.
PART THREE

COGNITION AND DESIGN THEORY
3.0. Introduction

The study of the function of cognition distinguishes two participating entities. On the one hand, there is the environment, a large domain which can be notably rich in the information it contains. The dimensions of this content have been analysed in detail in the first part of this study.

Man, on the other hand, is the user of environment who is in need of information. The reception and processing of environmental messages is of notable significance to man as it contributes to the development of his mental schemata and his overall understanding of the world.

It is between these two entities that designers, as well as anyone who shapes the environment, find themselves.

The question that arises and to which the third and final part of the study will address itself is what should the designer do in order to satisfy man's cognitive needs. Is it enough merely to carry out the project's requirements or are there any special considerations that designers must have in mind?

To answer these questions we will firstly examine how contemporary design theorists view cognition and then we will use the findings of the present study to develop a theory concerning man's cognitive needs.

3.1. An Overview of the Relevant Theories

20th century has been dominated by the principles of the Modern Movement the early masters of which approached architectural forms as "working tools or instruments" whose aim is to satisfy the needs that demanded their creation (i.e. Corbusier, 1947). They denounced indiscriminate ornamentation, which had become common practice in design, by preaching that good forms must derive from what they called...
the "true nature" of the object of concern. For this reason, they paid particular attention on the analysis of the design problem and the satisfaction of the operational aspects of the composite need. This orientation has been succinctly expressed in the well-known dictum "form follows function".

Thus, Modernists were interested in embodying in their objects an aesthetic quality which derives from the nature of the functions they performed or contained. In this sense, they were not concerned with the ability of the image of objects to function in relation to man's cognitive needs and the development of his mental world. It would seem therefore—especially after the discussion in the second part of this study—that new emphasis must be placed upon the function of the image of objects. Thus, the afore-mentioned paradigmatic motto could be transformed to "form follows function, but form functions". Viewed this way, the original dictum discloses a new property which does not degrade its functionalist orientation.

It must be noted that the purpose of the present study is not to replace the functionalist principles with a new theory but to modify that part of the dominant mainstream of thought that is pertinent to cognition. Since this study has focussed on environmental cognition, it can arrive at no conclusions with regard to functionalism as a whole.

Yet, the above transformation of the functionalist motto—a result of the findings of the present study—is relevant to a growing tendency to re-examine the functionalist tradition. A number of theories which belong to this tendency "view architecture as a system of cultural meaning" (Gandelsonas and Morton, 1980, p.243). Building and other design projects are thus seen as participating in a kind of non-verbal communication between people rather than as merely satisfying what the
functionalist principles prescribe.

Since the present study focuses on cognition which may go beyond man's operational needs, it relates directly to many of these theories. The aim of this section, then, is to assess their theoretical considerations in relation to the findings of the first two parts of the study.

As noted in 1.0., the question of meaning in the environment is firstly covered by semiology; especially its branch pertinent to architectural and urban design. Although semiology was originally founded as a broad discipline aiming at "the study of signs at the heart of social life" (Levi-Strauss, 1978, p.9), research on the qualities of the built environment has focused on certain issues in particular. Semiological approaches are mainly concerned with semantics* and syntactics whereas the issues of origins and use of signs do not attract equal attention. Thus, the discussion generally centers on topics like the identification of the sign in the built environment (eg. Jencks, 1980; Scalvini, 1980), the analysis of the way in which the elements in the sign are structured (Eco, 1980) and so on.

This is due to the fact that semiology had already developed a vocabulary of terms based on linguistics when it became apparent that the built environment can also be regarded as forming a system of signs (ie. as standing for something not present). It is after this realization that architectural semiology took off, a little over two decades ago. The main effort was to transplant ideas and principles which were found applicable

* Morris identifies three fields that the discipline had to cover: "semantics", that is the study of the sign in relation to what it stands for, "syntactics", the study of the structural relations between more than one signs, and "pragmatics", the study of the origins, use and effects of signs (Morris, 1946, p.217).
to spoken language, into the study of the language of the built environment. For this reason, the dynamics of both the origins and the use of environmental information has been a question of minor importance and the sign has tended to be seen as a "sign-in-itself".*

The lack of a systematic analysis of the origins of signs has notable repercussions on the richness of the content which can be derived from the man-made environment. For example, the emphasis often lies on the doer (as, in Bonta, 1979, and Krampen, 1979, pp.62-3) and this leads to the underestimation of other domains of environmental information. Thus, information about the users, the composite need and the External Factor are often ignored. Such an orientation may induce the designer into assuming that it is mainly the doer's input that generates environmental information**

With regard to the use of environmental signs, semiologists seldom relate the study of signs to research in psychology. A notable exception to this can be found in the writings of Krampen who uses a model of the cognitive act (Krampen, 1979, pp.51-60). This provides a description of the way in which mental schemata are juxtaposed to environmental stimuli. What it does not take into account however is that stimuli are not merely classified by means of mental schemata but they also proliferate changes in man's inner structures and mental world as a whole. Thus, by ignoring the function of accommodation, Krampen's approach results in divorcing the

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* Such signs may have existed accidentally without ever being utilized.
** It can be argued that this is implied in Jencks's illustrations in his well-known book "The Language of Post-Modern Architecture".
experience of man-made environment from its impact on the development of man's mental world.

Another element in Krampen's work that leads to the same conclusion is that cognition and activity are simply taken as being interdependent (Krampen, 1979, p.59). This stance draws the attention on the types of cognitive needs which are either dominated by man's purposive behaviour or lead to experiences that initiate it. For this reason, it fails to view the whole spectrum of cognitive needs that would have explained cognition's contribution to our understanding of the world.

Another approach which deals with the issue of the environment's content is offered by Norberg-Schulz. In his work, the interest lies in linking man's holistic (both cognitive and affective) experience of the environment to his general orientation or his sense of 'being-in-the-world'. To achieve this, he argues that the environment should incorporate existential meanings which, as man is in search for identity, will form his existential space, i.e. "a relatively stable system of space schemata or 'image' of the environment" (Norberg-Schulz, 1971, pp.10-11; 1980, pp.221-3). The built environment forms man's architectural space which, if architecture is to function properly, should be a truthful concretization of man's existential space. "The task of the architect, therefore, is to help man to find an existential foothold by concretizing his images and dreams" (Norberg-Schulz, 1971, p.114).

Since Norberg-Schulz's aim is to identify existential meanings in the environment, he does not attempt to explore the full dimensions of its content nor the conditions that sustain it. Although in his earlier studies, he refers to a wider part of this content (f.i. Norberg-Schulz, 1963,pp.118-27), he later focuses on information about man's relation to God or to society as a whole and so on (Fig. 50). In this sense, he is
When describing environments like Mies's Illinois Institute of Technology, Norberg-Schulz does not refer to the whole spectrum of their content but to the "image of harmonious, ordered universe" it evokes.

**FIGURE 50**

mainly concerned with the in depth dimension of the environment's content.

It can be seen from the above that although Norberg-Schulz's work is closely related to this study, its scope and orientation vary. This is also reflected on, and accentuated by the nature of his approach which is based on the phenomenology of Heidegger (Norberg-Schulz, 1979; 1980a, pp.6-11). Things "out there" are regarded as entities in their own right
(or as "gatherings a world") and the main interest in perceiving them lies in as much as such experience relates to man's "being-in-the-world". The phenomenological approach surely provides an insightful look at this. Since entities are viewed as wholes, however, there is no attempt to dissect the environment's content as this has been done in the present study. Thus, the need to explore the content in its full dimensions is incongruous with the approach adopted by Norberg-Schulz.

Lastly, and with reference to the theories of Norberg-Schulz, it must be noted that the need for existential meanings in the environment he identifies evidently refers to non-operational cognition. In this sense, it seems reasonable to suggest that his approach aims at discovering these qualities of the built environment which offer possibilities for what Maslow called "peak" experiences.

A third contemporary approach to cognition is that of Peter Smith. With regard to man's cognitive needs, Smith refers to "the need to make sense out of one's environment" as well as "the need to keep schemata alert" (Smith, 1974). Yet, his work is basically centered on the aesthetic experience of the urban environment. For this, he applies Cannon's principle of homeostasis (a human tendency for physiological equilibrium) to the case of man's psychological composition and concludes that people prefer a living condition in which homeostasis and tension will alternate. He then goes into an extensive examination of the qualities of the unconscious part of the brain and notes its preferences in terms of aesthetic experience. Thus, in as much as purely cognitive experience is concerned, Smith concentrates on deep messages which correspond to archetypal images. These meanings, which may be stored in the environment in the process of its shaping, are often projected on it by people who experience it. Smith characteristically writes that "by its organization of style, space, light, constriction, gloom, order and apparent chaos, (the urban system) represents
a projection of the human situation" (Smith, 1974, p.114).

Another interesting approach which relates to the present study and which proved to be remarkably influential is Kevin Lynch's work on "the Image of the City". By focusing on imageability Lynch's writings refer directly to the issue of clarity in the environment and, for this reason they will be discussed extensively at a later stage in this study. In the present context, however, the interest lies in relating the theoretical considerations which characterize his approach (and a notable number of subsequent studies based on his writings) to those of this study.

Lynch's point of departure is man's need for orientation in the complex modern cities (Lynch, 1960, pp.1-6). Although this need clearly involves cognitive activity, the way Lynch puts it bears little connection to the cognitive needs discussed in the present study. There are two reasons for this. Firstly, he views the need of orientation as the operational need of way-finding amidst a complex environment and this evidently limits the scope of cognition. The second reason is that in order to satisfy this need for orientation, Lynch is mainly concerned with the arrangement and interrelationship of the physical features in the city. Thus, he regards cognition as relating to the experience of the forms (that is: shape, size, relatedness and so on) of objects rather than the experience of their content (Fig. 51). It is not surprising that such experience is limited to the first-level identification of objects and their features. A similar attitude characterizes Lynch's study on the "Theory of Urban Form", in which he tends to divorce form from content (Lynch and Redwin, 1970), and later research on the image of cities where researchers based on Lynch's methods identify the urban features which are "known" by the widest number of subjects (f.i. Francescato and Mebane, 1973).
Lynch's drawings underline the nature of his approach.

FIGURE 51

In response to Lynch's theories, however, several studies (eg. Gulick, 1963) have argued that apart from identifying urban features man needs to receive more social information from the environment. Steinitz (1968) stressed the significance of congruence between forms and the activities they contain in this, whereas Zannaras (1976) pointed that the cognition of city structure (eg. land use, variations in density, etc.) also provides clues for way-finding. Finally, it has already been noted that the need for orientation is given a very different existentialist dimension - and in this sense it can no longer be regarded as an operational need - in the work of Norberg-Schulz.

To conclude the overview of relevant approaches one must consider the remarkable body of research presented by Rapoport, mainly in his book "Human Aspects of Urban Form" (1977). Based on both theoretical and field work from different disciplines relevant to urban design, Rapoport pays particular attention on the role of cognition in the man-environment relation. He views the environment as the organization of time, meaning, communication and space (Rapoport, 1976, p. 223; 1977, pp. 10-11). In this, cognition is important both in designing and in perceiving environmental forms.

As noted in the second part of this study, Rapoport includes
the first-level identification of objects in the sensory (what he calls perceptual) rather than the cognitive stage of environmental experience. By doing so, he implies that first-level information is experienced objectively. Yet, he later stresses the subjective element in cognition by viewing it as a process of "ordering and giving meaning" to the environment rather than decoding what already exists there and knowing it (Rapoport, 1976, p.233; 1977, p.108). This formulation which originates from anthropology - where individual differences are notably diverging when seen in a cross-cultural perspective - is not intended to lead to a phenomenological approach. Nevertheless, it carries in it the danger of being misinterpreted in the direction of an overestimation of personal parameters and an underestimation of stimulus dependency in perception.

Furthermore, it can be argued that if the above point of departure is not backed up with an approach which would put the emphasis on the individual, the meanings attached to the environment would appear fragmented and merely leading to isolated behavioural responses. In a sense, it seems that Rapoport is doing precisely this - his interpretation of course being subject to his main interest, ie. how people behave in different settings. Thus, although he acknowledges the fact that the built environment is a "major form of cultural information" (Rapoport, 1977, p.326), he sees its role as a domain for experience as relating to particular messages rather than as being of an altogether different quality, ie. complementary to man's overall understanding of the world.

This is perhaps explained by the fact that Rapoport is not interested in coming to what he calls an "overgeneralization about human needs" (Rapoport, 1977, p.383) and prefers to concentrate on specific aspects of design. In this sense, he does not attempt to unify man's cognitive experience of his surroundings by linking it to man's intellectual development in view of a generalized need to know and to understand. One
could argue that much of his work, and especially the afore-mentioned book, is characterized by the lack of a clear conception with regard to such needs. A conception which could have served as a backbone for the otherwise fragmented collection of case studies.

3.1.1. Comparative Analysis of the Theoretical Considerations

As can be seen in the preceding section, the issue of environmental cognition is now becoming increasingly central in design theory. The first item to note however is that most writers who refer to the word "meaning" attire it with a series of different interpretations (see Jencks, 1969). Since environmental experience is both purely cognitive as well as affective-evaluative in character, meaning can be regarded as being an amalgam of the two. When we say that a feature in the environment means something, we refer to both what it stands for and to what it means to us. Approaches like Norberg-Schulz's typically involve both explanations. The object of the present study, however, has been man's purely cognitive experience of the environment and for this reason we have used the term "information".

Another observation that can be made with regard to the theories discussed is that the environment's content would not have been dealt with by any writer if there had not been some conception of a corresponding human need. In all theories, except for writings in semiology, cognition relates to certain cognitive needs whether these are specific or generalized. Of these, it is only Smith and Norberg-Schulz who relate cognition to a cognitive need that goes beyond the particular activity of a person at the time.

Even then, however, cognition of the environment's content is not linked to the development of his mental world, as this has been elaborated
in this study. There are several reasons to explain why this important dimension of environmental cognition has not attracted a fair amount of attention.

The first reason is that research tends to concentrate on the requirements set by the activities contained in space rather than on people's basic needs. This attitude which stems from the behaviourist tradition - in which people are regarded as organisms responding to external stimuli rather than persons in their own right - is partly responsible for sustaining functionalism in modern architecture. Although the rise of cognitive psychology has broadened the scope of cognition, design theory tends to regard the latter as merely relating to people's overt behaviour rather than their cognitive needs. We have seen in the preceding part of the study that when cognition is activity dominated it only refers to a limited body of environmental information.

The second reason has to do with the nature of environmental experience. When cognition is regarded in momentary terms, it appears fragmented and, possibly, accidental. Even when one consciously perceives a certain body of environmental information which seems novel, the dynamics of experience are not usually considered in their full dimensions. It appears essential to approach cognition in the long run to assess its impact. Environmental cognition can, then, be related to something stable, although evolving, namely: man's mental world.

The last reason is that most writers tend to overestimate perception of forms and first-level identification. This attitude, which has already been mentioned in the case of Lynch's theory, has a direct implication on the nature of mental schemata which are regarded as being relevant to environmental experience: schemata are seen as being essentially directional and shape-like formations.
Peter Smith suggests that "to a child a house is as pictured here" (Fig. 52). This is the basic house schema. As experience develops, the schema is extended into sub-categories such as terraced house, semi-detached etc. Ultimately it crosses time and space to embrace historical and modern houses at home and abroad. The extent of the subdivision is a matter of experience and, to some degree, conscious learning (Smith, 1974, p.27).

The findings of the present study suggest that what Smith is in effect describing is the image of the elevation of a house when one faces it from the street. As experience develops one may extend the schema of the elevation to include different house typologies.

This conception of a schema corresponds to the schema of the form of a house, or the spatial aspect of the schema "house". Through this, one may experience a body of social information which has been materialised in the environment as differentiation in form (e.g. information about the users and framework, discrimination of rooms and functions within the house and so on). The mere existence of the house tells us that there are people who felt the need to live in this place.
When the emphasis is placed on the spatial aspects of schemata, it becomes difficult to penetrate beyond the visual aspects of form and a significant part of the content, like the information above, will be ignored. Cognition, then, only refers to first-level identification and its relation to the person's mental world becomes distant. For this reason, the word "schema" ought to retain its other, basic meaning from the Greek, namely: "model", "an abstract internalized model on an external reality". So long as we are interested in exploring the requirements set by man's cognitive needs, it is essential that the conceptual (and not only the spatial) aspects of mental schemata are considered.*

The tendency to overestimate perception of form rather than "cognition through form" is often apparent in the literature. For example, historians have been criticised as merely describing the formative aspects of buildings rather than relating their form to its content and conditions of production. Even Norberg-Schulz, who is particularly interested in deriving existential meanings from the environment, often appears to concentrate on the spatial aspects of schemata (eg. Norberg-Schulz, 1971, pp.10-11). A similar attitude characterizes many semiologists who, following the qualities of spoken language, have searched into the elements of the form of building (f.i. brick, column, door etc.) in order to discover the "semantic unit" in architecture. It appears reasonable to suggest that if such a unit is to be found, it is more likely to exist at the level of content (as, for example, a social or psychological datum) rather than at the level of form.

* It must also be noted that the schema in the above figure is not the only one for the spatial aspects of the concept "house". The concept is complex enough to comprise an extensive array of spatial and non-spatial schemata. Some of these may be so widely shared as to signify the whole idea strongly (eg. the smell of pipe-smoking next to the fireplace or that of boiled vegetables coming from the kitchen).
To conclude this section, we must note that the object of the present work has been the study of cognition and of what the environment has to offer in the direction of covering man's cognitive needs. The theories examined, although related to the present one, are different in scope and orientation either because they are interested in examining a specific part of the environment's content or because they attend to a certain body of cognitive needs, ie. the ones that are operational to the activity performed.

3.2. Cognition and Designers

The discussion in the first part of this study suggested that the content of architectural and urban forms can be tremendous. A growing number of writers, however, have argued that modern schemes do not finally embody such a content. Francoise Choay, the French urbanist, commented on the "hyposignificance"-ie. among other things, low informational content- of modern environments, a phenomenon which Bonta called "desemantization"(Choay, 1969, p.31; Bonta, 1979, pp.30-49). As Theo Crosby has put it, the forms that many modern designers produce are so low in content that they resemble "a human mind stretched beyond its limits" (Crosby, 1973).

The reason behind this phenomenon must surely be sought in the functionalist thinking that has dominated architectural production of the 20th century. Yet, it appears that it cannot be solely attributed to the pioneers of this mainstream of thought, who admittedly offered insightful approaches to design, but to the fact that the majority of modern architects followed the functionalist principles to the letter (see also Brolin, 1976) This orientation found a perfect fit with the economic priorities of modern societies which limit the budgets, thus restricting the designers' scope. The result is that, along with certain aesthetic
requirements, most modern designers are concerned with the satisfaction of the functions involved in their projects. Thus, functions like eating, sleeping, ventilating the rooms or moving through the house attract all their attention and no allowance is granted in respect to the function of the image of the end product in relation to the users' cognitive needs.

In addition to the above, contemporary advances in technology and transportation have made it possible for designers to use materials like concrete, aluminium and glass on a world-wide basis. As a result, buildings, districts and even entire city centres around the world are now becoming increasingly similar. What unites such International Style environments is not only that they are devoid of messages of their socio-cultural context but also that the amount of information they embody seldom exceeds what is necessary for the activities involved.

A visit around a number of buildings in most modern cities designed by "anonymous" architects is enough to illustrate this point (Fig. 52). The phenomenon is also apparent in housing estates. A door is little more than for passing through and so is a corridor. Few traces of the users' individual characteristics, the doer's personal input or the context in which environmental change took place are evident. Although the buildings still function in the conventional sense of the word, there is not much else for cognition apart, perhaps, from the social data responsible for precisely this hyposignificance (Fig. 53 and 49).

3.2.1. The Need for a Deep Understanding of the Function of Cognition

But what can the designer do in respect of all this? It must be acknowledged that, along with the evolution in society's values and priorities, came in recent years an increasing awareness on the designers' part of the social and psychological implications of their schemes. A
In these two buildings, designers attempted to materialize more data than what is strictly necessary to sustain the functions. Thus, the differences in the elevations of the bottom, middle and top floors reveal the relative significance of the activities performed in them, the cornices and entrances strengthen the buildings' overall function and identity while at the same time they embody a number of cultural elements and so on. The pleasant, ordered whole the design creates reveals perceptive and articulate architects. A similar comment cannot be applied for the typical, anonymous, downtown office block, like the one at the bottom.
Although the image of the square is not particularly exciting, it embodies an extensive set of information about the socio-cultural context in which it emerged, the differences between the users and doers of different houses, the discrepancies between the type of activities performed in the attic and those of the other residential floors and so on.

On the other hand, the housing scheme below is totally depersonalized (identical flats, few clues about discrepancies in activities, virtually non-existent input from the designer). Apart from the facts that this is a typical functionalist scheme and that it has become nowadays easier to build balconies, it is devoid of any messages of its socio-cultural context. On the whole, the scheme embodies the information needed for operational cognition (i.e. mainly first-level identification of entrance, lift, flat etc.).
notable number of architects, such as Ralph Erskine, have tried to make the best of the budget at hand aiming at a solution that will cover the widest body of human needs, cognition included.

Byker (Fig. 23) shows that such an effort can be successful even within the restrictions of modern societies. What is lacking is a holistic conception of the users' deeper psychological needs and the environment's ability to cover them. As noted in 0.1., this will enable more and more architects to acquire a clear understanding of what they should aim for so as to raise the quality of the environment.

Thus, the first step towards the satisfaction of man's need to know and to understand is that designers must become fully aware of the function and significance of environmental cognition. Designers should by no means disregard cognition by assuming that it is mainly operational in nature. Instead, it is essential that they acquire a deep understanding of how the form they create functions in relation to man's mental world. Thus, by considering the widest spectrum of man's cognitive needs, they will be in fact regarding people as persons in their own right rather than automatons who perform specific activities.

3.2.2. Establishing a Common Reference Frame

The question that arises at this point is what sort of information should the designer embody in a scheme? Should he load it with all sorts of different messages so as to appeal to the users' diverse cognitive needs or should he attire it with the cosmetic treatment that the early functionalists were so critical of?

It appears that neither of the above will solve the problem, at least if they were adopted as an overall approach applicable to every environment. Although the users' cognitive needs do vary significantly,
no one demands that the answers to all idiosyncratic impulses should be permanently materialised in built form. On the other hand, excessive ornamentation does not necessarily yield a rich content since it only involves a certain type of environmental information*. In addition to the above neither suggests where the attempt to embody information in our forms should end and this may easily lead us to overloaded environments. Research has shown that settings which are too chaotic in the information they contain are as undesirable as monotonous ones because people become tired and abandon their efforts to experience the content (see, for example, Rapoport and Kantor, 1967).

It seems therefore that there has to be a common reference frame to which the content of a given environment must conform. This should be aligned with what one expects to experience in the given setting. The discussion in the first part of this study has shown that all environments have an inherent potential content: the what, why and how of their production. It is precisely this content which will have to be related to man's cognitive needs for the given setting to yield the common reference frame needed (Fig. 54).

The potential content of would be environments is given by table 1.4., the result of all factors which are involve in environmental change and generate information. This table, which includes the designer's own input, indicates the limit that a form's content can reach.

* It carries information about the kind of design used (first-level information), the need it covers both for the particular situation and the context in which it emerged (second-level information) and its style and philosophy as f.i. romantic, harsh geometric etc. (third-level information). Although the ordered and cautious use of ornamentation can accentuate the rest of the forms content (as f.i. in the Greek temples), the complete reliance on it is liable to create an overload of trivial information.
cognitive needs depend largely on the activities performed in space, as in environments like a motorway, the inside of an office and so on.

Symbolized by: 

The activities contained in space are not restrictive. A wider spectrum of cognitive needs develops and demands satisfaction as in environments like living-rooms, kitchens, street elevations and so on.

Symbolized by: 

The users' cognitive needs are independent of, and sometimes determine activity and cognition may intentionally aim at the entirety of the content as in the case of art objects, sites for sight-seeing and so on.

Symbolized by: 

FIGURE 54

The users' cognitive needs, fluctuate from being strictly operational to being entirely autonomous. As noted in the second part of this study, the latter occurs when the person is devoted to the object of concern, exploring its content. The nature of the functions performed in different settings indicate the cognitive needs most likely to develop amongst the users.

The designer, i.e. the editor of environmental messages, is to a certain extent in the position of deciding what information he will embody in the final product. For this reason, he should strengthen, order, diversify or even conceal the scheme's potential content depending on the nature of the users' cognitive needs in respect to the given setting. For example, in an environment in which people operate fine machinery, the activities performed dominate cognition and the amount of information embodied should conform with this*. At the other end of the scale, an

* Even these environments, however, need some kind of background information to keep the user's attention alert. In a motorway, for example, this role is played by billboards, organised vegetation, fences etc. which, among other things, embody the message that society cares for the motorist.
art object (not the museum but the painting or sculpture itself) is the perfect example of an object that has to be "devoured" for what it stands for. Designers of such objects are therefore stretching to its limits, or indeed to any direction they wish- the content of the end product. In between the two ends of the scale, can be found all other forms which designers create. Out of all these, environments like bathrooms, auditoriums and tennis courts are towards the operational side, where as living-rooms, public squares and streelevations are more prone to give rise to cognitive activity that does not depend on the functions performed.

Although most environments can be placed safely along the aforementioned scale, it is clear that the amount of information finally embodied in the end product is still subject to the designer's interpretation of the situation. Yet, discrepancies in interpretations will not fluctuate too much since they will have to conform with a conception of the users' cognitive needs. Thus, the framework established above can be expected to help in a twofold manner: it will firstly safeguard designers from assuming that all cognition is operational, thus enabling them to work towards the satisfaction of a wider range of cognitive needs, and, secondly, it will provide the context to which all interpretations refer. In this sense, divergencies in individual interpretations will smoothly register in built form as third-level information revealing elements of the particular designer's approach.

3.2.3. Exploiting the Environment's Own Potential Content

As noted earlier, all environments which are in the process of being shaped have a potential content. Whether this potential will finally be materialised in the end product or not is up to the designer.
With some of the factors involved in environmental change the
designer cannot do else but allow them to result in distinct
differentiation in form. When he is asked to build a house, for example,
the end product will convey this information about the need that generated
it - unless of course the designer hides it by making it look like a
church or some other widely shared schema.

The rest of the factors involved are not as restrictive. Designers
can generally choose whether the house they design will resemble a
chalet or an English country house or whether it will be practical or
sophisticated.

The question is what happens with the entirety of factors that
interfere with the production of environment. Are modern designers
aware of them and, if they do, do they see them as being a part of their
scheme's potential content? The answer is that although designers are
aware of what is involved with the design problem, architectural practice
has shown that they do not tend to view it as a generator of information.
The result is that much of the potential content does not register in
built form where the users' cognitive needs would have demanded it, either
because designers consciously disregard it or because it eventually
resulted in differentiation in form not strong enough to be meaningful.

Therefore, before proceeding with the examination of how to make
the best out of an environment's potential content, we must firstly
establish some clues about what may carry an environmental message.
The discussion in the first part of the study has suggested that
information is carried by an immense variety of differentiations in
form which are impossible to group. Thus, the basic conclusion is that
every situation carries its own dynamic and should be treated
accordingly. When doing this, however, one should note that excessive
intricacy in design does is not necessarily manifest in significant changes in the form's content. Thus, the safest clue is that, when dealing with the environment's content, the designer's lines, shapes, volumes, colours and so on should constitute, divide or accompany distinct conceptual entities. In this manner, messages will clearly register in built form whereas noticeable differences which contribute little to this content will be abandoned.

With the above in mind, let us now focus our attention on Table 1.4. One could argue that the most significant body of information in a form's content is the one pertinent to the primary need that generated the form's existence. This is the body of information that will help us answer the question "what is this" and identify the form. For this reason, the form should be close to the users'schema of this type of environment and this appears essential for all kinds of different cognitive needs**.

But there is more in this type of information than mere messages like "this is a house". There are answers like "this is my house" as well as all data that helps to answer the question "why has this been produced". Indeed, such information can be so varied and so deep (like f.i. "people have needs") that it is not possible for it to register in the end product. Some of these messages, however, can become evident in the final solution.

* For example, the Pyramids are far richer in content than many heavily ornamented environments.

**In certain extreme cases, however, it is possible to deviate from the existing norms and produce something, like a "tromp d'oeil". This should then register in the final product as third-level information of the designer's personal input. It is evident, however, that designers should consider the users' cognitive needs very carefully before attempting to create this illusion (as in the house built like a church mentioned above).
In this suburban apartment block in Athens, individual flats stand out and manifest a variety of different owners and users.

FIGURE 55

Many proprietors of similar grandiose establishments compete for identity in Las Vegas.

FIGURE 56
Giving the form identity, for example, is a must for many environments. The end product will thus embody the information that this particular primary need arose among these particular users who satisfied it with this particular solution. A good example of how this can be done can be seen in the Aegean island settlements and has been followed in schemes like Safdie's Habitat. Although individual primary needs (in this case flats for the need for housing) are closed to a typological average, they still deviate from it enough to reveal the differences among their users (Fig. 55; see also Figs. 22 and 23).

It must be noted, however, that the problem of identity is not an issue that can be tackled lightheartedly. If not treated with caution and in close relation with the surrounding physical fabric of the form in question, it can easily result in chaos as in the case of the infamous Las Vegas strip (fig. 56). For this reason, designers should be careful especially when dealing with working environments in which activity dominates cognition, such as the inside of an office.

With respect to the remaining second-level information, there are several options left for designers. They can show, for instance, that the primary need had not been pressing by achieving high standards of finish and by working on the overall design to its finest detail. Furthermore, in certain cases designers will have to strengthen the image of the overall primary need so that it becomes dominant not only in respect to its "by-needs" but to its surrounding physical context. This is required for a number of civic buildings, bank headquarters and other institutions which are integral elements in a city's structure.

Finally, the idea of second-level information can apply to the residents of a whole district, town or even nation. In this case, the users are represented by their councils, governments or institutions.
who are responsible for providing specific primary needs. The fact that it is "us, the townsfolk" who live in this town can be expressed in built form in a number of ways that should be apparent throughout the town and be characteristic of it (eg. unique street labels, street markings, baskets, bus-stop signs and all other forms of street furniture for which the council is responsible). In this sense, people would immediately recognize where they are, while many everyday objects, instead of appearing accidental, will carry in them an extensive set of information of the society that created them (like British phone booths, post boxes and double-decker buses).

Let us now consider the extensive set of third-level information starting with the body of information which relates to the "by-needs" of the composite need. Section 1.3.2. has pointed that "by-needs" are singularly important for the final shaping of the form because they set its dimensional standards. For this reason, we are allowed to regard them as the backbone of the form's content.

As noted earlier, the functions and activities demanded by "by-needs" will result in differentiation in form containing potential information about the manner in which they are generally performed, about the users' who will perform them in this particular project as well as about the doer and the way in which he interpreted the problem. In many environments the amount of potential information resulting from the activities performed will be countless. For example, the design of a door in a house not only involves the activities of passing through it and dividing one room from the other but also using its handle easily, checking if there is light in the other room through a transparent panel fitted in the door, servicing its parts and function, making room for other activities by having it slide in the wall and so on. If we consider that in the forms resulting from these needs the characteristics of the
users and the door are added, then it appears that designers are faced with a difficult task: Not only should they bring this content to the surface but they must also order it in such a manner that the users are not lost in an environment of conflicting messages.

All activities resulting from a composite need are interdependent, simply because they all refer back to the primary need. In many cases, activities which are different in nature take place in the same environment (like watching television, opening the windows, having parties and servicing the appliances in a living-room, or mixed land use paired with a score of other activities in a city district)*. In view of the above, the designer is required to attain a clear understanding not only of the activities involved in the design problem, but also of their interrelationship both in respect to themselves and with regard to the overall function. He should then decide upon which activities are the most significant. Differentiation in form should then be based on this hierarchy of relative significance (Figs 57 and 58).

Thus, in a highschool complex, the headmaster's, teachers' and secretaries' offices should differ from the main body of the complex, ie. the classes, as well as from the janitors' room and service areas. Further division should take place with regard to the various subsets of the above functions (eg. laboratories and ordinary classes, student and staff lavatories etc.). To all this differentiation in form, one should add the distinct portrayal of the occupants' characteristics in a manner that will not confuse the overall appearance of the structure. For example, if the school is oriented towards technical studies or sciences, certain elements such as laboratories are bound to become more prominent than others.

* Evidently, in all environments cognitive activity resulting from man's cognitive needs is also present.
When contemplating this apparently simple building in Edinburgh, one is expected to be intrigued by the multiplicity and interrelatedness of functions revealed by the strange pattern of windows.

FIGURE 57

The balcony that runs along the periphery of this apartment block in Athens (left) does not only fail to register the functions contained in the building but also disputes the transmission of the weak messages conveyed by the kitchen and bathroom windows. The manipulation of the elevation of the building at right is far more successful as it materializes a much wider body of the users' and activities' data in the end product.

FIGURE 58
There are many ways to adapt the appearance of the final solution to the nature of the activities of the composite need. Realizing where one is only after one has entered the room, is obviously not enough. Establishing a code by arranging the elevations of the various buildings, by designing the circulation system so that nodes, corridors and staircases vary according to where they lead to, even by colouring the doors, windows, inner and outer walls in an organized way, all these can help to materialise information of the functions and their users in the final solution (Fig. 59). It must be remembered that it is not enough to position all the integral structures of the complex neatly around the yard so that we have a solution that it is functional in the conventional sense of the word—we must also enable people to "read" all this in the final solution.

The last thing to note with respect to the content resulting from the activities involved is that this content is evidently needed when cognition depends on activity. However, the above rule entails two reservations. Firstly, in certain environments the cognitive needs of certain users differ from the rest. In a track and field stadium, for example, athletes are more activity-minded than visitors who may read advertisements, enjoy the scenery, experience their surroundings as they wish. Evidently, the environment's content should not disrupt the athletes' performance at the cost of the visitors' interests. Secondly, the performance of some activities will be more important than others. For this reason, the information concerning less significant activities should never conflict with that of dominant ones.

Finally, let us examine the remaining body of third-level information which relates to the External Factor and the doer's personal input. Although last in the series, this potential content is by no means the least since it is the outcome of all factors which affect the
The idea of entering is emphasized by as little as two pillars and the shaping of the surrounding wall in the house above (built by Lutyens in Ireland) or the simple frame out of wood in the scheme below (designed by Erskine, in Bruket, Sweden). The same structure also conveys second-level information about the identity of the users.

FIGURE 59
production of environment, except for the composite need. This richness is reflected by the fact that it starts from the materials used and the information they contain and ends up in the designer's deeper psychological disposition or the influence he may have had from a remote theory or philosophy. In a similar sense, such information can be very apparent and encompassing the whole appearance of the environment or it may also be conveyed by a minute detail.

Any item out of those listed in table 1.4. and examined in 1.3. (eg. materials, legislation, social context etc.) can be used to portray the overall manner in which the primary need is satisfied by the given solution. It can often be more than one since some of the above factors are correlated. For example, a house can be built of stone and be a traditional country house (like the Tombazis house in Fig. 40). The discussion in the first part of the study, however, has pointed out that certain factors, like materials, topography, climate and, to an extent, technology do not contain a substantial body of social information. For this reason, designers must be careful not to rely solely on these factors in their effort to invest meaning in their designs*. On the other hand, more socially inclined factors are richer in content. The solution will not only carry in it the message that the user and doer have chosen (or have been forced to choose) the particular form out of all possible ones, but it will also convey messages about its social, cultural and economic context, the reasons that originally produced it.

* It appears however that much of modern architecture is doing precisely this - even to the expense of the activities contained in the forms. In the absence of other messages, weak information conveyed by the structure (ie. mechanics) of the building envelope stand out.
It must be noted that even this limited potential of such factors, can produce meaningful forms, if treated properly. The owner of this house, for example, will evoke notably different readings depending on the way he acts upon the vegetation in his plot. If he leaves the big trees as they are, they will dominate the scene, if he arranges the plot into a garden he will evoke a safe and orderly feeling. Finally, he can reserve wild nature for his backyard or he can leave the plot bare denoting the limits of his interests in life.

Thus, designers should note this wide range of influences and limitations that are involved with their project as well as the variety of ways in which they, themselves, act upon it. Ideally, the final solution should incorporate legible traces of all factors involved (since all environmental change is somehow influenced by them) along with the portrayal of the designer's own background experience and motivation, his imagination, his clarity of thought and so on.

Table 1.4. and the discussion in 1.3. constitute the arsenal that designers must adapt to the circumstances of the particular design
problem so as to create meaningful environments. In order to achieve this, the designer must acquire a deep understanding of the dynamics of the situation at hand (Fig. 61). Being aware of the codes of portrayal, he should then be prepared to shape the form accordingly not only with respect to its overall image (as mentioned above) but to the whole range of its components.

![Left: Trinity Church, by R. Upjohn, N.Y., 1846. Right: PanAm Building, by W. Gropius and others, N.Y., 1963.](image)

Trinity Church is magnificently situated at the culmination of a long canyon-like street, seemingly protected by the walls of skyscrapers. The vista-stopper at right ignores the dignified old structure - Grand Central Station - at its base, dominates the buildings around it and depersonalizes Park Avenue because its appearance is too weak to capture the dynamics of its positioning and express it in built form.

FIGURE 61
The above meat designs of two banks in Corstorphine, Edinburgh, convey different information because of their designers' different approaches with regards to the limitations of the External Factor. The designer of the bank on top conformed perfectly with building regulations for the area thus expressing the desire to become an integral part of the district. The design of the other bank has been more individually minded. It combines traditional codes (tiles, overall shape) with other distinct elements to denote that although the bank still is warm and old-fashioned at heart, it takes a wide-eyed but rigid look at the future.

FIGURE 62
This implies that materials and technology should not be used indiscriminately but in relation to the information they contain and the content desired by the architect. In this manner, their cultural potential will become apparent and will contribute to the image of the end product (Fig. 62). More socio-cultural signifiers can then be incorporated, like symbols, traditional forms or designs, so as to reveal the place, culture and society in which the form emerges. We should note, however, that simply copying codes employed in the past would lead our forms' content in a direction opposite to the one desired; it would convey pseudo-messages about us belonging to a society which has not changed. For this reason, designers are advised to express their own experience and attitudes on such codes and place them in a context that suits them or even transform them accordingly (see, for example, P. Johnson's transformations in Fig. 52).

The Lomonosov University in Moscow, built in 1959, has been based entirely on much earlier designs. An almost identical image is offered by Hotel Ukrania of the same period.

**FIGURE 63**

Finally, the discussion in 2.2.3. has indicated that when cognition is operational to man's purposive behaviour, a certain amount of third-level information is needed. Apart from the overall message of, say, a pleasant and peaceful office room, some more messages are needed to go with the functions involved (f.i. this is the old file, this is the new file). As cognition fluctuates to becoming less dependent on activity however, the need for the entire wealth of this content is increasing.
It is needless to argue on the demand to embody this content without disrupting either the information of the primary need or the continuity of the content that relates to the activities involved.

Before closing the discussion on how to make the best of the environments' potential content, we must refer to a number of techniques that are at the designer's disposal. The first set of means to exploit this content is offered by insightful authors such as Gordon Cullen. In his book "Concise Townscape" (1961), Cullen refers to a notable amount of aspects of urban imagery like defining space, focal points, serial vision, enclosures, vista stoppers, the distinction between hereness and thereness and so on. If combined with the present study, many of Cullen's illustrations become the means through which the potential content of would-be environments can materialise. In the case of the PanAm building (see Fig. 61) for example, a careful look at its topography reveals the prominence of its site, amidst New York, a city of established significance and splendour. For this reason, it appears that the building should have been given the shape and form of a focal point rather than a vista stopper as it turned out to be (ie. implying that this is an edge in the city and that the street is not so significant) (fig. 64).

Another manner in which the environment can be shaped is by introducing in it elements which naturally belong to different contexts. This technique which rests on the principles of expectancy (see section 2.2.1) is bound to surprise the viewer, in much the same way as the work of surrealist artists does. The result is that the level of arousal increases and data of both contexts (ie. both of the intruding element's and our setting's) stand out in perception triggering a rich, multi-level experience (Fig. 65). Obviously, this technique, which is becoming increasingly popular, should be employed with extreme caution and only for specific cases,
The enclosed space surrounded by the buildings of the Art College in Edinburgh (below), if treated properly, becomes an additional level at which the feeling of "homeness" and "security" provided by the institution can materialise. A similar observation could have been made with regard to the internal courtyard of the City Chambers (above) if not for the hard and seclusive landscaping and the cars that are allowed to park in it. This particular enclosure reveals the official business-like atmosphere of the institution.

FIGURE 64
Top: Jewellery shop, by Hans Hollein, Vienna, 1975
Bottom: Notch Project, by James Wines and SITE, Sacramento, 1977

To the environment of these two shops, and all their content, a novel one is added: the one that allows huge cracks to register and stay on the wall. Are the proprietors so poor that they cannot fix them (indeed, the jewellery is too luxurious for that matter) or is it all kidstuff?
The last matter to note derives from the fact that social environments do not change in the same manner that built environments do but much faster. Even if a designer has managed to capture and materialise the factors involved in environmental change, how will he enable his forms to adapt to evolving circumstances? We all know that built form is by definition immobile, but it appears there is often a need to allow the users to act upon and deface their settings. In view of this, some degree of freedom is required by the final solution. Open-ended design in which people take part within a given framework, as well as merely introducing people - or their projections - in semipermanent activities in streets or public squares will increase the environment's richness and its capacity of being stimulating (Fig. 66).

3.3. The Issue of Clarity in the Environment

It has now become apparent that our surroundings can be as rich in content as our cognitive needs would desire. It has also been shown that this is a matter of allowing the environment's own potential content to register in form rather than dressing up our concrete and steel structures with alien elements.

The discussion in the preceding section however has made apparent that embodying this content in the end product is as important as ensuring that it will be transmitted to the users smoothly and efficiently. A main issue that relates to the conveyance of meaning is the issue of clarity and legibility in the environment.

As early as 1960, Kevin Lynch argued that most modern urban environments are lacking in clarity and imageability and proposed a theory to deal with the matter. In this section, we will reassess Lynch's considerations by comparing them with the findings of the present study.
As noted in 3.1.1., Kevin Lynch suggests that the imageability of the built environment is essential for people's orientation in the city. He states that "(imageability is) that quality in a physical object which gives it a high probability of evoking a strong image in any given observer. A highly imageable city in this peculiar sense would seem well formed distinct, remarkable, it would invite the eye and the ear to greater attention and participation... The perceptive and familiar observer could absorb new sensuous impacts without disruption of his basic image, and each new impact would touch upon many previous elements. He would be well oriented and he would move easily. He would be highly aware of his environment" (Lynch, 1960, pp.9-10).

In developing his argument further however, Lynch assumes that "an environmental image may be analysed into three components: identity, structure and meaning". Following this observation he hastens to divorce meaning from the first two, on the grounds that there is a wide variability in the "individual meanings of a city", confusing thus meaning with fourth-level associational experience (see 2.2.3.). By doing so, he inevitably confines environmental objects to being capable of evoking their mere identity and structure. In contrast to what has been written in the passage above, Lynch views objects as being devoid of any representations of social and psychological data or information other than those of their own "self". Thus, by reducing the objects' content to first-level identificational information, Lynch aims at producing environments whose forms would be easily imprinted in human minds. This is characteristically expressed in his search for theories of orientation in primitive societies or through unfamiliar natural landscapes so as to apply them in the case of the supposedly "meaningless" modern cities.

Urban environments, however, do carry meaning and one should not ignore the fact that they convey information at various different levels
(eg. commercial centre, lively square, back lane, old district where such and such has happened, a friend's neighbourhood, the park I visited on Sunday and so on). Such multi-level information, combined with one's past experience and interests, will generally provide enough cues for orientation. If it does not do so and there is no city map handy, one may always ask for one's way.

The whole issue appears to be wrongly put. The findings of the present study suggest that if Lynch had accepted the content stored in our surroundings from the start, there would be no need for him to go into the various theories of orientation to support his theory. Braking down the image into identity and structure, on the one hand, and meaning, on the other, and dismissing the latter, is not only a methodological error (since meaning may include identity and structure) but also confuses the matter.

As has been previously discussed, the individual needs to know where he is at any moment (see 2.2.1.). Hall states that "man's feeling about being properly oriented in space runs deep. Such knowledge is ultimately linked to survival and sanity. To be disoriented in space is to be psychotic" (Hall, 1966, p.99). If the need for orientation is seen in its broadest sense, as presented here by Hall, it clearly relates to basic needs like the need for safety or reassurance or the need to know and to understand. For this reason, instead of merely demanding the identification of spatial appearances, the need for orientation should be seen as referring to the deeper awareness and understanding of the data which set the immediate situation a person finds himself in. In this sense, it aims at an extensive set of information embodied in our surroundings.

In view of the above, man needs a legible environment, the content
Top: Middleton Park, by Lutyens, Oxfordshire.

Middle: Casa Guell, by Gaudi, Barcelona.

Bottom: Villa Stein, by le Corbusier, Garches.

It is interesting to note the relation between the main entrances to the buildings and service doors. By changing the size of the doors, Lutyens and Gaudi succeeded in materialising their difference in function in the most legible manner.

Le Corbusier, on the other hand, found himself in a dilemma because he wished to keep the elevation in symmetry, while there was space for only one service door. To achieve a clear contrast between the two elements, he needed the help of additional features.

FIGURE 67
of which would be easily grasped at any moment. The need for orientation is thus transformed into a need for "social orientation", a need that is no longer operational in nature since it does not necessarily relate to way-finding in complex urban environments. Indeed, the need for social orientation includes what is demanded by Lynch's original concept, i.e. imageability in the way first-level information is portrayed in built form. In addition to the above, however, it also relates to the entirety of the environment's content. It becomes a question of "clarity versus noise" in all levels of materialisation of environmental information (fig. 67).

One could list a long series of illustrations showing clarity and legibility in the environment in the novel sense discussed above. A measure of the extent such a listing can attain is given by the extreme variety of possible cognitive experiences that may occur.

At city level, Hausmann's Paris is a masterpiece of Urban Design, among other reasons because of the degree of clarity and imageability achieved. The city's grand boulevards reflect its grandeur as well as the ambition to be regarded as the centre of the world (Figs 26 and 68). This system of boulevards is neatly interwoven with a series of elements, which vary in size and density of content and incorporate the Seine as part of the design. These meaningful elements are properly situated so that not only spatial but also social orientation is made easy, as both boulevards and focal points are loaded with data of the nation's past and present history. Many of the elements of the Parisian landscape (e.g. Champs-Elysées, rue Rivoli, Avenue Foch, Trocadero) have such a distinctive character that they clearly capture the land use and social "physiognomy" of the surrounding areas.

It can be argued, however, that the most interesting characteristic
The Arc de la Triomphe in l'Etoile is a typical Parisian landmark, the focal point of a number of boulevards.

**FIGURE 68**

of Hausmann's Paris is the idea of economy in the way form has been shaped. It is on this notion of economy and regulated use that clarity rests. Massing and detailing occur in close relation to the conceptual entities they correspond. This results in a remarkable and by no means monotonous uniformity that can be experienced from the street. The fact that only public buildings may rise above a certain level strengthens the image of the city as a whole, its people and their values (fig.69).

A similar example of clarity can be seen in the unique case of the centre of Edinburgh (Fig. 70; see also the plan of the city centre in Fig. 26). This is based on the juxtaposition of different environments which form the context within which information can be embodied without confusing the overall image. The core of the city is divided in three zones (the medieval city and the castle, the gardens and the Georgian New Town), which are separated by brief and easily graspable transitional
Regulations referring to the building envelope ensure the impressive prominence of public buildings, like the Sacre Coeur, below. Note also clarity in the way individual building elevations, like the one on top left, are treated.

FIGURE 69
areas. All three zones are distinctly different in content (medieval mysticism of the older quarters, natural environment disciplined within the busy city with the railroad running through it as though in a rural landscape, the well ordered grid and Georgian houses for the upper-middle class and so on).

The amphitheatrical layout which is sustained by the change of level along the lines of transition allows the image to be grasped at a glance. Its main components are thus experienced both in their own context and in juxtaposition with one another. As the City Council's "High Buildings Policy" notes, the observer gets at once the impression of being in a special environment which is worth exploring in detail.
Such imageability enables scores of additional messages to be unobtrusively incorporated in the overall image. Thus, although all three domains abound in physical features they are so legibly divided that it is difficult for any of them (even for the possibly confusing Princess Street elevation) to distort this image. In this sense, clarity does not contradict variety and complexity; on the contrary, they may be complementary so long as both differentiation in form and the information carried by it are structured in an ordered manner.
PART FOUR

CONCLUSIONS-

A COMMENT ON THE DESIGNER'S ROLE IN SOCIETY
Modern architecture and urban design are currently in a state of flux. Although the technical means that designers have at their disposal, have increased dramatically, the solutions they finally produce often fail to satisfy the most lenient critic. In many cases, modern environments are even blamed as contributing to feelings of depression, alienation and so on. It is evident that the way we have learned to design environments is not adequate - additional criteria are needed to raise the quality of our surroundings.

A growing discussion on the man-environment relation is dealing with the issue as a whole and has pinpointed a number of areas demanding the designer's concern. The question of the way in which people experience their surroundings has been among the first that were raised. Thus, it is now becoming apparent that the image of what we design is as important as the functions and activities involved.

Yet, our approach to the appearance of the end product is not agreed. Many designers relate the issue to pure aesthetics and see in it the need to achieve an overall distinctive shape. A growing tendency to view the environment as participating in non-verbal communication between people has not as yet matured enough to produce distinct paradigmatic guidelines for the designer.

It appears that so long as this concern over the environment's image is not based on an understanding of the human needs it corresponds to, it will entail the danger of being dealt with superficially. For this reason, the present work has been devoted to the study of a most significant body of such needs, man's need to know and to understand, and the environment's capacity to satisfy him. It has been expected that the thorough examination of these two issues will not only lead to the redefinition of environmental cognition, but will also provide a theory
for the manner in which our surroundings must be shaped to suit people's cognitive needs. To succeed this, it has been essential to view man in his full dimensions as a person rather than an organism who performs specific activities.

In the first part of the study, the object has been the exploration of the informational content embodied in the environment in the process of its shaping. After a thorough examination of all the factors involved in the production of environment, it has been found that this content can be extensive both in volume and variety. Table 1.4. represents the potential content of any given environment in all its richness. This information is ordered according to the manner in which it relates to the primary need for the particular environment.

The second part of the study focuses on man, the user of environment and examines the nature of man's cognitive needs and the environmental information these needs correspond to. When the activity performed in space dominates cognition, only a certain set of information is needed. It has been found, however, that cognitive experience is often initiated by a need to know that transcends the scope of the activity a person is engaged in at the time. Cognition then will tend to cover a much wider part of the environment's content, in certain cases it may even embrace it entirely. Evidently, there is an inherent difficulty in knowing exactly how people perceive their surroundings at a given moment. Yet, we can safely infer from existing tendencies after consulting psychological research and narrations of individual experiences.

The information received is not simply added as new knowledge to a person's picture of the world but also affects his already existing schemata which thus become more accurate representations of reality. The fact that this property of cognition relates to information and schemata
so varied in nature, suggests that environmental cognition plays an important role in our overall understanding of the world.

In the third part, the findings of the study are brought in relation to current design theory and practice. The assessment of contemporary theories points that most of them view cognition as being operational in nature (i.e., the means to a specific end: the activity performed in space) while others, like Norberg-Schulz's, are interested in dealing with a limited part of the environment's content. None of the theories examined, however, assesses the significance of environmental cognition by linking it to the development of our mental world.

With regard to the functionalist motto "form follows function", the findings of the present study suggest that it should be transformed into "form follows function, yet form functions". In this sense, the function of the image of man-made environment in relation to people's cognitive needs and its contribution to the development of their mental world will be stressed.

If we examine the majority of International Style architectural schemes with respect to the requirements of the users' cognitive needs they cover, we will observe that their appearance generally satisfies the needs' operational aspects only. The discussion in the second part of the study however, has indicated that man is in need of a certain volume of environmental information which should not be so high as to confuse the activities he is engaged in, nor too low so as to generate feelings of monotony, depression and boredom. To achieve maximum satisfaction of people's cognitive needs, there has to be a Common Reference Frame to which the content (and, hence, the appearance) of an environmental form must conform. This Common Reference Frame is provided by the combination of the environment's potential content
(represented in table 1.4.) and the nature of man's cognitive needs for the given setting, ie. the degree to which cognition depends on the activities performed.

The volume and variety of environmental information contained in table 1.4. shows that the environment's own potential content is rich enough to satisfy any cognitive need. Designers, who are the editors of environmental messages to a notable degree, should manipulate their schemes' appearance so as to meet their users' cognitive needs for the given setting.

The information which derives from the functions contained in space is inevitably the backbone of the form's content. But there is much more than this. There is second-level information of the primary need and the context in which it has arisen; all other messages should generally be subsidiary to these. Then, there is third-level information of the manner in which the users perform both the overall function and its by-needs, of the manner in which the doer tackled the limitations of the External Factor and so on. Such messages will place the form firmly in its social, economic, cultural and temporal context. Lastly, there is information about the doer himself, his background experience and motivation, his techniques, influences, attitudes and interests with respect to the given project, even traces of his psychological disposition and the archetypal images he carries in him. Evidently, when the doer's input is viewed within the context of table 1.4 and the Common Reference Frame established above, it is placed within a context that will increase designers' responsibility over their personal impact on their schemes.

Many techniques can be used to materialise the afore-mentioned information clearly in the final solution. Before applying them indiscriminately however, designers should,
a. acquire a deep understanding of the function of cognition and the environment's capacity to satisfy man's cognitive needs. This appears to be a task that designers' education must fulfil.

b. examine how the particular environment they are dealing with is structured within the Common Reference Frame established above. This implies that designers should arrive at an adequate fit between the nature and volume of information in the environment's potential content and the users' cognitive needs for the given setting.

c. be aware of the fact that embodying information in the final solution is equally important as ensuring that it will be safely and smoothly transmitted to the users. For this reason, all information must be materialised clearly and legibly and in such an ordered manner that will prevent the variety needed from confusing the overall image. In this manner, not only clarity and order but also diversification and richness will be achieved.

The above conditions will safeguard designers from treating the appearance of their schemes superficially or from caring only for the functions they contain. It can surely be expected that this will lead to a more meaningful environment, an environment far more important than a form of non-verbal communication: a rich domain for experience contributing to man's mental development.

The fact that form functions in relation to people's cognitive needs and understanding of the world has a significant effect on the designer's role in society. It is sad that people nowadays express more complaints with regard to the responsibilities derived from this boosted role, than gratitude to the designer's benefit. It is hoped that the present study will contribute towards the latter.
Clearly, additional research is needed on a number of issues as, for example, the codes according to which information is materialised in the environment, the levels of complexity and variety desired, the way cognition relates to man's other basic needs like man's aesthetic needs and so on. It is expected that the thorough examination of such issues will lead to more detailed guidelines for the designer while, on the other hand, it will contribute to the satisfaction of a wider range of psychological needs.
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