

**INFORMATION AND  
ARCHITECTURAL DESIGN - A  
STUDY OF CERTAIN  
THEORETICAL ASPECTS**

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STATEMENT

I declare that this thesis is my own original work.



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## PREFACE

This thesis is an attempt to illuminate certain selected aspects of architectural design theory, and the result of a project conceived nearly six years ago. Having spent over five years in architectural practice, I was at the time wishing to undertake research of a theoretical nature in an educational institution. My first opportunity to pursue some of the ideas set forth below was provided by a year as a part-time lecturer in the Department of Architecture, University of Edinburgh, and by a research grant from the Royal Institute of British Architects. A year later I was given a full-time post as a lecturer. Although this led to an extension of the time I had originally envisaged for the completion of the thesis, a fortunate and exclusive involvement with the teaching of design since then has enabled me to give undivided attention to the problems of design thought.

The thesis was written under the supervision of Professor Barrie Wilson. He has been generous of suggestions, criticism and time. The detailed arguments of this thesis are my own, but the underlying concepts were generated in many exchanges with Professor Wilson. My thanks are due to him for his interest and encouragement.

Many other friends and colleagues have helped in formulating my arguments. Ron Crofts read the early versions of Chapters I, II, III and IV; I have found his reservations and suggestions very helpful. Some of my students conducted the pilot study reported in Appendix 4. They also undertook an extended study of the components of architects'

tacit knowing described in Chapter III, and produced a video-tape entitled 'Influences'. They will forgive me for not being able to name each one of them, but their contribution is sincerely appreciated.

Geoffrey Broadbent, Bill Hillier, Basil Honikman, Adrian Leaman, Professor Guy Oddie, Professor Reima Pietila, Professor Richard Seaton and Lance Wright read various working papers relating to this thesis and offered useful conceptual and stylistic suggestions. Gabriel Epstein, his partner Peter Hunter and Reima Pietila supplied the details of a number of illustrations. I am very grateful to all of them.

Finally, my wife read the draft of this thesis and typed it. Anyone who has wrestled with a project like mine will know what it has occasionally cost her. I thank her for being so patient.



## ABSTRACT

The shortcomings of the ways in which design-related information is conventionally collected and organised into a brief suggest that information and design should not be looked at in isolation of each other but together with all their dynamic dimensions. The first step in the direction of such a total view is to identify every kind of determinant of design and describe their inter-relations. The determinants of architectural design may be listed as follows : a) factors in the spirit of architectural vocation which individualise designers; b) factors belonging to the collective consciousness of architects as professionals; c) functional/practical aspects of design; d) information on qualitative aspects of design. Conventional studies of design-related information deal exclusively with the functional/practical aspects, but the development of a valid theory of architectural design requires that the other three aspects are studied and their inter-relations described.

Factors of architectural vocation which individualise architects may be explained in terms of what in psychology is known as 'schematization'. The term 'schema' enables us to explore observable patterns or regularities in the predilections and perceptions of architects. When applied to architectural situations the notion of schema shows that the past experience of an architect consistently reveals itself in model solutions of different kinds which can be analysed and classified, and the implications of their employment can be established. Under certain circumstances some of these personal models gain the respect of the profession at large and become highly influential in

shaping the collective consciousness of the profession. At any stage of architectural development the components of the implicit knowledge embedded in emergent models may be specified. Further, the emergent models when identified and described yield design concepts rich in implicative power. By including the desirable attributes of emergent models as part of a design programme it is possible to increase the effectiveness of the thought process followed by architects. Thus concepts which describe unique qualities of an emergent model provide us with a way of enlarging the traditional notion of information for design. *archit. language*

Moving on to consider information on qualitative aspects, past theories of architecture show that 'increasing the effectiveness of functional/practical aspects' and 'creating special effects, enhancing users' interest in the building and producing impact' are the two purposes of the qualitative features of an environment. Any environment can be described in terms of universal features like elements, relations, abstract qualities such as privacy or monumentality, and actions and events that take place in the particular environment. By combining these disparate entities we obtain a feature/function model of architectural quality and show how it can be used in the process of design and as an evaluative tool. Finally as a last step towards the consideration of information and design in all their complexity, we attempt to analyse how verbally formulated requirements are transformed into architectural solutions. Through an exploration of the role of emergent models and a study of the part played by interpersonal communication between architects, clients and users in the design activity, we offer a theoretical explanation of factors affecting the transformation of written briefs into ideas for buildings.

Thus the central concern of this thesis is with the inter-relation between factors of architectural vocation which individualise designers, factors belonging to the collective consciousness of the profession, and the underlying rules or laws governing the creation of architectural quality. All the conclusions are theoretical in nature; they attempt to bring together accepted knowledge, facts and research findings on the nature of design, and as such pose problems of evaluation. To overcome these we impose the requirements of agreement with facts, generality, parsimony, consistency and explanatory value on each theoretical conclusion. These criteria, besides being tools of self-criticism, point out difficulties, omissions and achievements of each conclusion and suggest areas of needed research.

# I. INTRODUCTION

## F INTRODUCTION

The quality of the whole process of design and execution of an architectural project depends upon decisions taken at the early stages; as a result the early flow of information between participants is crucial. Clearly, the responsibility for obtaining all the information needed for design and for organising it into a well-formulated brief rests with the architect. A good brief is an essential pre-requisite for a satisfactory design, and both emerge mainly as a result of continuous communication amongst design team, client and users. The participation of everyone affected by and concerned with a particular project may therefore seem ideal, but in reality such participation is infrequent. Most present day building projects are commissioned by corporate bodies, public and semi-public organisations, housing authorities, property developers, regional boards, etc.; these projects are usually meant for use by sections of the population (tenants, household owners, students, teachers, patients, doctors, nurses, and so on) mostly unknown to the design team when the act of designing is being carried out. The interests of these user groups are usually represented by members of the client committee which liaises with the design team; this committee also acts as provider of information on users' requirements. Complete participation at every level and continuous exchange of views amongst design team, client body and future users are often seen as

impracticable, and representation of one kind or another on behalf of users is the norm. But representation by its very nature raises a number of issues concerning the social, political and technological framework in which the design activity takes place. Questions such as 'who is responsible for what' give rise to timidity in discussing every aspect of design information on the part of everyone involved. At every level, the safe and the conventional are repeated, and so are the mistakes. Even in cases where there could be complete participation, the nature of interpersonal communication and its relationship to architectural design remains an unexplored topic.

There are of course numerous design guides, check-lists and other established methods of recording generalised information on users' requirements. They do offer valuable help to the architect and his clients in formulating the brief, yet they are not received with universal approval by practising architects. Some feel that, quite often, design guides encourage excessive attention to detail at an early stage and thereby prevent all participants in the design process from gaining a feel for the overall quality of the conceived environment.

The constraints presented by representation, the fact that interpersonal communication between architect, client and users is not a well understood area, and a conviction that there is a close relationship between information, its transformation into design, and the quality of the products of design presented a case for this research. The best way to begin would seem to be to set out the subject matter of this thesis in the general context of briefing procedures, so that it may be clear how the thesis fits in with studies in this area.

## Brief, Design Guides and Check-lists

The term 'brief' originates in the judicial realm and as such aims to express openly the client's intentions, objectives and policies regarding the use of the proposed building. It attempts to list the constraints - economic, legal, etc. - that would operate in the particular situation, and it outlines factors acceptable to everyone concerned in the act of building as realizable. Delegation of responsibility - an issue raised by the concept of representation - is further strengthened by the legal overtones of the term 'briefing'. For instance, in situations where the client is a corporate body it ultimately assumes responsibility for maintaining at least part of the finished project, and often in situations of this kind the brief is merely a schedule of accommodation together with a manual of maintenance requirements. No doubt maintenance requirements are important, and indeed depending upon the type of building they may well determine the form of the design. But in formulating an architectural problem, requirements such as these need to be considered in relation to others, and the importance of each carefully weighed if the final outcome is to be more than a partial solution.

Quite often when the brief does go beyond being a simple schedule of accommodation, a legally binding document and a manual of maintenance requirements, it tends to include statements such as 'the designer should aim to create a human environment' or 'an environment that would symbolise the achievements of the particular institution to be housed in the conceived environment' or 'an environment that would act as a foil to the aspirations of inhabitants', and so on. Such impregnable statements suggest that the problem of what leads to

qualitatively good design results should be studied carefully. There is a real need to look at the notion of 'information for design' in more fundamental ways, and to explore the qualitative determinants of design in their full dynamic context.

✓ Check-lists and design guides certainly have a place in structuring the design task, but their role is usually seen as helping the designer to avoid mistakes, whereas design concepts normally emerge in the presence of a more positive stimulus. Furthermore, many of the design guides and check-lists operate on the assumption that all problems have solutions, and that these are known to the architect. The real design situation is quite different. To begin with, products of design are conceived for a very long life-span, and in general we receive a sense of continuity from the older surviving buildings and objects. This suggests that the designer should respond to what he anticipates will be the demands of the future. Consequently he will have to operate to some extent in the absence of a great deal of relevant information. In time, new information becomes available and imposes limitations on commonly accepted ways of defining the design task.<sup>1</sup> Secondly, chance, uncertainty, indeterminacy, probability and even doubt are fundamental to all branches of contemporary knowledge. But design education and practice quite often remain indifferent to this fact. In actual design situations it is simply not true that the problem is always known and its solution is there to be found; on the contrary, often the problem is not very clear. Therefore the task is to establish the nature of design problems, which of course is basically different from the operation involved in finding the solution. But the point is that there can be no absolute certainty that the problem has been correctly identified.

It would be a mistake to suggest that design guides serve no



purpose for the designer. Their main virtue is that they are concise and therefore identification of standardised information becomes easy. But because they are concise they tend not to make explicit the assumptions behind their suggestions, and therefore at one stage or another these assumptions are taken for granted and eventually bear no relation to the problem the designer sets out to solve. It is possible to demonstrate that improved design solutions result when the designer avoids formulating the brief in terms of solution-images.<sup>2</sup> To some extent design guides obstruct a basic exploration of the requirements to which a design should respond, and this in turn diminishes the architect's creativity and his responsibility towards the user.

Standards and design guides do not always reflect the diversity of activity patterns and life-styles of users. For instance, the Ministry of Housing and Local Government Bulletin No.6 (1968) indicates the preferred dimensions and furniture arrangement for a living room, and points out that "these dimensions are generally suitable at all stages of a family cycle, although at the earlier stages there might be fewer armchairs than the numbers shown."<sup>3</sup> But what does 'living' mean? Not only the requirements of families at various stages of growth call for different arrangements for living, but their requirements vary according to the prevalent system of values. In some families the living room is simply a passage with a television set and a few massively upholstered chairs, while in others it is associated with 'graceful' living. Standards put forward generalised ideals which may not be much of an ideal for anyone. Furthermore, as Barry Cullingworth put it, "housing quality is a relative concept: relative both to the general level of housing standards and the standards of living. What one generation regards as undesirable the next regards as intolerable. Standards are valid only for the time

they are conceived."<sup>4</sup> The implication of this is that standards and design bulletins cannot be regarded as relevant for all times in an absolute sense, and if we regard them as such we face the danger of perpetuating meaningless uniformity.

Lastly, one should certainly pay adequate attention to the problem of information explosion. It is not by processing and check-listing all the available information that any progress towards the achievement of improved design results is to be made. It is in establishing the degree of design relevance each type of information has and in structuring it such a way that it affects the designer's thought process that significant advances are possible.

#### Information and the Nature of Design in their Dynamic Context

Having suggested that the role of information in the act of designing is not a passive mechanical one, and having freed the topic from entanglement with legal matters of client/architect relationship, one finds oneself confronted with the notion of information for design. Although the term 'information' has been mentioned earlier, a clear explanation of what this term entails as far as this study is concerned has not been given. In the context of this study, 'information' is meant to represent something more than a network of constraints (legal, economic, etc.), data on users' activities and requirements and technical possibilities; for the purpose of this study is to enquire into the act of designing when the 'information' at the architect's disposal is felt to be incomplete.

Incomplete knowledge of what architecture is supposed to do certainly affects many architects' perceptions, decisions and actions. One knows from one's own experience of designing that the mental state during the process of design can range from severe doubt to a whole-hearted conviction about one's own ideas. In this process information and design are inextricably linked and therefore they should not be considered in isolation of each other, but together in their dynamic context. The first step in this direction is to identify all the types of information which determine the final outcome of design, and describe their interrelations.

The physical provisions required to perform various activities, the relationship of activities to one another, the special limitations imposed on finances, the location, climate and topography of the site chosen, the standards of thermal, visual and acoustic comfort to be achieved in the proposed project, the number of car parks required, capacity of lifts, sizes of rooms, and the network of constraints (building regulations, fire regulations, and so on) are one kind of data which has already been mentioned. We might call this type of information the 'functional-practical'.<sup>5</sup> In considering information in all its dynamic dimensions it is helpful to bear in mind the extent to which a particular piece of information is considered relevant by all participants in the building process. It is clear that when the functional-practical aspects of design are described correctly their value and relevance will be appreciated by the user, the client and the architect.

The second type of information, which again has been mentioned earlier, is the kind of data which attempt to describe aspects of design in less tangible ways than data on the functional-practical.

aspects. Included in this kind of information are such qualities as friendliness, privacy, psychological defensibility of spaces, different kinds of meaning a building or a component of it may have for users, and so on. We may simply label this as 'information on qualitative aspects of design'. Once again in considering this type of information with reference to the participants in the building process it can be seen that because qualities such as these are rather abstract and intangible, agreement about their value and relevance between users, client and architect may or may not exist.

The third type of information which has not been mentioned so far but which significantly determines the outcome of a design is related to the personal input which the architect brings to the rationally formulated and largely shareable nature of the other two kinds of information. The case for distinguishing this from the other two rests on the fact that an architect's work is not simply the result of externally specifiable input. Other than the nature of the design problem itself, a number of factors - such as the architect's own selectivity in receiving and structuring the other two types of information, and the network of habits, attitudes and ways of seeing the task he has acquired as a member of a closed community of professionals - inevitably affect the ultimate design synthesis. Some of these determinants of design can be described as information (e.g. the technical constructs explained in Chapter III) but there are certain features in the thought process of a designer which cannot legitimately be described as such; nevertheless these features affect the form of design, and therefore they need to be accounted for and explained, and their interrelations with other kinds of information need to be considered. Although details in the

↔  
Further decision

the mental phenomena of designers cannot be described totally as information, for the purposes of labelling, the term 'inventive information' may be permitted.

The interrelation between the three types of information is undoubtedly complex, but a study of information related to the nature of design should be at least as much concerned with the second and third types as with the first. From what has been said so far it is obvious that a classification of information determining the final outcome of design in terms of the functional-practical aspects, information on qualitative aspects of design, and inventive information comes naturally from the prevalent pattern of briefing and the nature of design. Further, the fact that this classification marks clearly the degree to which the relevance and value of each kind of information may be appreciated by everyone involved in the building process provides a further reason for adhering to it. The main concern of this thesis is with information on qualitative aspects of design and with inventive information, but it must be stressed that an analysis of these two types as distinct elements in isolation from each other and from the functional-practical would not make a significant contribution to the study of information and design in their dynamic relation. Therefore there is a need to study not just these two types of information as separate elements, but rather the complex network of relationships that link and unify the three types of information as elements in the human process of designing. This has certain broad implications for the method of investigation that is to be adopted.

Theoretical Assumptions, Method of Investigation and Difficulties  
Encountered during the Course of Research

If relations between information and design are to be explained in a meaningful way, we need to seek such relations not just on the surface - that is to say in the products of design, in reviews and in architects' statements about what they attempt to do - but beyond this kind of empirical reality. This is very much a rationale of what is called the 'structuralist school'.<sup>6</sup> Thus Levi-Strauss for instance points out that although men invariably use phonological and grammatical rules in their speech, they will not, unless they are linguists, be consciously aware of them.<sup>7</sup> Structuralists suggest that the same is true of all social phenomena - no matter whether it is myth, fashion or systems of kinship and marriage. What the observer can see on the surface is not a structure of human activity but simply evidence for the existence of that structure. On the other hand, although the structure of human activity is not itself what can be seen on the surface, it can only be derived from what is seen. Without entering into a detailed discussion of the structuralist school we may accept that - together with other social phenomena such as kinship and marriage, fashion and myth - design as a human activity constitutes a system of codes with the characteristics of language in a formal and metaphoric sense. The emphasis put on the indivisibility of all social phenomena by such a theoretical view seems particularly valuable and, given this view, methods of investigating the different types of information and their interrelations seem to follow naturally. This thesis is concerned with understanding certain aspects of the design activity; therefore reasoning, lines of argument providing possible ways of viewing the design activity

as a human phenomenon, and citing evidence from established findings in social sciences are the kind of methods that will be employed. The purpose is to explain the relations between different kinds of information and consider how they affect the nature of design. The methods of investigation to be adopted also provide an implicit basis for ascertaining the validity of the final conclusions. Nearly all the conclusions of this thesis are generalisations derived from reflecting on the existing body of knowledge, established research findings and other accepted facts; they are the essence of theories or theoretical formulations in the human sciences. Successful theories tend to be well coordinated conceptual systems, but the least any theory is expected to do is to suggest areas where research is needed. However at any point in time a truly successful theory not only stimulates further research but also makes possible a deeper understanding, facilitates change of outlook on a range of accepted issues and finally produces as by-products new methodologies and procedures. The value of any new methodology or procedure can be demonstrated in a worked example, but the potential of a theory in changing the traditional outlook and increasing understanding depends upon the following requirements: a) agreement with facts; b) generality; c) parsimony; d) consistency; e) explanatory value. All these are well-known and widely accepted criteria in fields which deal with theoretical work.<sup>9</sup> The final chapter will develop these in more detail and make an attempt to employ them as standards against which the conclusions of this thesis may be assessed.

In the field of architecture there are few precedents for the kind of theoretical study with which this thesis is concerned; hence illumination on key issues facing the study had to come from other

fields which, using approaches similar to those described above, deal with topics such as cognition, perception, theory of knowledge, and so on. It is seldom easy to break out of the framework or world view offered by a discipline like architecture, and view its activity with the aid of the framework of another field. Quite often frameworks of different fields seemed like mutually untranslatable languages and in the interest of consistency of language some important ideas had to be included in appendices. Finally, many of the works from outside the field of architecture cited as evidence for arguments advanced in this thesis were in themselves highly interesting and absorbing, thus making the temptation to digress difficult to resist. Special efforts had to be made to ensure that the research focussed its attention on the interrelationships between the three types of information and the nature of design.

### A Plan for the Thesis

Having identified the inventive aspects, those aspects which lead to quality in the final building, and their relation to the design process as potential areas of study, and having suggested broadly the method of investigation to be adopted, it remains to give an account of the issues that will be tackled and the order in which each of them will be presented.

The thesis begins with the inventive aspects. Even a cursory look at any architectural design suggests that strength of logic and concern for problem requirements are not the only forces which direct



designers towards solutions. It is obvious then that together with these we need to look at the spirit of architectural vocation and see in what ways it affects the nature of design. It was suggested earlier that designing, as a human activity, can be regarded as a system of codes with language characteristics in a formal and metaphoric sense. If this is the case we can imagine the intrinsic structuring force of design activity as consisting of further specialised structures (the spirit of architectural vocation being one of these structures) in the same way as human life in general can be seen as consisting of specialized structures like language, fashion, myth, kinship systems, and so on. As we know, these latter features of general human life produce observable patterns of speech, types of clothes, stories and marriage respectively. Therefore the analysis of factors of architectural vocation which determine the nature of design should look for observable patterns in examples of design, so that the structure of design activity itself may be derived from these patterns. In this connection patterns or regularities concerning the spirit of architectural vocation seem to occur at two levels. Firstly there are those which individualise a designer, and these are the central concern of Chapter II. The term 'schema' borrowed from the field of psychology enables us to explore observable patterns or regularities in the predilections and perceptions of the designer but makes it difficult to proceed beyond some general observations about the nature of design. However as an extension of this idea of 'schema' it is proposed that, in many instances, design can be seen as being based on 'models' in the sense that the past experience of a designer consistently reveals itself in some personal prototypical solutions he employs. In many cases these models are previous projects

the architect has executed and believes to have been successful, or projects of other architects for whom he has a high regard; in certain rare cases models are also derived from such things as abstractions from landscape constructions, visual arts of relevant periods and symbolic generalisations such as 'a closed form is preferable to open forms', and so on. While being idiosyncratically structured these models are representations of designers' thought processes. Early images of what might be a suitable solution are derived from these models and an analysis of this process in Chapter II attempts to establish certain general properties of factors of architectural vocation which unconsciously determine the nature of design.

Secondly, we may consider the inventive aspects at that level of community or group of architects by extending these aspects to include habits, attitudes, ways of seeing, sets of beliefs, etc. which architects acquire as a closed community. Chapter III explores the possibility of viewing these factors as a system of codes with language characteristics. The models described above seem to do more than influence individual architects' approach to design. Under certain circumstances models seem to become established as accomplishments, become recognised as such by the architectural community and provide a basis for further practice of design. Models of this sort are highly influential in shaping the architectural community's network of habits, beliefs, attitudes and ways of seeing. Again this network seems to constitute an implicit and unconscious structure underlying every kind of design instance. Thus Chapter III is concerned with questions like 'how does the model function in the process of design?' or 'if the architectural community is regarded as a subculture with inventive communal aspects functioning as a

distinct language, what consequence does this have for the problem of providing information for design?'. .

Inventive information is one of the main venues for investigation, but we must also consider the interrelation between the three types of information and the nature of design. What are the implications of inventive aspects for the structuring of architectural problems? How can the conventional notion of information be extended, made richer and structured into a brief in such a way that it affects the thought process of the designer? How can the design relevance of a particular piece of information be established? Chapter IV is concerned with issues of this nature.

Chapter V focuses its attention on the second main venue of investigation, namely information on qualitative aspects of design. A study of how this kind of information has been dealt with in past architectural writings and criticisms suggests that there are difficulties in describing architectural qualities; but this does not mean that architects cannot produce these qualities in their buildings. Just as native speakers of a language do not need to know its phonological and grammatical structure in order to be able to use it, so we should not expect architects to be able to explain or even be conscious of the underlying laws which govern the creation of qualitative features in architecture; but we can expect them to be aware of the concrete manifestations of these laws. What this means, however, is that if we are to establish law or rule-based structures behind qualitative features of architecture our point of departure must be examples of architecture which can provide us with observable evidence for the existence of such structures. From some examples of architecture and from insights offered by the history of architectural

theory Chapter V derives a model to explain the principles that govern the production of quality in architecture and explores the possibility of using them as design tools. Chapter VI takes the final step towards investigating information and design in all their complexity and considers how verbal formulations are transformed into design; it attempts to explore the role of models and the part played by interpersonal communication between architect, client and users in this process of transformation. The last two chapters contain a summary of the main arguments and conclusions, an evaluation of their value to the field of architecture and outline suggestions for future research.

Since the area with which this study is concerned is relatively unexplored it presents a number of difficulties in the choice of words and in certain definitions. Appendix 1 therefore gives a list of terms used in this thesis together with explanations or definitions wherever possible. It will be noticed that there have been several references to the word 'model'. This is used in different senses in different parts of the thesis, and Appendix 2 considers the various senses in a systematic way. Adequate methods of environmental analyses, the skilled performance of architects and ways in which past theories deal with architectural quality are highly related to the subject matter of this thesis. But the distinctive terminologies of each of these topics made it difficult to present them as integral parts of the main text, and therefore they appear in appendices 3, 4 and 5 respectively. Lastly, most of the conclusions are concerned with the illumination of certain aspects of design; there are however a few conclusions which lead to practical suggestions on how the quality of design process may be improved and it seemed advisable to demonstrate the relevance of those conclusions which lend themselves to practical

application with a worked example: Appendix 7 is concerned with this.

The last task of this chapter must be to give some indication of the nature of the conclusions which are anticipated and their values to the field of architecture. Above all, this study attempts to provide a basis for constructing a theory of design process and a theory of qualitative features of design. On the one hand it provides a description of the moving forces behind the multiplicity and diversity which characterise the human activity of designing, and on the other it explains the inherent laws that govern the production of qualitative features. Since in all the explanations, arguments and possible ways of viewing a phenomenon advanced in this thesis there is a consistent recourse to established studies on topics like cognition, perception and theory of knowledge, it is hoped that these conclusions are significant advances on those derived from conventional and rather idiosyncratic theories about architecture.<sup>10</sup> Lastly and needless to say, an explanation of how and why a phenomenon functions must necessarily have implications for how it should function, and thus the conclusions of this thesis are both descriptive and prescriptive. While promoting a better understanding of design activity and qualitative aspects of design, it is hoped that some of the approaches and procedures prompted by this research may be of practical value to architects.

## Chapter I : Notes

1. Raman, P.G., 'Design Education and Curriculum Development', unpublished paper.
2. See, for instance, Maguire, Robert, 'Approach to Architecture', RIBA Journal, April 1971, pp.140-41.
3. Ministry of Housing and Local Government, 'Space in Home, Metric Edition', Design Bulletin No.6, HMSO, London, 1968, p.30.
4. Summarised by McKean, Charles, 'Homes fit for Humans' a report on the RIBA Conference at Stirling University, RIBA Journal, August 1973, p.374.
5. The term 'functional-practical' has been adapted from Norberg-Schulz, Christian, Intentions in Architecture, London, 1966.
6. Lane, Michael (ed.), Structuralism, London, 1970, pp.11-42.
7. Lévi-Strauss, C., Structural Anthropology, New York, 1967.
8. The essence of progress is that laws, principles and theories must always be treated as approximations derived from the data of experience and they should remain forever subject to alteration and correction in the light of new evidence. Therefore the most important reason for attempting to discover conceptual order in any human endeavour and expressing it in the form of a theory is that it enables further hypotheses to be developed; these may be tested and thereby firm directions for action and further investigation may be evolved.
9. See Allport, Floyd H., Theories of Perception and the Concept of Structures, New York, 1955, pp.8-12. There is a sixth criterion which many schools of social sciences insist upon, and this is the experimental availability of theories. But there is a limit to the understanding of experimental procedures an architect can achieve in a given time. Chapter VIII will indicate which of our conclusions suggest future interdisciplinary field experimentation.
10. A sympathetic reviewer of a paper closely connected to the notion of inventive communal information says: " I believe it is the first to appear on the environmental cognition scene which looks at the way architects construe architectural designing and design. Raman explains how, in spite of contradictory research findings about how the human and physical environment ought to be, architects continue to 'architect' and buildings continue to be built. He suggests that in this rather 'doubtful' research climate, the architectural community has developed its own way of looking at the 'world' and evaluating its meaning. Whether this is the real reason for the way architects behave and respond is open to debate. The importance of Raman's work lies in his examination of the beliefs and constructs of architects and their profession. Its special value lies in that it could constitute a new and much

needed social science basis for looking at and building architectural theory." The author of this thesis concurs with the reviewer's judgement that the existence of a network of the architectural community's habits, attitudes, beliefs and constructs is the real reason for the way architects behave is open to debate. But no other part of this thesis has evolved more since presentation of the paper at Wisconsin University in May 1974; discussions with Dr. Honikman and his review have helped in this development.

- a) Raman, P.G., 'Towards a Social Psychology of Design', Proceedings of the EDRA 5 Conference, 1974, Vol.XI, pp.87-97. General editor Carson, Daniel H.; editor for Vol.XI Honikman, Basil, Milwaukee, 1974.
- b) See in the same volume 'Environmental Cognition: its Potential for Enhancing Design and Policy Formulation', Honikman, Basil, pp.6-7.

## **II. INVENTIVE ASPECTS AND INDIVIDUAL DESIGNERS**



## II. INVENTIVE ASPECTS AND INDIVIDUAL DESIGNERS

The design output of architects can be predicted from the input in terms of the combined influence of the nature of problems and nurture of architects only to a relatively limited extent. This does not mean that inventive aspects simply consist of unanalysable intuitions. We can see at least some inventive features embedded in the outcomes of design and the processes an architect adopts. In other words, it is not the unannounced thoughts of an architect that are important in themselves but what he consciously does with them. If we can, admittedly imperfectly, call these personal unshared and private features of the design process 'information' we can say that this may be transmitted by a designer to himself, not only by his own thoughts and feelings but also by means of common experiences, for instance examples of architecture he admires and whose features he attempts to emulate in his own work. Thus we can crudely regard the individual designer as a self-communicating system as well as a component in a communication network. An architect may be said to generate inventive information when he encodes one level of his experience into another, whether he adopts features of a well known building in his design or derives his ideas from different types of graphic exploration. This is the background to the analysis of inventive aspects, but before embarking on this analysis the case for concluding that

design cannot be the result of a specifiable input must be closely argued. Arguments on this matter are taken up at two levels; firstly in connection with the psychological spurs of individual architects, and secondly in connection with certain inadequacies of recent works on design methodology.

#### Logic of Design Determinants or Social Science of Design Process

Can design be the result of a clearly specifiable input?<sup>1</sup>

If it can be, this implies that design can flow from factual problem requirements and that the thought process that leads to solutions is logically accountable and can be clearly spelled out. Even though this thought process may not be clear at the time, because of short-circuiting and hurry, retrospective evaluation can show the process of reasoning and logically spurred decisions which lead the designer towards what he believes to be the correct solution.

This is somewhat different from saying that given a design idea, regardless of its origins, its suitability can be tested by logical procedures. But when we say that design can be the result of an externally specifiable input what we mean is that the process of getting an idea can be logically reasoned out. It follows then that discovery or apprehension of a design solution and justification of its suitability are one and the same process. That which conducts the designer to the generation of an idea is also that which justifies holding the opinion on its suitability. The intellectual process that leads the architect to the solution is in itself a

ground for supposing that the solution is the correct one. This concept of inducing a solution from facts must have been developed through a misdirected analogy with relations of the following sort:

All men are mortal  
Socrates is a man  
therefore Socrates is mortal.<sup>2</sup>

In an abstract sense, discovery and justification in this sort of logic are one and the same, but in the real design world it is doubtful whether anything more than a tiny minority of ideas are formulated through the use of this kind of process. Moreover, if design can flow from facts we insist on the primacy of facts, but how often can facts be stripped bare of the smoke-screen of interpretation? And what of the prevalent theories of design? Do they not at times force us to see facts in special ways? Lastly, as George Polya put it, in order to solve a problem we require a certain amount of previously acquired knowledge,<sup>3</sup> and as far as architectural design is concerned this previous knowledge need not be a part of the particular problem that is being solved; furthermore this knowledge can be of a personal kind. All this means that the 'psychology of knowledge' or the subjective side of the issue cannot be rejected in favour of the 'objective' or the 'logic of design determinants'. Of course they need not be mutually exclusive, but in the design world one does seem to be dismissed with the other. Design methodologists for instance point to the failure of architects in coping with the complexity of issues which design should resolve and urge the adoption of a more rational procedure taking the form of 'working from the particular to the general'.<sup>4</sup> On the other hand practising architects are indifferent to design methodology<sup>5</sup> and feel that what is advocated

by methodologists is not how practising architects design or ought to design. A few methodological works are relevant to the analysis of the inventive aspects; however a consideration of these must be deferred until later.

Let us now turn to another aspect of the argument in favour of the case that design can be the result of a specifiable input. Can we not, it may be asked, regard computers as neutral tools in the process of design?<sup>6</sup> Before answering, it is necessary to make some basic comparisons between computer-aided design and intuitive design. An architect normally formulates his design solution through the use of some convenient representation or partial representation. This usually takes the form of drawings, models, etc. A computer-aided design system replaces this form of representation with symbolic descriptions consisting of numbers and words stored in the computer memory. The operations performed are logical and arithmetical manipulations, and are not always directly controlled by the human operator but may, at least partially, be determined by the stored programme. In order to develop useful symbolic descriptions (usually known as data structures) for computer-aided architectural design it is essential to consider architectural forms as capable of being split into discrete and identifiable elements and to evolve a notation for identifying the elements and for describing their interrelationships. Now if we look at the evolution of architectural design as invention or apprehension of form, some very curious conceptual similarities with computer-aided design emerge. From the days of the Aristotelian conception of form, through to the days of Vitruvius (his discussion of Orders) to Renaissance theorists like Alberti, Serlio, Durand's famous *Precis* (1802) and up to the days of Julien Guadet's work

Elements and Theories of Architecture (1902) architectural forms were conceptualised combinatorially. More recently, Alexander's ideas on synthesis of form and the idea of patterns more or less see design as compositions constructed out of a limited set of fundamental elementary components. Chapter III and Chapter V will have more to say on this. Immediately it is important to recognise that computer-aided design as it is currently approached is an extension of the architectural tradition of elementary compositions. This has several implications but the one that is most important to the subject matter of this chapter is that computer systems cannot be regarded as formally neutral tools in the design process. On the contrary, their application to the design process can be expected to call for corroboration of formal principles entering the mind of men through the process of the kind vaguely called 'intuitive'. Such formal principles are imaginative posits invented in one piece and then, through a process of application, refined and articulated.

These then are a few reasons why design cannot be the result of an externally specifiable input. This does not mean that facts are not legitimate data for the architect, but as Chapter I indicated, along with facts we need to emphasize the spirit of architectural vocation, and consideration of inventive aspects is a way of providing this emphasis. Factors that individuate a designer are the subject matter of this chapter and architects as a group (non-pathological) are used as a unit of analysis in the next chapter. The idea of architectural form, its apprehension and/or discovery, the role of vision as opposed to sight and representation in this process, and the manner in which an architect

encodes one level of experience into another are identified as topics with which the individual psychology of the designer is inextricably entangled. These topics have considerable implications for the process by which building form comes to be determined. Therefore it seemed ideal to set out these topics in the general context of works on design methodology; more particularly as topics related to the problem of how synthesis in design can be explained adequately.

However before doing this there are some points of clarification that need to be made. In the analysis of inventive aspects with which this chapter is concerned the emphasis is not on the individual architect's source of inspiration or on what makes a particular architect unique with the psychological topic 'personality' being at the centre. It is rather on observable regularities with which past experience, well known buildings, graphic explorations and other such elements induced by nurture and training come to have a bearing on the nature of design. The criterion for emphasising actions of designers that are of peculiar architectural calling is not simply that such actions take place, nor even as mentioned in Chapter I that they occur frequently and consistently, but rather that they fit in with what is known as the theory of knowledge in general and indeed with certain aspects that we conventionally know as the theory of architecture. Finally, it must again be stressed that to say that strength of logic and concern for problem requirements cannot be compelling is not to suggest that logic can be disregarded.

## The Problem of Synthesis in Design

Quite correctly, early methodologists were interested in formalised methods as educational means. Unfortunately as everyone who writes on methodology puts forward a method of his own, formalised procedures have proliferated to such an extent that practising architects have become sceptical about them. Further, formalised procedures seem to perpetuate an analytical fervour amongst students of architecture and there are many reasons for this state of affairs. Firstly, in proposing rationalised procedures, methodology appears to have failed to demonstrate the heterogeneous nature of solutions that can be proposed for the same problem.<sup>7</sup> Thus students are led into a situation where the search is for the ideal solution, and in many cases this search is in vain, resulting in a lack of final synthesis. Secondly, the model of rationality advocated by methodology does not take into account the full reality of the design situation. Rather than enabling students to understand design as it is done, in practice, it puts forward ideas on how it should be done and in many instances downgrades with contempt a large part of what present day architects actually do; this produces a great deal of uncertainty in students' minds. Lastly design methodology does seem to overlook messages from different fields about the intellectual struggle for adequate methodology.<sup>8</sup>

The universally despised form-giving tradition of the modern movement, the associated rhetorics and the largely idiosyncratic nature of modern architects' theories about architecture are the reasons why methodologists deny any relevance to how an architect does conduct his affairs. Their feelings towards the modern

movement are understandable; it is, however, a long step from the rejection of the psychological idiosyncrasies of a publicity-conscious architect to the rejection of the elements induced by nurture and training in the psychological make-up of a professional architect. Having denied any relevance to how an architect does design, methodological works inevitably find it hard to say anything about how an architectural solution comes to be synthesised. Even when they mention synthesis it is done through the use of expressions like 'creative leap', 'flashes of inspiration', and so on (techniques like synectics and brain-storming are often mentioned). While one can understand the spirit behind expressions of this sort, their repeated employment in design method literature suggests that most methodologists inadvertently succumb to the idea that design thought is an unassailable mystery. Here, however, a reference should be made to Alexander's Pattern Language which is perhaps the first work in the field of design methodology to recognise the problem of synthesis in design.<sup>9</sup> Patterns are a collection of already synthesised bits of a design problem which the designer uses to synthesise the total form he requires. In other words the process is a synthesis of ready synthesised bits of a design problem. The question posed by Royston Landau<sup>10</sup> of whether architectural design is simply a summation of facts or whether it goes beyond this is relevant here. Furthermore, anyone who has had the personal experience of designing an artefact will know that he always operates under conditions where the information available is much less than that which will eventually be contained in the designed artefact.<sup>11</sup> Indeed this is why all designs call for a certain amount of originality.



Discussion of synthetic aspects of design becomes difficult because it involves the introduction of the characteristics of the designer into the design process. Any discussion of synthesis in design calls for a more dynamic view of design where there is a genuine interaction between the designer and the nature of the problem. A great deal could be learnt by examining examples of design synthesis and linking them with the psychological matter of information reception and structuring.

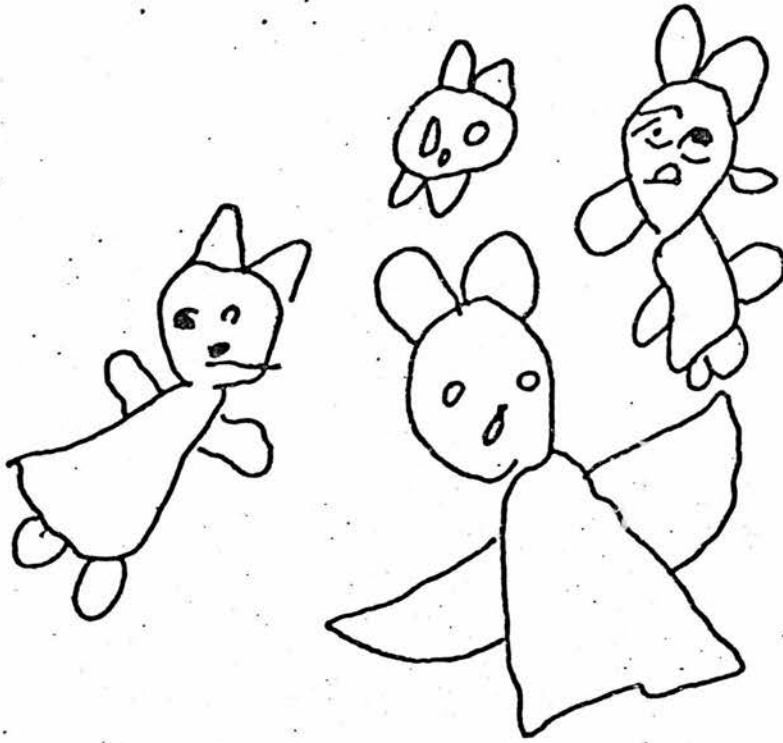
#### A Psychological Viewpoint of Synthesis in Design

Neither generation of solutions directly from defining parameters (e.g. Alexander's method) nor attempting it through deliberate stimulation of intuition using techniques like synectics have found much application in practising designers' offices. Somewhere in between these extremes lie many possible gradations of approaches which in fact most designers use. It is the task of researchers in design methodology to attempt to describe these. There is a need to study the structures of design thought through the dissection of real examples of synthesis and through systematic links with some established theories of perception. The selective and interpretative nature of perception as it exists in design activity must be emphasised and illustrated with examples of synthesis in design.

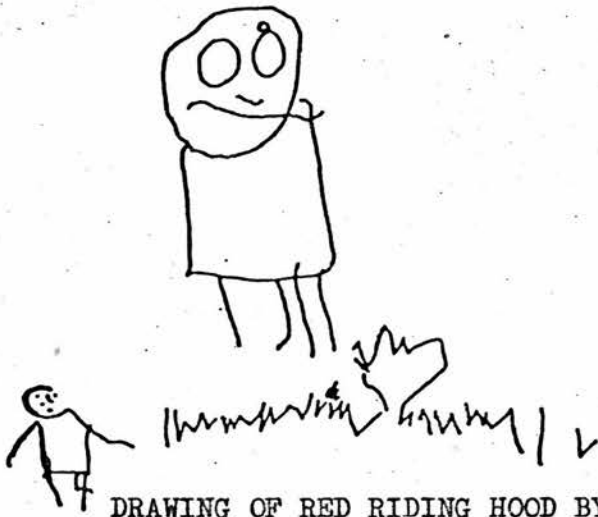
Psychology of perception demonstrates in various ways that what is perceived depends not only on the objects perceived<sup>12</sup> but also on the mental state of the perceiver, that is his expectations

and preconceptions about the objects perceived. The term 'schema' as used by Head<sup>13</sup> and Bartlett<sup>14</sup> is one of the terms which illustrate this fact. Bartlett's work on memory first introduced the notion of 'schema' into psychology. The usefulness of this term is well known. As Oldfield has put it "Perhaps the chief merit of this has been that it enables us to move with conceptual ease among a great variety of psychological phenomena, many of them very obscure, and reaching far beyond memory itself."<sup>15</sup> In the field of architectural design it does provide us with a conceptual aid for exploring on the one hand the designer's predilections, and on the other hand the expectations of the user.

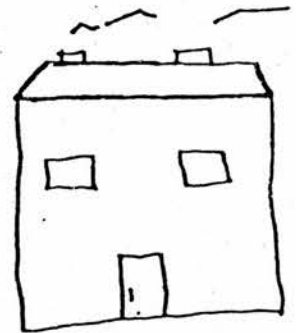
If we define 'schema' as 'habitual perception'<sup>16</sup> this will aid our understanding of the relationship between old and new information. It will help us to consider how past information predisposes us to act in certain ways rather than in others.<sup>17</sup> The way children learn to draw provides a good example of schematization. Studies on babies' eye movements reveal that at the earliest age babies are interested in the human face more than in anything else. Jane Abercrombie has suggested that babies build up schemata of people's faces and use them for interpreting the world.<sup>18</sup> Although there seems to be a controversy about how much early drawings of children are based on their observation of faces, it is clear that children's first drawings of animals are not very different from their drawings of humans. A human schema made with ears on top of the head becomes a rabbit or a bear.<sup>19</sup> Fig.2.1 is an example of this. In a drawing of Red Riding Hood and the wolf by a four year old (Fig.2.2) the only difference between them is in the number of legs.<sup>20</sup> In illustrating children's drawings of houses Jane Abercrombie goes



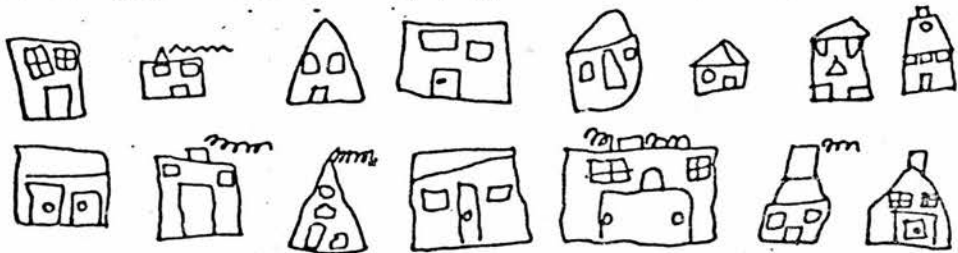
HUMANS OR ANIMALS? DRAWING BY A FOUR-YEAR OLD  
 (from Kellogg, 1969).  
 FIG. 2.1



DRAWING OF RED RIDING HOOD BY A  
 FOUR YEAR OLD (from Abercrombie, 1969)  
 FIG.2.3



A CHILD'S DRAWING OF A HOUSE  
 (from Abercrombie, 1969)  
 FIG.2.2



BUILDINGS BY FOUR TO SEVEN YEAR OLD CHILDREN  
 (from Kellogg, 1969).  
 FIG.2.4

even further.<sup>21</sup> She observes that next to humans, children like to draw their own houses. These drawings resemble human faces very closely; they tend to be symmetrical, the mouth becomes the door, the windows the eyes (Fig.2.3). Fig.2.4 has been reproduced from a fascinating study of children's drawings which also illustrates this point.<sup>22</sup>

Of course a child's world is not as inflexible as the adults' world of empirical facts, and therefore shows more transience and transmutability. Because of this it is extremely difficult to observe schematization as an identifiable process in architects' works. Obviously, the phenomena involved are much more complex. Again, as Oldfield has put it "Bartlett's methods do not lend themselves much to further refinement in the direction of systematic quantitative experimental design. They remain somewhat esoteric, their precise character less important than the conclusions of the man who devised and used them."<sup>23</sup> It seems hardly worthwhile making attempts to pin down 'schematization' in architects' works. Here certainly is a familiar conflict between relevance and objectivity. It seems that no direct testing by physical manipulation of the outside world is possible for an architect's 'schemata' other than simply discussing them and comparing and contrasting them with those of other architects. The following is some evidence for the fact that schematization is at work in many architects' work.

### Models as Routes to Design

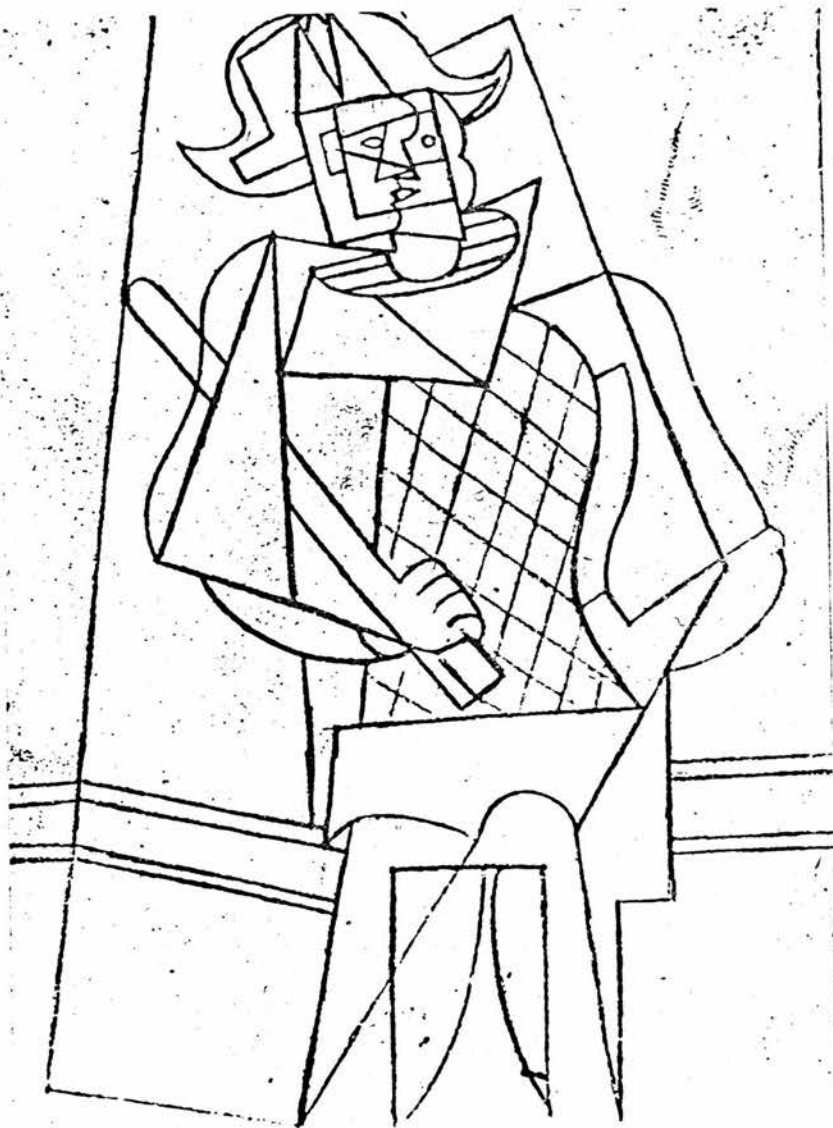
It is tempting to interpret Classicism, Neoclassicism, Gothic Revival, Eclecticism, etcetera as forms of schematization. This however would be a mistake since the derivative aesthetic standards evolved in these styles have nothing to do with the perceptual processes of the individual architect; they are to do with the collective consciousness of a group or a community of architects. If, however, instead of the revivalist point of view we consider the point of view of an architect like Viollet-le-Duc we discover that he used Gothic architecture more as a model for advancing an entirely new structure of ideas applicable to the architecture of all times rather than as a derivative source.<sup>24</sup> Now the question that needs to be asked is why an eminent theorist like Viollet needs a model at all? Could he not have arrived at his new rational point of view from first principles? When we encounter them later in this chapter and in the next one, the answers to these questions will prove basic to the understanding of the nature of design. This abstract discussion will depend, however, upon further exposure to examples of models in operation in the design process. Immediately then we can see that schematization is a process of using models to interpret the world around us and therefore it can be invoked as an explanation for the thought process followed by Viollet-le-Duc.

Our interest in perception is obviously rather broad, in the sense that we are interested in the question 'why things or happenings appear or seem to appear as they do to the designer'. Thus this question covers not only single objects but also the

complex environmental situation. It is true that psychologists tend to assign this last consideration to cognition rather than perception, but in design the two processes seem to be overlapping and from the point of view of an adequate explanation of the design process it seems hard to consider one in isolation from the other. This fact is clearly shown by the way in which Le Corbusier explained his architectural ideas. He is important to the modern movement not only because of what he has done but also because of what he has shown. He saw past buildings, visual arts of his time, ships, aircrafts and other twentieth century objects in terms of ideas for architecture. Summerson,<sup>25</sup> Giedion<sup>26</sup> and Serenyi<sup>27</sup> offer evidence for the fact that Le Corbusier saw in modern paintings and past buildings potential ideas for architectural design (Figs. 2.5, 2.6). But are these just conjectures? Le Corbusier's own account of his work with extensive sketches of buildings and objects he admired suggests that the observations of these authors should not be dismissed as mere conjectures. Once again the question why a gifted architect like Le Corbusier should abstract his ideas from other existing objects needs to be asked.

Le Corbusier did reject a great deal of prevailing revivalist and eclectic academic traditions, but as Giedion<sup>28</sup> suggests he deliberately sought for experiences in the architecture of former times in his travels which eventually found their way into his designs. This would suggest that there seems to be a parallel between the themes that run through the work of Viollet-le-Duc and Le Corbusier. Viollet felt that an architect

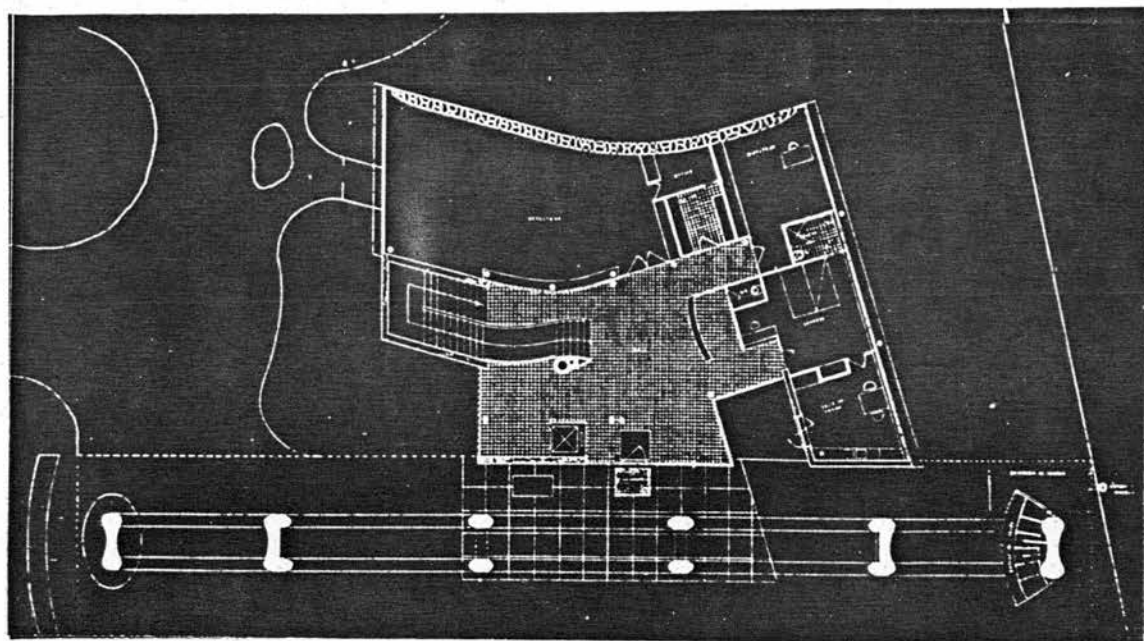
"must analyse what pleases him; he must be conscious of the logical process which lies behind the successful result. The architect's education must proceed



'ARLEQUIN' BY PICASSO, 1914 PENCIL DRAWING  
 (Collection George Melly)  
 FIG.2.5

in two stages. First he must learn to analyse the masterpieces of the past; then he must make his own synthesis, serving the conditions and using the materials dictated by his age."<sup>29</sup>

While we cannot sense in Le Corbusier's work the rigorousness with which Viollet carried out his analysis of the masterpieces of the past, both men did believe in the relevance of other existing works; Le Corbusier simply extended relevance to objects other than past buildings. What is central to the subject matter



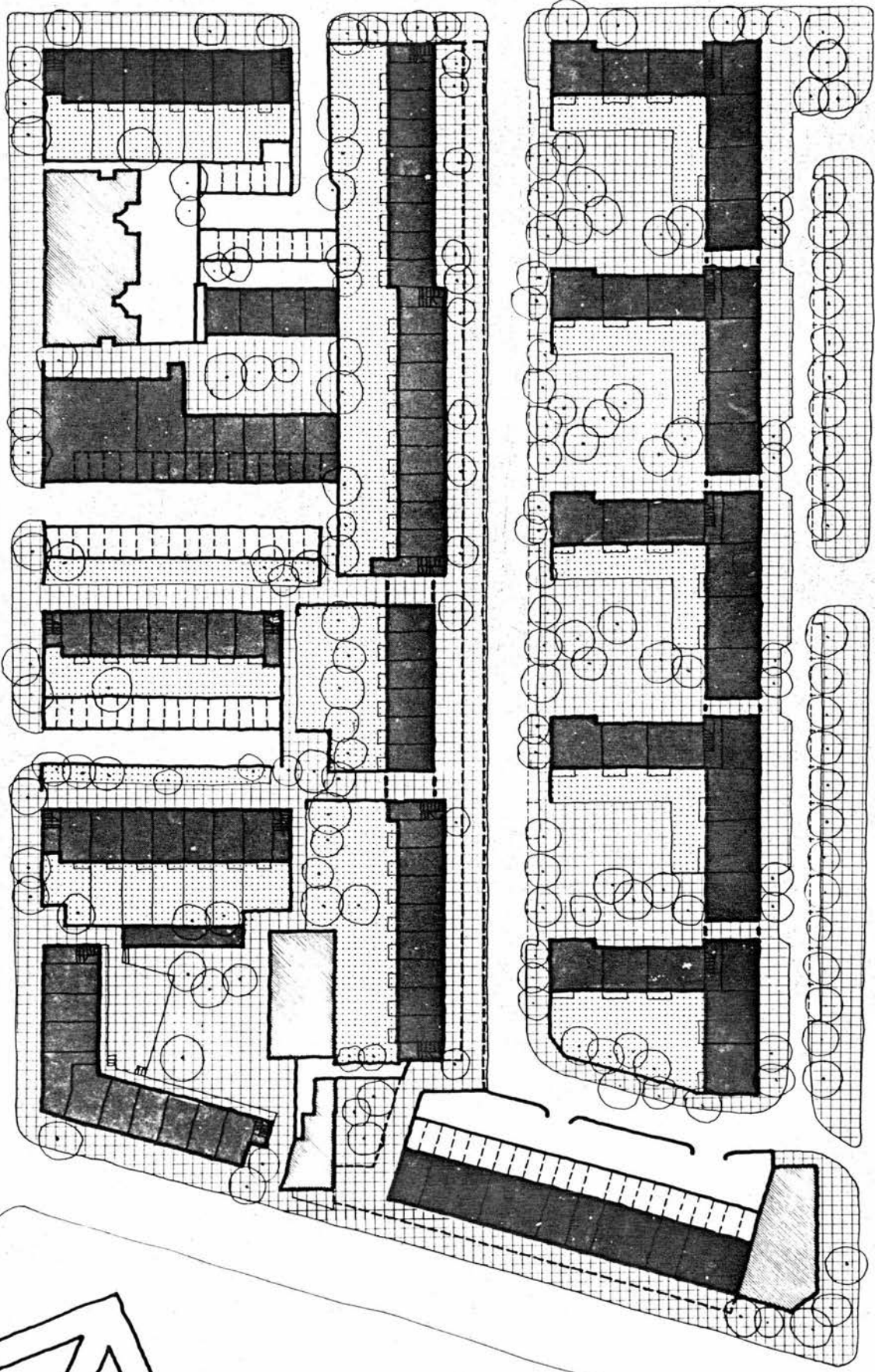
PAVILLON SUISSE, CITÉ UNIVERSITAIRE, PARIS BY LE CORBUSIER 1930-32.  
FIG.2.6

of this thesis is the use of something as a model for advancing a new idea.

Consider now the works of a few other architects. As suggested earlier, perceptual processes should not be restricted to objects alone. Gio Ponti's preoccupation with closed forms as opposed to open forms may be interpreted as an example of schematization, only in this case the solution is not interpreted through the use of an object as a model - but rather through a verbal generalization, namely that a closed or finished form is superior to an open-ended one.<sup>30</sup> Norman Forster's description of his scheme for a Norwegian shipping company amenity centre provides a still more concrete example of how previous schemes get used as model solutions. The scheme, Forster explained, had its origins in his scheme for the



Camden Street



Royal College Street

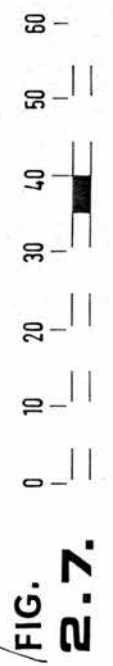


FIG. 2.7. Camden Housing London Shephard and Epstein Architects

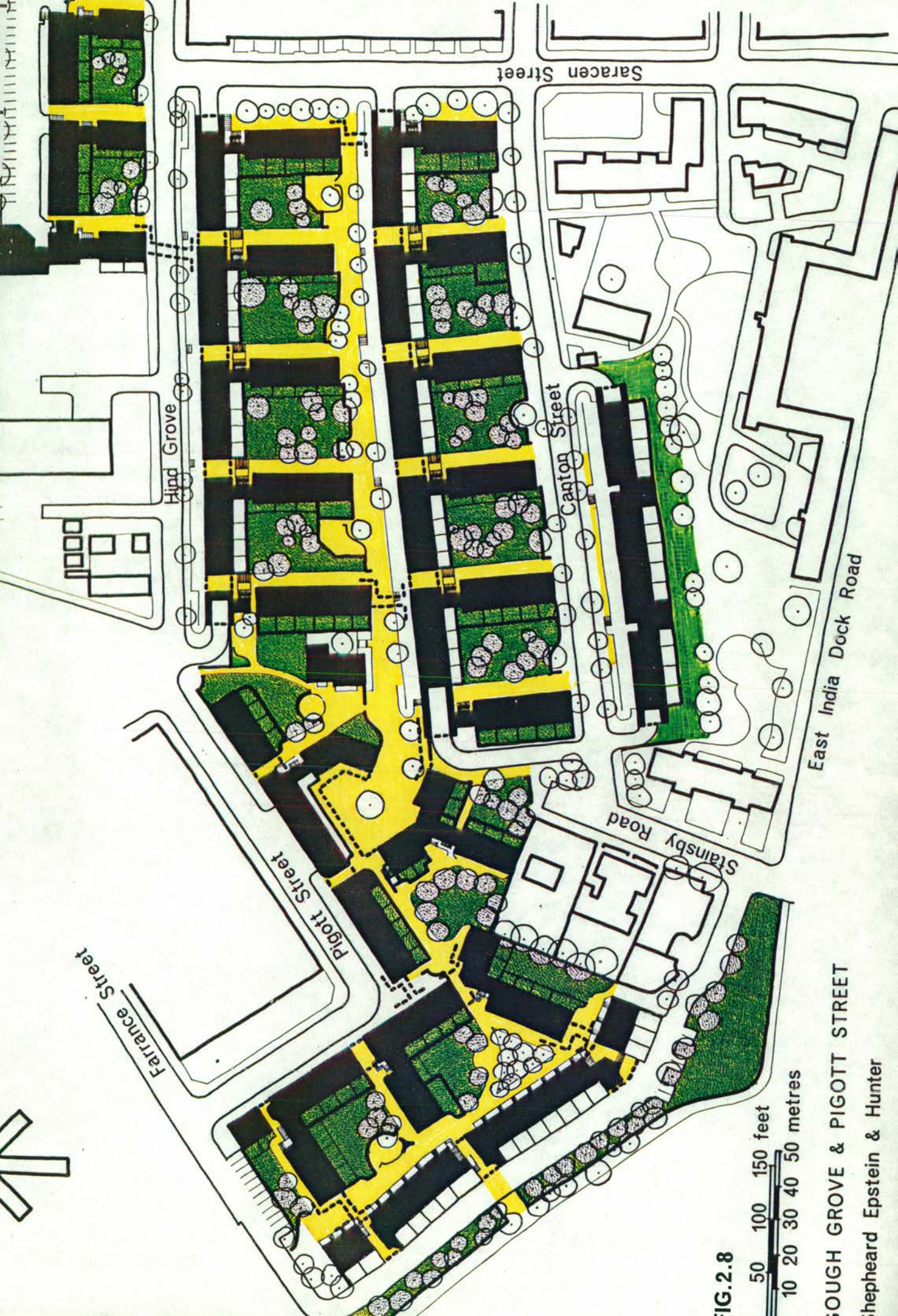


FIG.2.8

ROUGH GROVE & PIGOTT STREET

Shephard Epstein & Hunter

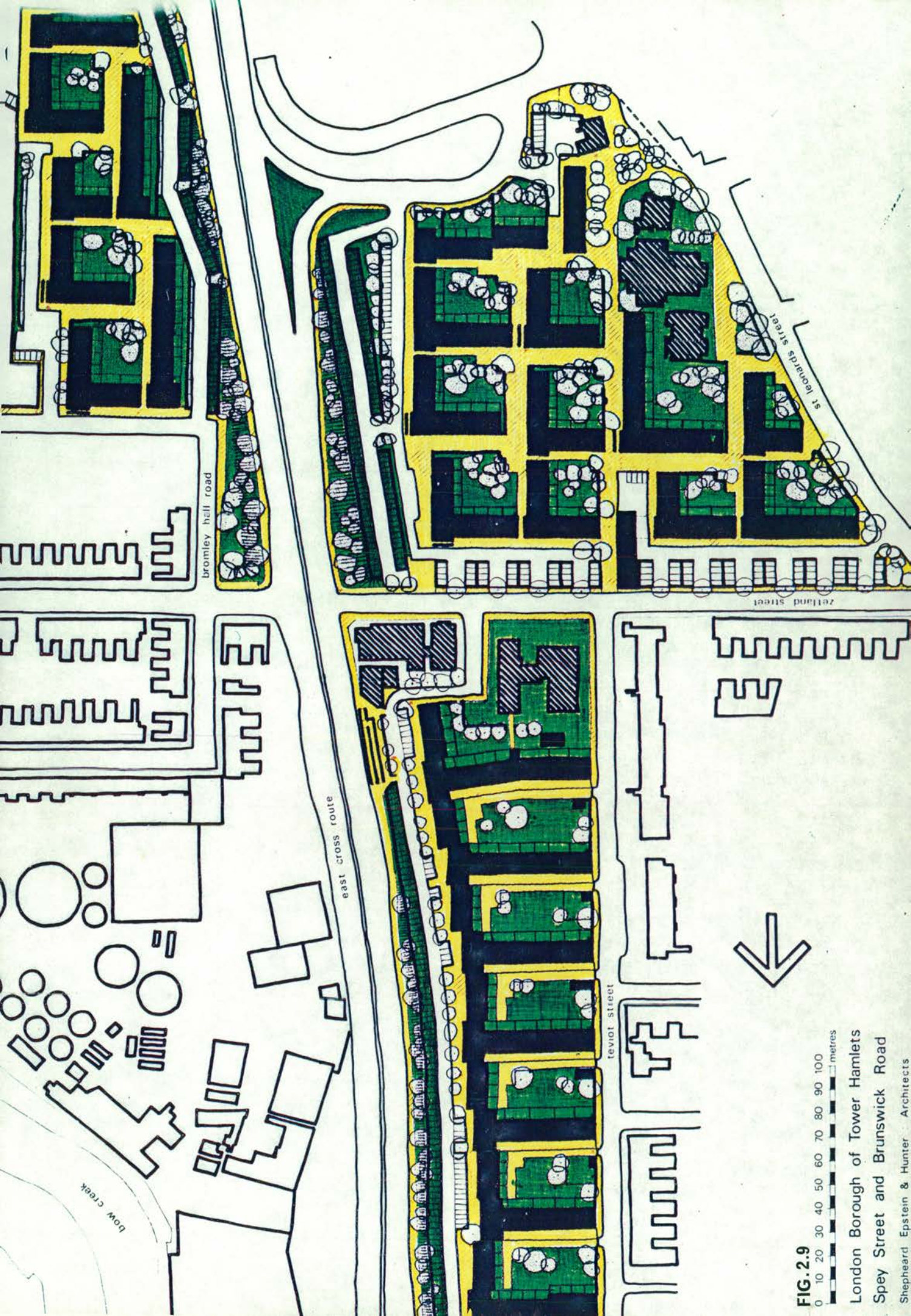


FIG. 2.9

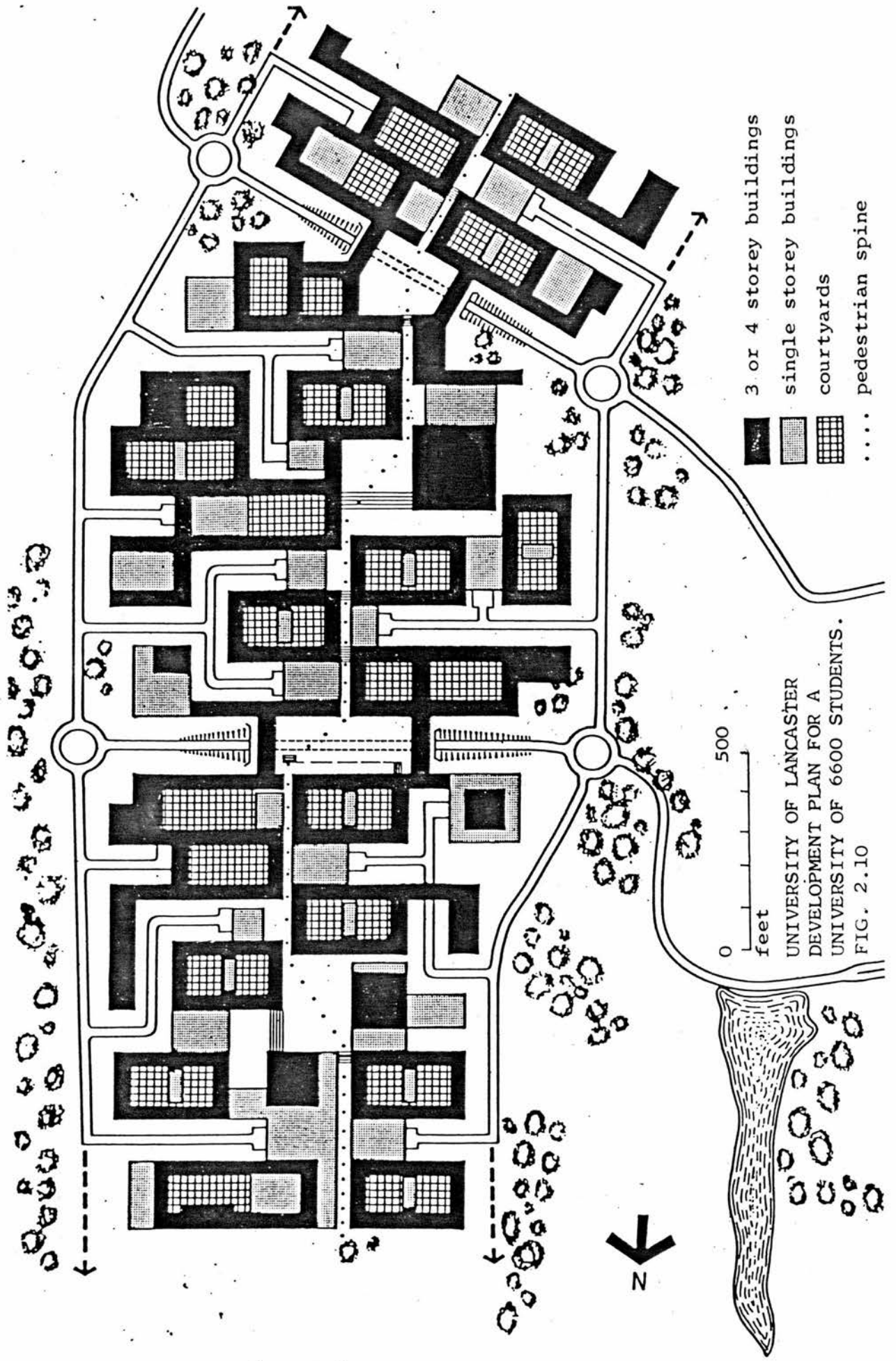
0 10 20 30 40 50 60 70 80 90 100 metres

London Borough of Tower Hamlets  
Spey Street and Brunswick Road

Shepherd Epstein & Hunter Architects

school at Newport, which in turn was influenced by California SCSD work.<sup>31</sup> Figs. 2.7, 2.8 and 2.9 show three housing schemes by the London architects Shepheard, Epstein and Hunter. It can be seen that all three schemes follow roughly similar patterns, that is to say the shape of blocks, their location and orientation, the location of pedestrian routes (sometimes these are covered walkways), carparking, private gardens, public open spaces, etc. appear to be ordered and distributed in the same way in all three schemes. Our intention here is not to suggest that this firm's approach is limited, but rather to see what invariant characteristics appear in different works of particular architects. Furthermore, it must be accepted that if an intelligent architect finds that a pattern of arrangement has been shown by the test of time to work he would wish to re-employ that pattern. Indeed the fact that Shepheard, Epstein and Hunter improve systematically a single pattern of arrangement in the light of past experience may well be their strength, particularly when we consider the harmful solutions arising from many architects' attempts to be unconventional or inventive at all costs. The architects of these three housing schemes readily admit that the similarity in appearance as well as in arrangement is partly due to their wish to re-employ successful past solutions, and partly it is due to a particular way of seeing, that is to say 'schematization'.<sup>32</sup>

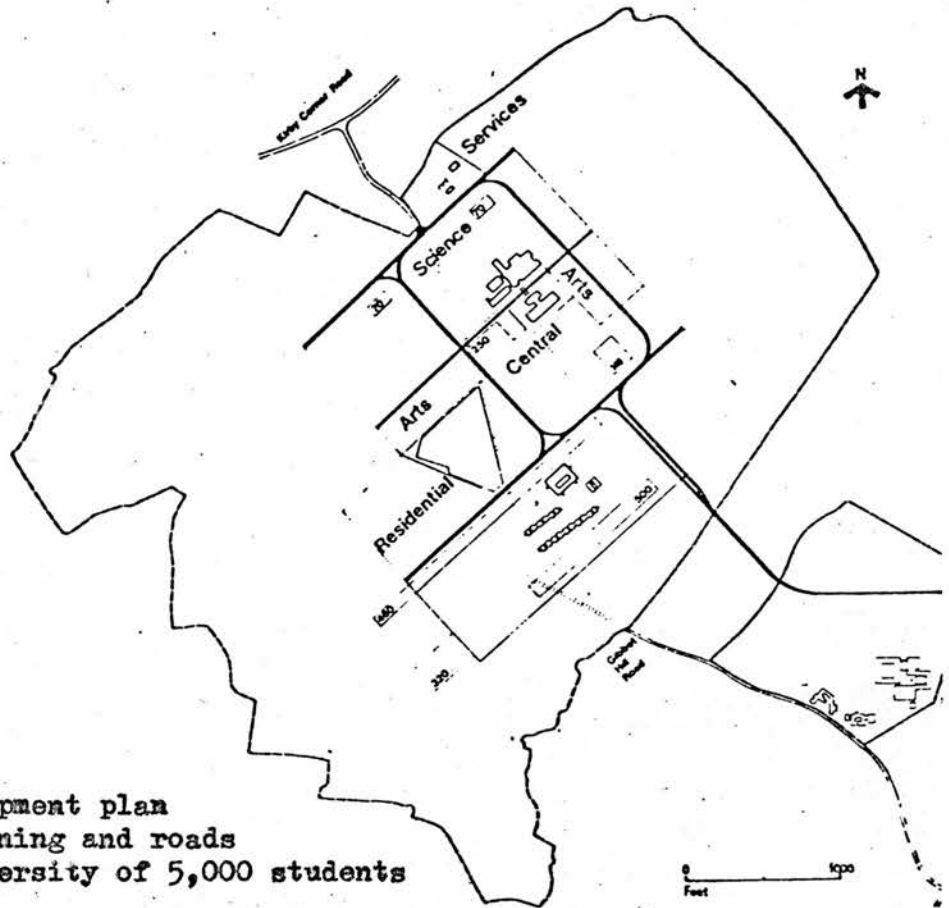
In the same way, certain organisational similarities will be noticed in this firm's plans for the universities of Lancaster, Warwick and Ghana, although in the case of the last two projects they were invited to redesign existing masterplans. The plans shown in Figs. 2.10, 2.11 and 2.12 all have pedestrian walkways



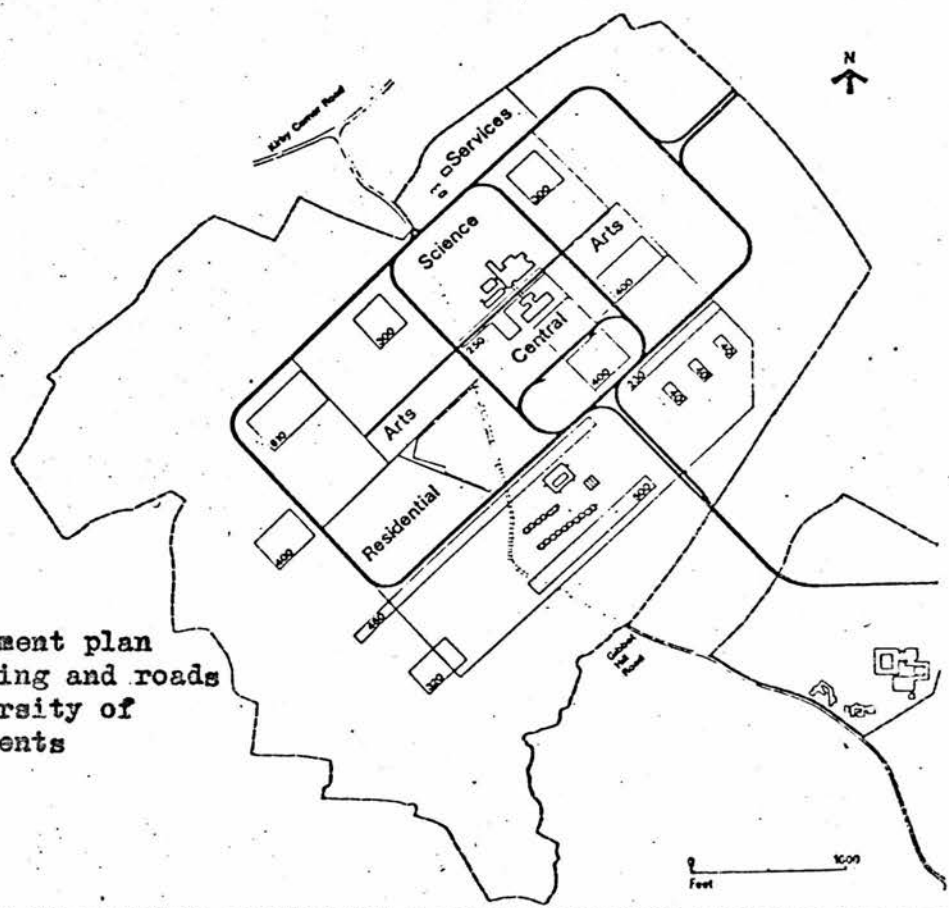
- 3 or 4 storey buildings
- ▒ single storey buildings
- ▤ courtyards
- .... pedestrian spine

0 500 feet

UNIVERSITY OF LANCASTER  
 DEVELOPMENT PLAN FOR A  
 UNIVERSITY OF 6600 STUDENTS.  
 FIG. 2.10

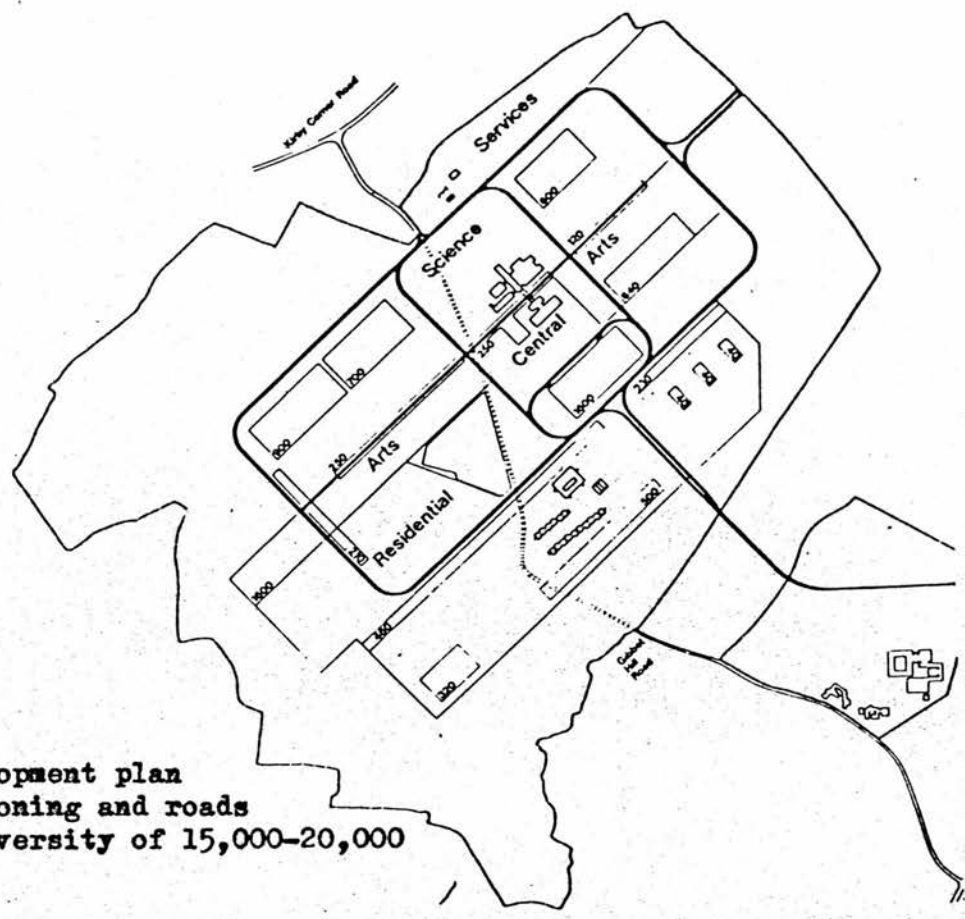


the development plan showing zoning and roads for a university of 5,000 students

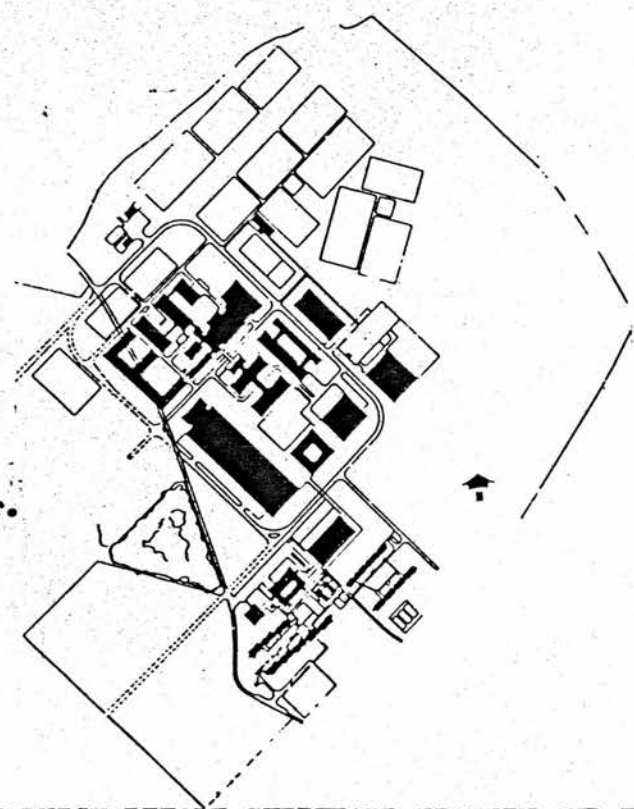


the development plan showing zoning and roads for a university of 10,000 students

PLAN FOR THE UNIVERSITY OF WARWICK BEFORE SHEPHEARD EPSTEIN AND HUNTER TOOK OVER (the numbers in the plans refer to car parking spaces available within the area outlined).  
 FIG.2.11



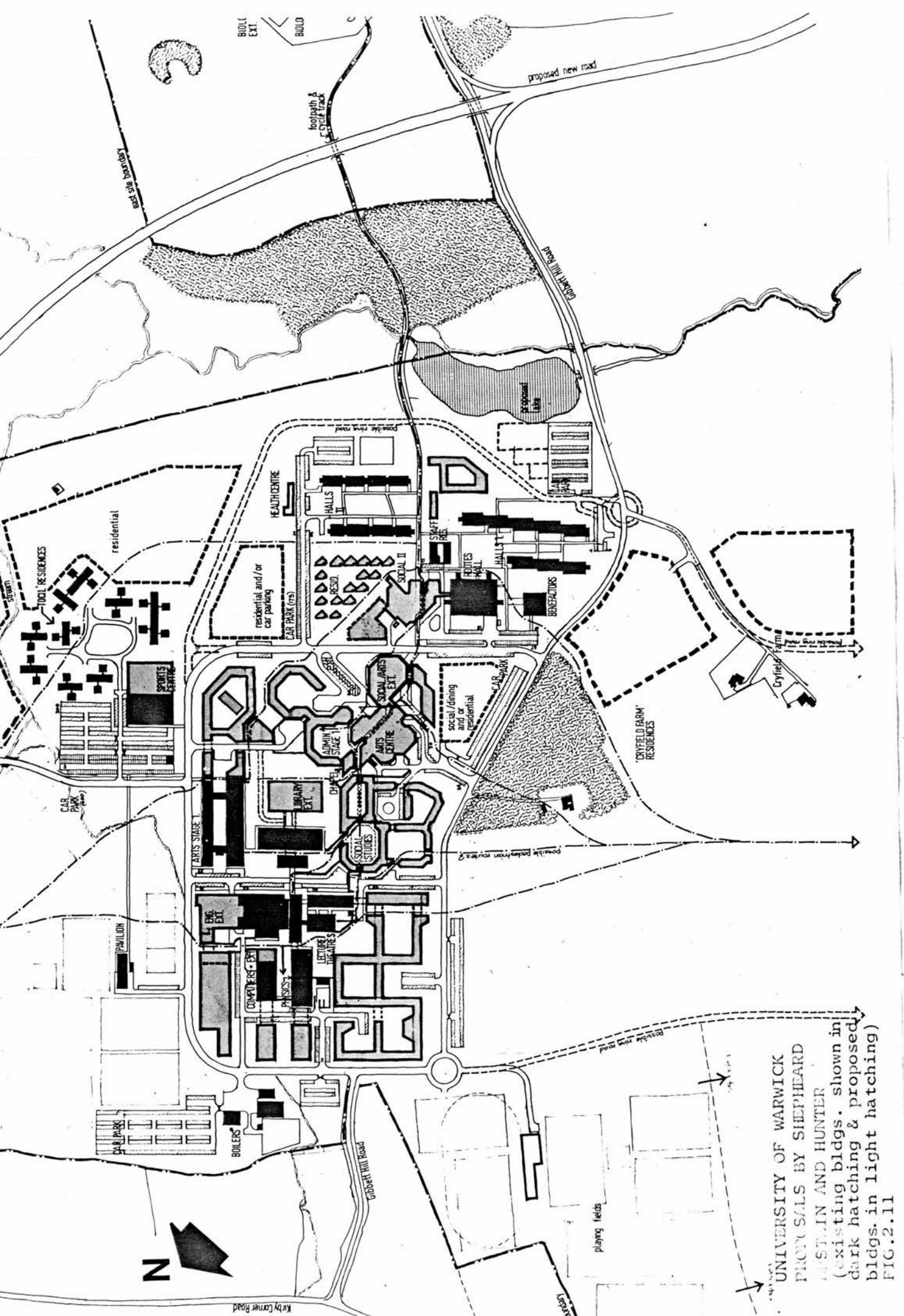
the development plan showing zoning and roads for a university of 15,000-20,000 students



details of central areas completed before Shephard Epstein and Hunter took over.

PLAN FOR THE UNIVERSITY OF WARWICK BEFORE SHEPHEARD EPSTEIN AND HUNTER TOOK OVER (the numbers in the plans refer to car parking spaces available within the area outlined).

FIG.2.11



UNIVERSITY OF WARWICK  
 PROX SALS BY SHEPHEARD  
 WESTON AND HUNTER  
 (existing bldgs. shown in  
 dark hatching & proposed  
 bldgs. in light hatching)  
 FIG.2.11



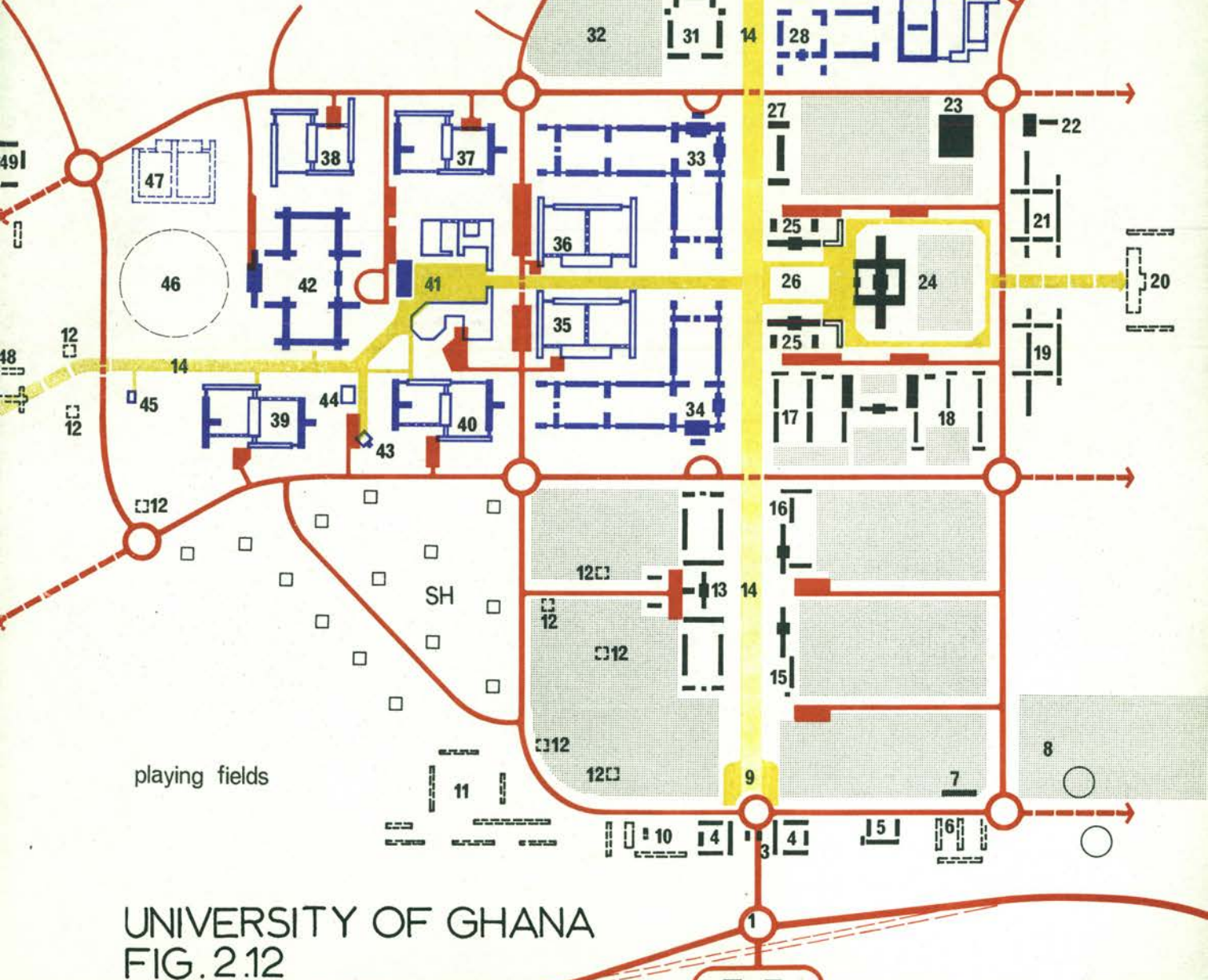
# DEVELOPMENT PLAN : DETAIL

legend

- roads
- main pedestrian ways
- existing faculties, institutes etc.
- extension areas for above
- existing halls
- new halls and student centre
- temporary buildings
- SH staff housing



to achimota



UNIVERSITY OF GHANA  
FIG. 2.12

as their focus. They all attempt to minimise cross-currents of vehicular traffic and to combine the benefits of urban and rural living. In all three schemes the phasing is linear, starting from the centre and growing outwards in order to minimise inconvenience to areas already completed.

In offices in which there is a continuous flow of projects, the situation outlined above - namely the repeated employment of personal models - can be shown to be typical. Less concrete but perhaps more subtle are the processes followed by the Finnish architects Aalto and Pietila. They find the structure of Finnish landscape full of ideas for built form. Before discussing their process in greater detail one peripheral but important point concerning landscape and built form must be dealt with. It is sometimes suggested that deriving built forms from landscape is done with a view to integrating architecture with the surrounding landscape. Yet Aalto's Finnish pavilion for the New York 1963 Fair, the Dormitory at MIT and Pietila's entry for the Finnish Embassy competition in New Delhi, all with their forms derived from Finnish landscape, demonstrate that this is not a satisfactory explanation. This calls for a discussion of the fundamental issue of form and content to which we shall return at a later stage in this chapter.

Presenting a number of abstractions derived from Finnish landscape Pietila said:

"They are prototype landscapes of Finland seen as a national romantic photographer sees his native country. Or, they are imaginary shapes designed to present Finnish landscape. Further, there are abstract forms that one can see as fictitious spaces and at the end there are diagrams or graphs simulating some environmental space characters."<sup>33</sup>

This would seem a good example of where an architect understands the nature of perceptual processes involved in designing, accepts the inevitability of schematization and deliberately attempts to make new use of acquired schemata.

Although many of his buildings have a direct relationship to the structure of Finnish landscape, Aalto has never articulated his thought process in the same way as Pietila has done. This may be partly because Aalto's written contributions are only few in number; nevertheless from the few written sources that are available it is possible to know a great deal about the processes he adopts. Aalto describes his mental state when he is designing like this:

"Whenever I have to solve an architectural problem I am inevitably held up by the thought of its realisation - it is the sort of 'three o'clock in the morning feeling', probably due to the difficulties caused by the weight of the different elements at the moment when the design is being carried out.

The social, human, technical and economic demands which are found alongside psychological factors and which concern each individual and each group, their rhythm and the effect they have on each other, are so numerous that they form a maze which cannot be worked out by rational methods. The ensuing complexity prevents the basic architectural idea from taking shape.

In such cases I proceed in an irrational way as follows: for a moment I forget all the maze of problems, I erase them from my mind and busy myself with something which can best be described as abstract art. I start drawing, giving free rein to my instinct, and suddenly the basic idea is born, a starting-point which links the numerous, often contradictory elements already mentioned, and brings them into harmony with each other.

While designing the Municipal Library in Viipuri (I had a lot of time at my disposal - five long years), I spent a great deal of the time making children's drawings, representing an imaginary mountain, with different shapes on the slopes and a sort of celestial super-structure consisting of several suns, which shed an equal light on the sides of the mountain. In themselves these drawings had nothing to do with architecture, but from these seemingly childish drawings sprang a combination of plans and sections which, although it would

be difficult to describe how, were all interwoven. And this became the basic idea for the library which, unfortunately, has now been destroyed. This basic idea consisted in grouping the reading rooms and the lending rooms on different levels, like on the slope of a mountain, around a central control desk uppermost in the building. Above everything was erected a sort of solar system - the round conical skylights.<sup>34</sup>

Quite obviously Aalto's description while providing support for the schemata thesis does raise a host of related issues such as, for instance, the role of representation, abstraction, etc. in the process of design which are dealt with in the remaining part of this chapter.

With reference to the schemata thesis it must at once be stressed that schematization is not a rigid, closed process. Analysing a design problem and preliminary attempts at designing, for instance, could to some extent affect our schemata (see Figs. 2.13 and 2.14). Rokeach's work on open and closed minds is relevant here.<sup>35</sup> Scores on a printed test of dogmatism, devised to compare individuals in this respect, not only correlate with scores on printed tests of attitudes, values and changes in belief systems, but also with individual differences in certain observable aspects of problem solving. The open minded who get low scores on the dogmatism test are more capable of dealing with a new belief system that is at odds with a previously held belief system, and of synthesising new information into an integrated whole. Architects' training does include training in heterogeneous problems so that shifting of schemata in response to different information is made easier. Yet it is possible that our prejudices could be so entrenched that we would never revise them. Mental rigidity in design situations can be thought of as the state of mind which

UNIVERSITY OF EDINBURGH : DEPARTMENT OF ARCHITECTURE

PROFESSOR GIANCARLO DE CARLO

Professor De Carlo will deliver a public lecture on:

**URBINO, ITS ARCHITECTURE AND PLAN FOR DEVELOPMENT**

in Lecture Hall A, David Hume Tower,  
on Tuesday, 29th October, at 5.15 p.m.

De Carlo will also be leading the following Departmental Seminars:

Monday, 28th October, 5.15 p.m.

Upper Lecture Room, 18 George Square

Architecture of Participation

Thursday, 31st November, 5.15 p.m.

Upper Lecture Room, 18 George Square

University Planning

Depending upon the number of people who wish to participate in the Departmental Seminars, it may be necessary to arrange a larger lecture room. Therefore those who wish to attend any of these Departmental Seminars are requested to contact Miss Helen Simpson at 667-1011, ext. 2405.

# de carlo



A FIRST ATTEMPT AT A POSTER DESIGN



# Giancarlo De Carlo Urbino, its Architecture and Development Plan

Tuesday 29th Oct. 1974 5.15pm L.R.A.  
David Hume Tower, George Sq. Edinburgh

FINAL DESIGN OF A POSTER

FIG.214a  
(see also 2.14b)

UNIVERSITY OF EDINBURGH : DEPARTMENT OF ARCHITECTURE

PROFESSOR GIANCARLO DE CARLO

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in Lecture Hall A, David Hume Tower,  
on Tuesday, 29th October, at 5.15 p.m.

Professor De Carlo is a practising architect/planner. He has taught at Yale and MIT and until recently was the Head of the School of Architecture at Venice. Professor De Carlo was a member of CIAM and Team Ten. He has written several books on planning and architectural subjects. His development plan for Urbino and his new buildings reveal considerable respect for the history of the city and its old architecture.

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University Planning

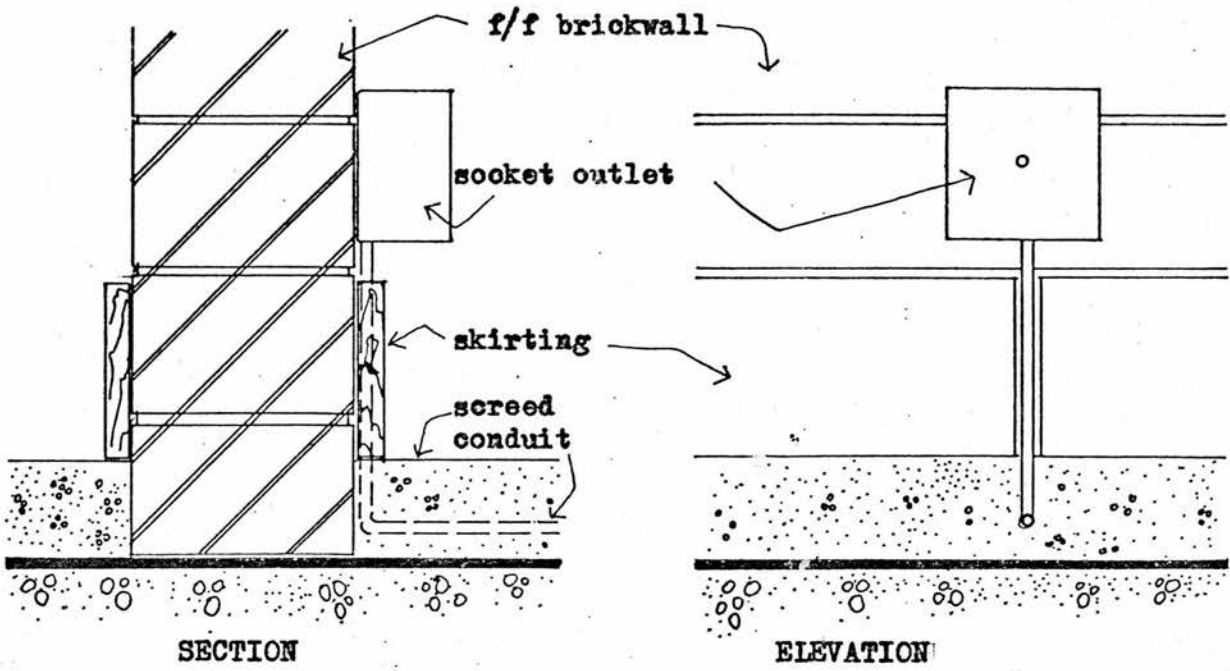
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acquires certain schemata and attempts to force reality at all costs into them. When we talk about deliberate stimulation of intuitive leaps we simply mean that we give ourselves a chance to make new use of acquired schemata. For an illustration of this in a concrete design instance refer to Fig.2.15. Fig.2.15 shows the way a socket outlet detail was accommodated on a  $4\frac{1}{2}$ " brickwall (for economic reasons the wall had to be left unplastered on both sides). Fig.2.15a would have been the conventional way of installing the socket outlet. Omission of plaster would result in exposed conduits and socket outlet boxes. The arrangement shown in Fig. 2.15b was devised as an answer to this problem and it came about as a result of the designer giving up the predilection for thinking about brick courses in a conventional way.

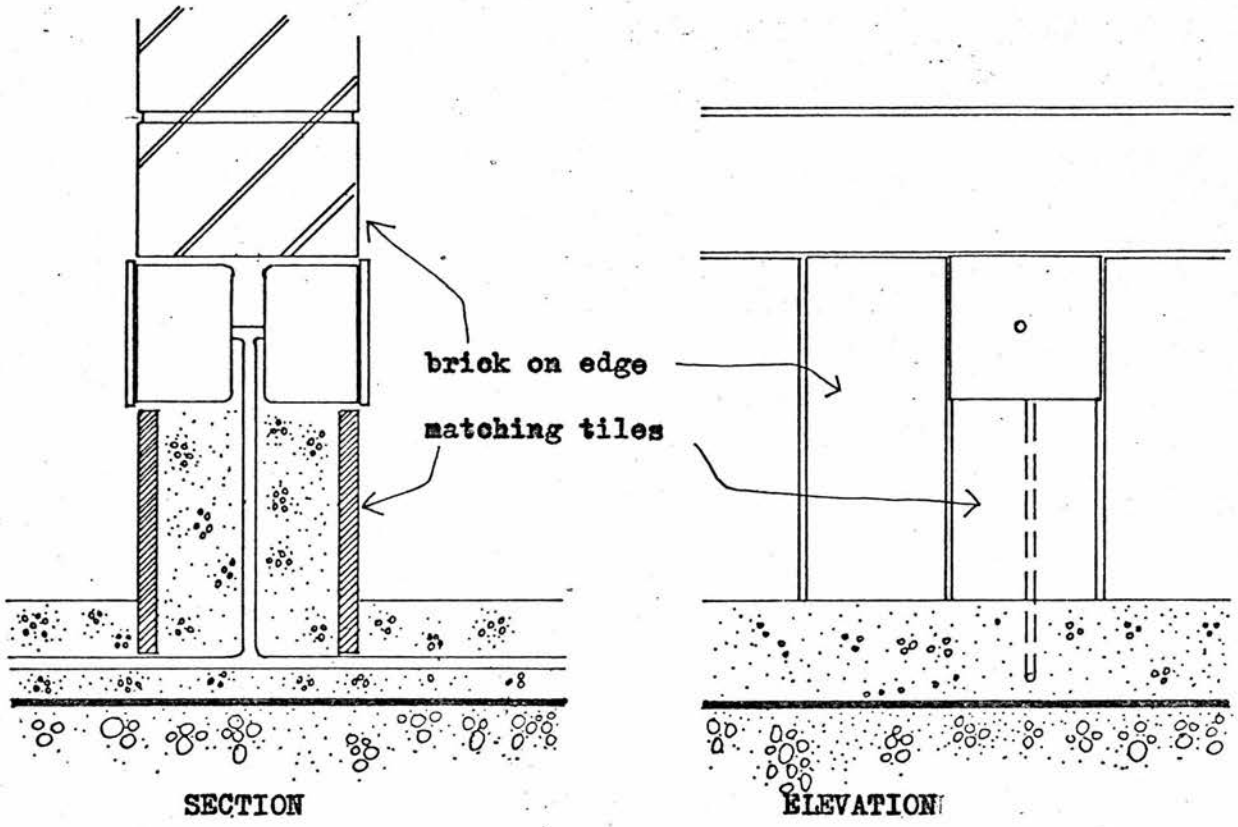
The two-string problem which was originally devised by Norman Maier in 1931 and which is widely employed by psychologists illustrates the same point.<sup>36</sup> Two strings hanging from the ceiling are to be tied together, but they are far apart and subjects cannot grasp both at once (Fig.2.16). The best solution is to tie a weight to one string and set it swinging like a pendulum, then run over to the other string and bring it to the swinging string at the right moment. Only 39% of Norman Maier's subjects got this solution within ten minutes even though a pair of pliers, suitable for pendulum weight was available in sight on a table. Pliers are conventionally used to hold things, so their use as a pendulum weight requires restructuring the functional significance of pliers. When the experimenter pushed one string to make it swing and handed the pliers to the subject, 38% more were able to solve the problem. Apparently this aid directed their attention to the







SECTION  
FIG.15a

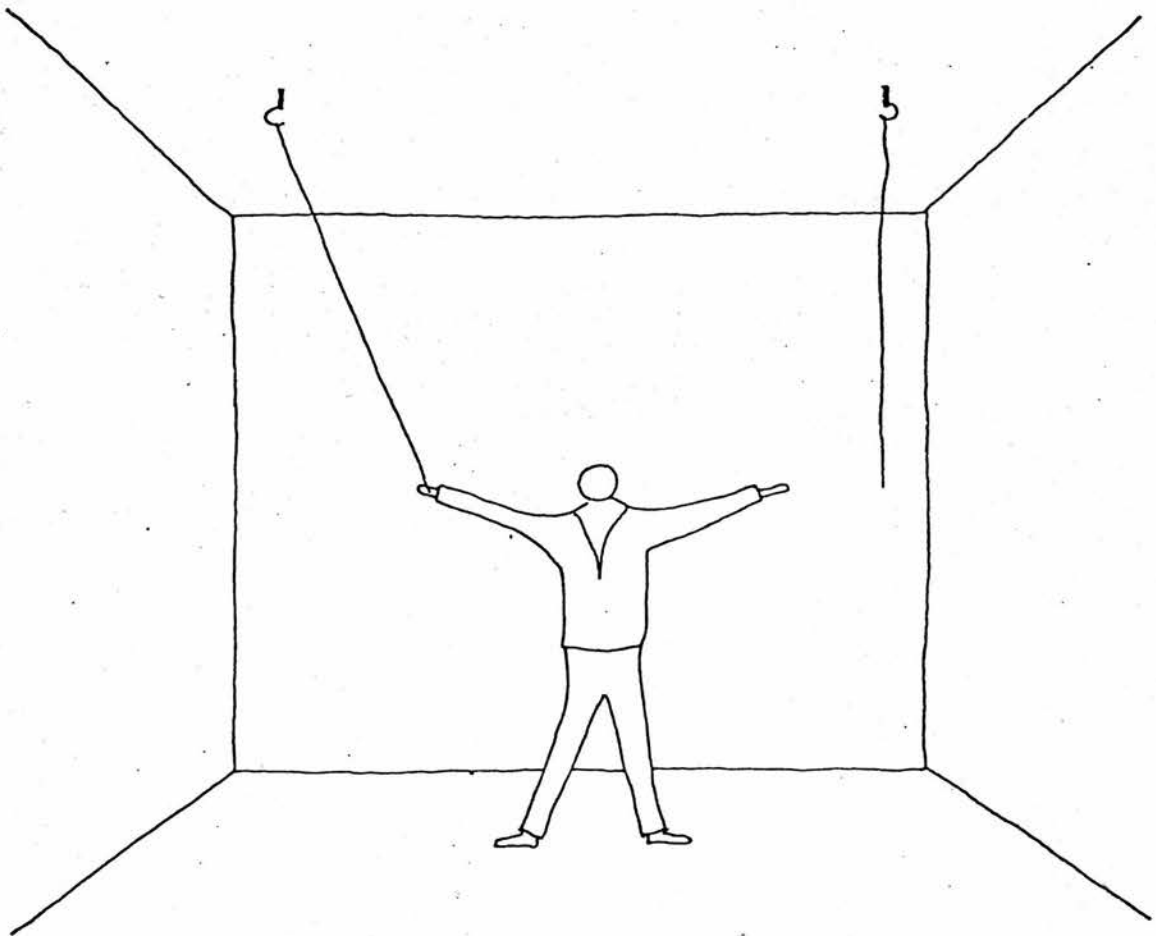


SECTION  
FIG.15b

DETAILS OF ELECTRICAL SOCKET OUTLET IN 4½" F/F BRICKWALL  
(source: author's own).  
FIGS.15 a and b

unusual potential of pliers.

The examples of architects' work discussed earlier are intended only to illustrate the notion of schematization in a design context. The purpose is not to launch a new method, less still to suggest that the efforts of those architects are worth imitating. The aim is simply to point out that the designer's mind is not a clean slate in which problems inscribe their solutions automatically. From the users' point of view, they too build up expectations based on their own past experience. There might be a gap between users' expectations and the designer's



TWO-STRING PROBLEM: HOW CAN THE SUBJECT TIE THE TWO STRINGS TOGETHER?  
(source: Mair, 1931)

FIG.2.16

schemata. Research in design methodology ought to investigate this. Juxtaposing users' expectations and designers' schemata in this way calls for some comment. Designers as a group can be treated as a sub-culture; their predilections can be described in terms of schemata and a network of beliefs, habits and ways of seeing. Many present day building projects are designed for use by a cross-section of the population and this makes it difficult to regard the users as a sub-culture; terms like 'schema' are quite unsuitable for describing their predilections. Chapter VI proposes a different way of describing users' interests and the term 'expectation' here should be accepted as a form of shorthand.

#### Models as Media for Design Thought

From our discussion so far schemata are like screens or filters which regulate the perceptual process. In architectural design these filters have tended to be past buildings, landscape constructions, visual arts of relevant periods, past solutions of particular designers, and so on. All these we called 'models'. This idea of models is not inconsistent with our notion of schemata, since we saw how children build up 'schemata' of the human face and use them as 'models' for interpreting the world. While the tentative conception of schematization facilitates the consideration of a variety of psychological phenomena, the idea of model helps us to talk about determinants of design that originate in the perceptual processes of the architect in specific ways. The idea of model is a fundamental one in the process of design and therefore deserves further

examination. This idea was implied in most of the design contexts discussed above and it is fair to say that we have used the term 'model' in many different senses. Thus we described:

- 1) Viollet-le-Duc's Gothic studies as model studies from which a new synthesis was to be achieved;
- 2) how Le Corbusier saw the paintings of his time as model ideas for architecture;
- 3) how Le Corbusier saw aircrafts, ships, and other objects as model architectural ideas;
- 4) how primitive structures of the past served as models for Le Corbusier's new ideas;
- 5) how Forster used an established accomplishment like the California SCSD system as a model;
- 6) how Forster, Epstein and others have used their own past projects as model solutions for their future designs;
- 7) how symbolic generalisations like "closed or finished forms are superior to open forms" guided Ponti towards certain solutions;
- 8) how abstractions derived from the structure of landscape have served as models for advancing architectural ideas (Pietila);
- 9) how graphic work (doodles) which was partially derived from problem requirements served as a model for interpreting the required solutions.

It is evident that not all these senses of 'model' are inconsistent with one another; as we will soon see some are elucidations of others. Nevertheless, given the diversity, it is natural to ask: is there anything in common between these senses? Is there anything definite or general about the notion of a model which ought to be made clear? Or are we simply referring to certain

arbitrary accounts of architects and certain peculiarities in their work using the same word 'model'?

Preliminary attempts to answer these questions by an examination of the architects' accounts presented earlier make it clear that the nine different senses of 'model' fall into three main groups. The close affinity between primitive structures, modern objects, and Le Corbusier's buildings suggests that the relation is a purely visual one. Ponti's symbolic generalisations are also to do with visual aspects (included in this group are other slogans such as 'less is more', 'complexity and contradictions', and so on). A certain stylistic inconsistency here must be admitted. Although these latter generalisations cannot be called models they do have a close parallel to Le Corbusier's process of deriving ideas with visual ends in mind. This kind of thinking can justifiably be called model-based, particularly because of the fact that these generalisations serve as filters through which design ideas are extracted. For the sake of brevity let us call them models of visual characteristics.

Viollet-le-Duc's recourse to Gothic structures, Forster's interpretation of California SCSD system, Epstein's linear plan and his prototype for housing schemes belong to a different group; they are prototypical solutions embracing a host of features of design such as relationship between elements and sub-elements (buildings, movement systems, different kinds of rooms, open spaces, etc.), constructional systems, services systems, and so on. It is only natural that an architect should want to consider whether the structure of his own previous designs and that of buildings he admires is applicable in a broad sense to new design situations he

encounters. This kind of consideration directs him to features in the prototype which need further development and/or new interpretation. Finally, Aalto's abstract graphic works, Pietila's abstractions derived from landscape and perhaps, to a lesser extent, Le Corbusier's interest in the visual arts of his time are psychological aids to the discovery of form. From now on we will take it that textual examination of architects' accounts of what their inspiration is can be reduced to one of these three models, namely models of visual characteristics, prototypical solutions and aids to the discovery of form. It is obvious from the brief description of each of these that the second and third categories are of fundamental importance.

#### Models Used as Prototypical Solutions by Architects

Consistent employment of pre-designed solutions to new design situations by a good proportion of architects suggests that models regarded as prototypical solutions are in some sense essential to the process of design. As was pointed out earlier the current methodological bias has gone so much towards examining what is conceptual that practising architects are accusing the methodologists of forgetting to allow for what is practical. It is hoped that inclusion of models of this sort in our account of the design process will be of help in explaining the nature of design. It should be pointed out that Epstein's linear plan or the California SCSD work are not a static, formal device which is simply transferred to a new situation by the architect. Each is indeed a system in

the process of growth and a designer's effort to examine their suitability to a new design situation helps in that growth. Models of this sort belong to the personal inventive aspects because answers to such questions as 'why is the architect using that particular model and no others' will in the main be subjective. Nevertheless this group of models is much more concrete than the next (models as aids to discovery of form) and hence communication between architects about the merits of a particular model and its state of development is that much easier; in the majority of instances such communication takes place implicitly. At a certain stage of development models of this sort begin to gain recognition by a group of architects and thus become part of the communal inventive aspects of the design process (this phenomenon is discussed in Chapter III).

Now it may be asked whether or not at some stage of development the prototype of a prototype has been conceived from first principles. This is a very important question and the consideration of the nature of solutions at the early stages of any design field provides an illuminating answer. It is a well known fact that early iron bridges closely resembled timber bridges. Early New England houses followed medieval English precedents with heavy handhewn timber frames infilled with bricks; but the harsh climate of New England soon showed the vulnerability of the system. From these examples and from our discussion of schematization it would seem that employment of what is already known to new situations and then progress from there on reflects the nature of the human mind. This fact could be used to elucidate the concept of models. Let us now be a little more precise about the notion of

models. When Epstein employs his linear plan as a model solution for the universities of Ghana and Lancaster he is not asserting that the design situation in these two places is one and the same. He is implying rather that in terms of physical elements such as a collection of educational buildings, the traffic and pedestrian movements between them, administration of the various buildings, and in terms of phasing, the situation is analogous. One could in fact point out a number of other characteristics in one institution which do not hold for the other, and we shall call these 'negative analogies' of the model. Type of administration, movement systems, services organisation, and phasing are in fact the characteristics that we want to ascribe to both projects, and these we can call the 'positive analogies'. But the important point is that generally there will be some characteristics in the model about which we do not know whether they are positive or negative analogies; these are the more interesting characteristics and they come to the fore when we attempt to apply the model to a new situation (for example the vulnerability of the medieval English house to harsher climates encountered in America). This third set of properties may be labelled 'neutral analogy' and it is these characteristics that enable us to consider models as something more than objects for replication and as systems in the process of growth.

#### Models as Aids to Discovery of Form

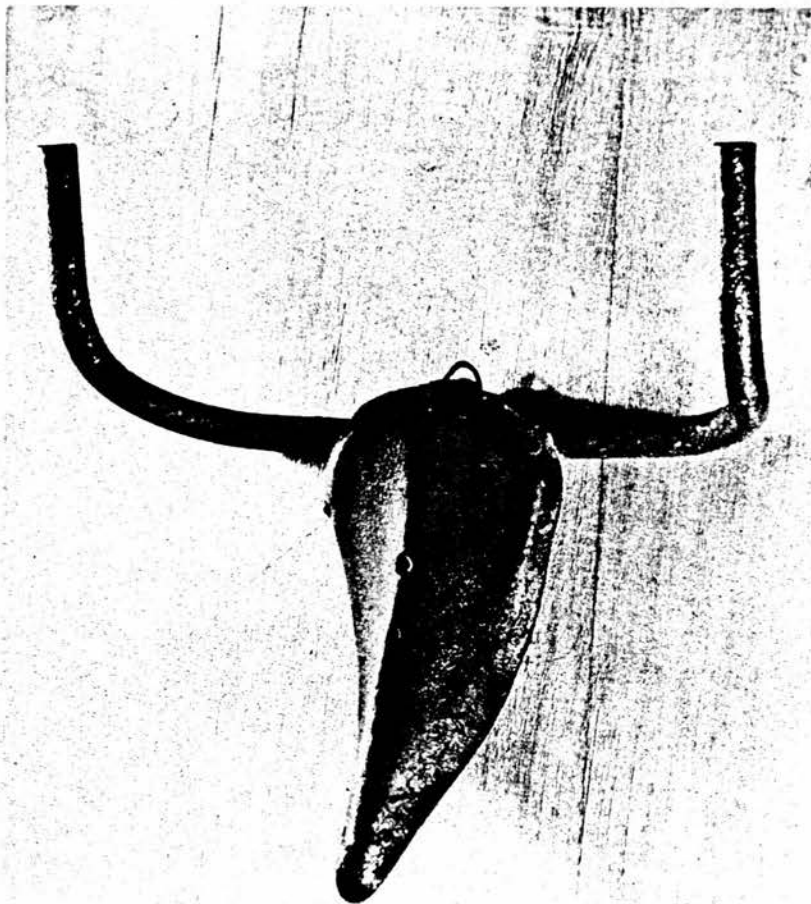
It is obvious in our discussion of models as prototypical solutions that the neutral analogies of these models in many cases



proved to be heuristic devices. In our third group of models the neutral analogy is simply much more dominant. The abstract graphic work which Aalto carries out is performed for the sake of finding a physically interpretable form. But what do we precisely mean by form?<sup>37</sup>

In ordinary language the word 'form' carries a number of meanings; however in the design context it cannot be simply shape plus some extra ingredients such as colour, texture, and so on. This would imply a static meaning. The interpretation of the term 'form' that is most useful for a discussion of design is that 'form' is an orderly assemblage of parts.<sup>38</sup> If we look at Picasso's sculpture 'Bull's Head' (Fig.2.17) we see that it is made from a bicycle seat and a handlebar. The handlebar and the seat share no common characteristics with the form of a bull's head except the way in which they are assembled. The form of a bull's head is realised precisely through this assemblage. The same is true of Picasso's sculpture 'Baboon and Young' which is composed of a toy car and a football (Fig.2.18).

Familiar things assume different forms. Water, for instance, exists in the form of ice, snow, and so on. Electricity is another example which takes on a variety of forms. Similarly, the same form may be exemplified by different contents. The example of the 'Bull's Head' given above illustrates this idea. Generally speaking the form of things is discovered in two ways: (a) by abstraction, that is through the recognition of common forms from a variety of instances; and (b) by reinterpreting forms we already know. The latter way is usually easier, since our search is confined to forms that are already known. Models as prototypes discussed in the last



BULL'S HEAD : METAMORPHOSIS 1943.  
The sculpture was owned by the artist himself  
(source: Roland Penrose, The Sculptures of  
Picasso, 1967)

FIG.2.17



BABOON AND YOUNG

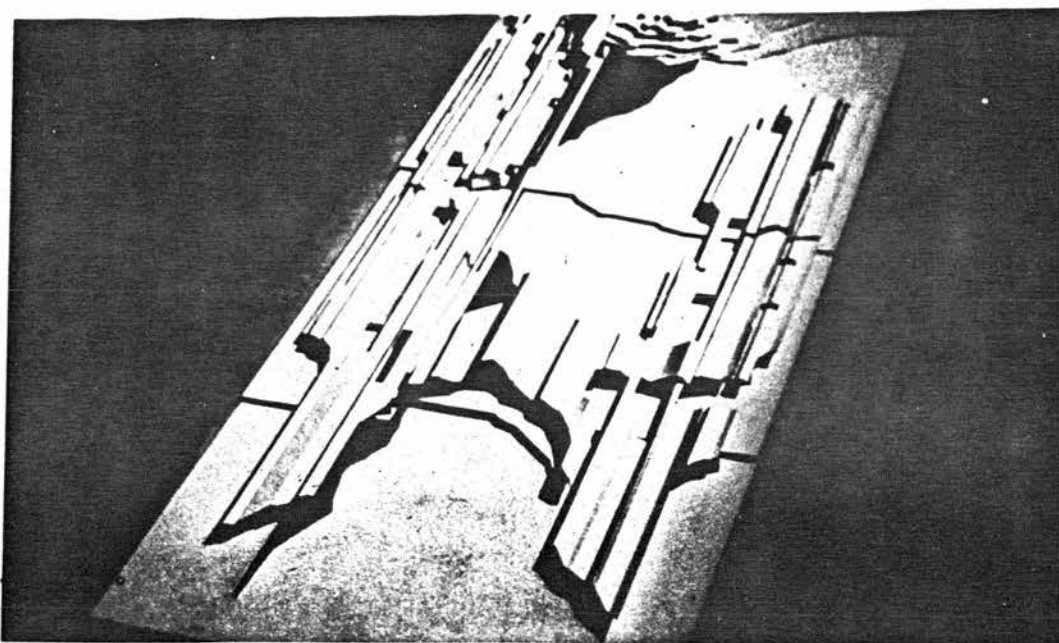
(source: Roland Penrose, The Sculptures of Picasso, 1967)

FIG.218

sub-heading are to do with this way of discovering and/or apprehending form. But the power to recognize a common form in a chance collection produces innovative design. This is simply another way of saying that inventiveness depends on one's ability to make new use of acquired schemata. This is the essence of models as heuristic devices. The three examples which belong to this group are Aalto's graphic explorations, Pietila's landscape abstractions and Le Corbusier's interpretation of the visual arts of his period. Here we can see the idea of recognition of common form in a variety of instances quite clearly.

Different things that exhibit the same form are analogous. Analogy is a means by which we represent one thing using another which has similar structure. When we draw the floor plan of a building or a street map we may say that we draw what can be called its 'logical picture'. The logical picture differs from the ordinary picture or photograph in that it need not look in any way like the original object. The relationship between the original object and its logical picture is not that of a copy, but of analogy. Indeed the more like reflections of the original objects street plans and building plans look, the less useful they are. Floor plans and street maps are useful not only because of what they show, but also because of what they leave out.

If we consider Aalto's description of his approach to design given earlier, and what Pietila has to say about his abstractions in this context we can see that both are concerned with the dynamic process by which form is invented; hence the neutral analogy is highly significant. Landscape abstractions are a concrete 'picture' of something 'A' which is used analogically to evolve a



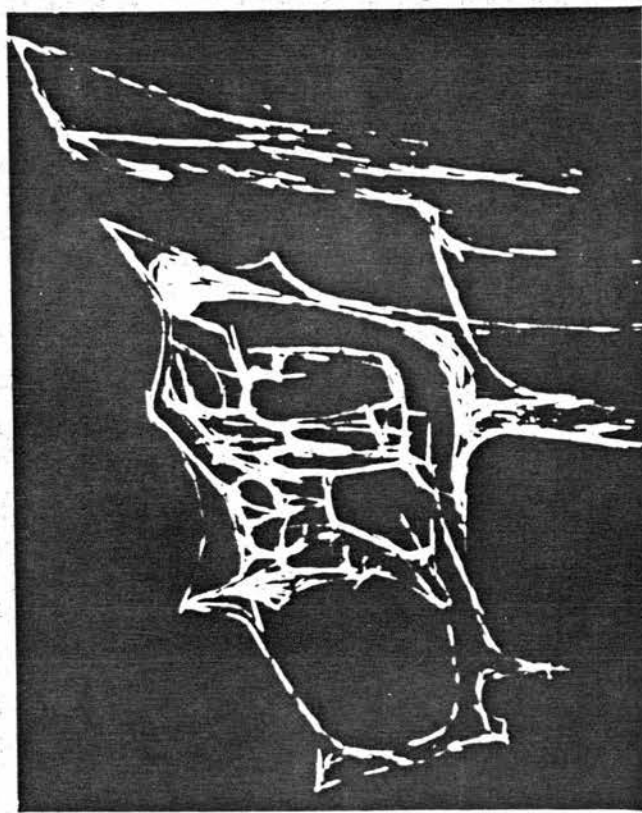
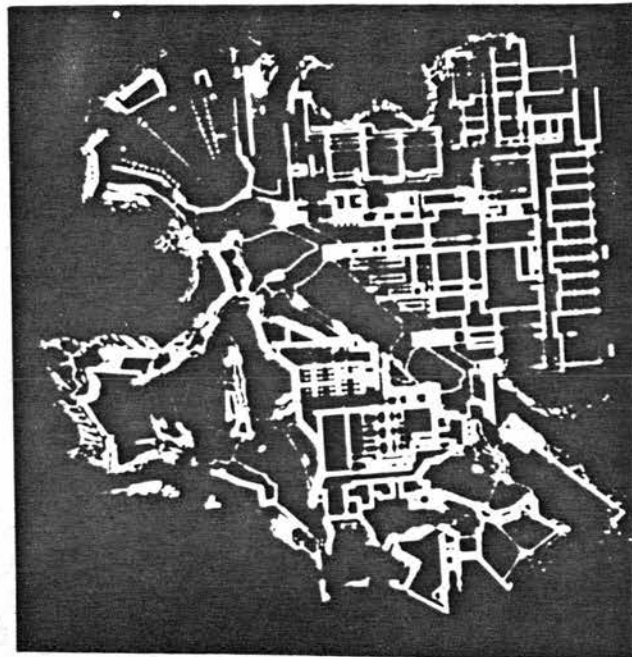
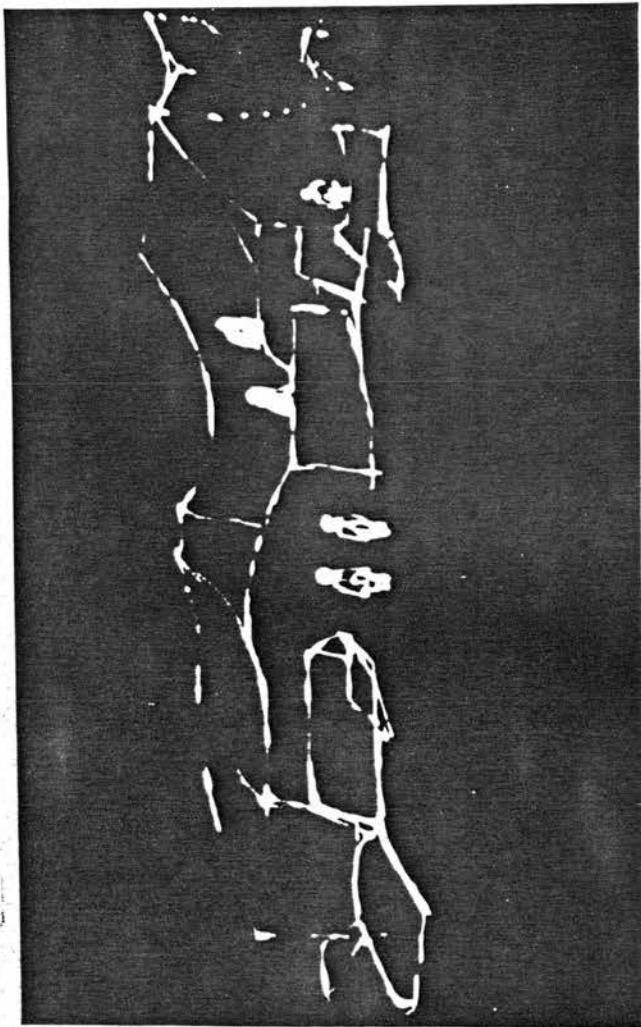
MODEL OF PIETILA'S COMPETITION PROJECT FOR THE FINNISH EMBASSY  
IN NEW DELHI  
(from Pietila, 1970)

FIG.2.19B

THE LANDSCAPE WHICH WAS USED AS A SOURCE FOR DERIVING THE FORM  
OF THE EMBASSY  
(from Pietila, 1970)

FIG.2.19A



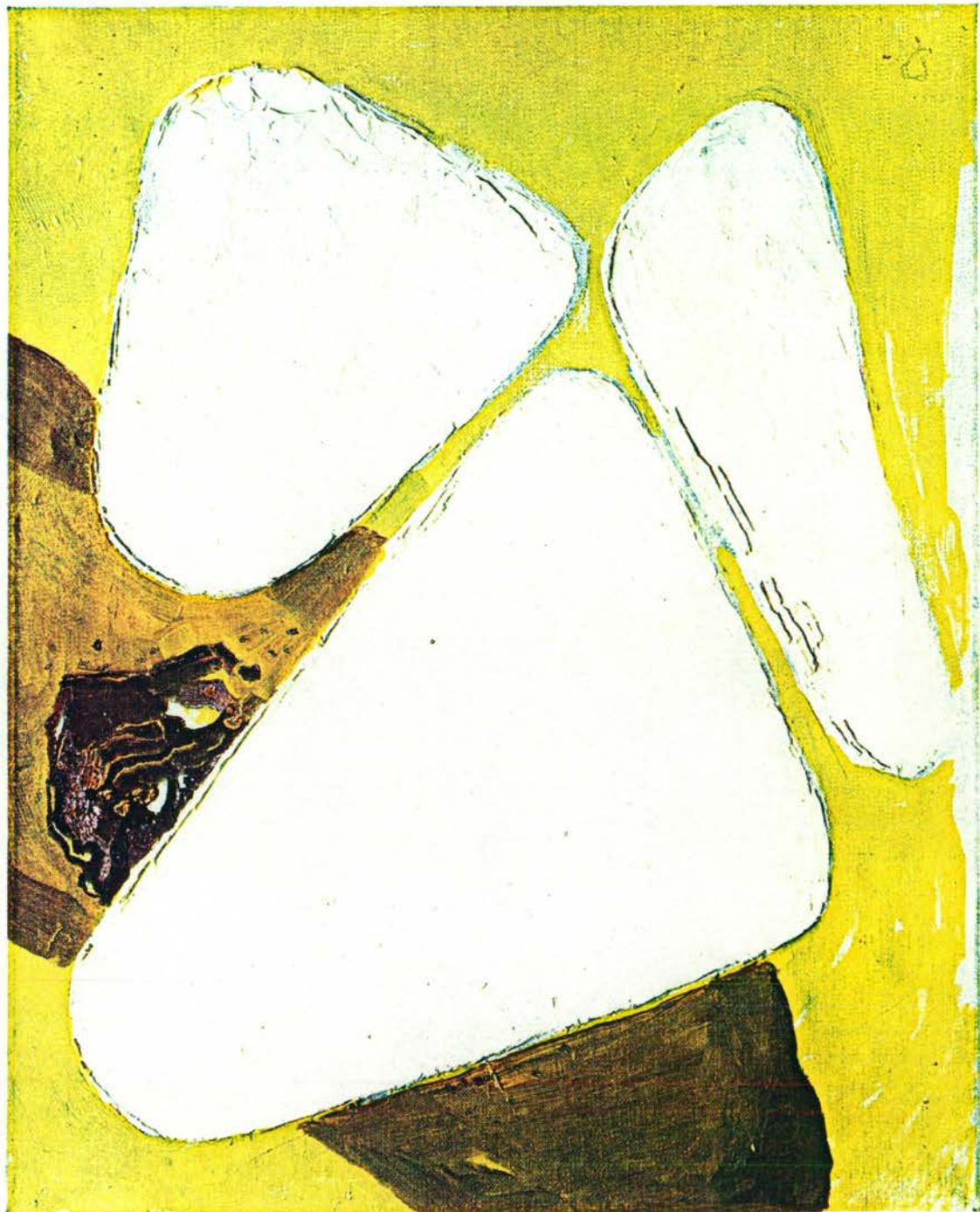


PIETILA'S STUDENT UNION  
BUILDING AT OTANIEMI -  
EARLY SKETCHES AND FINAL  
PLAN. Pietila uses words  
like composite image of  
conditions in the nearby  
environment, simulation of  
the micro-geography of the  
site and so on to describe  
these drawings.  
(source: Pietila 1970)

FIG: 2.20

concrete something else 'B'. Talking about the winning competition entry for the Finnish Embassy at New Delhi (Figs.2.19a and 2.19b) Pietila said "the project simulated the landscape and geomorphologic formations typical of the middle Finnish region (Fig.2.19a). The observed forms of hills, waters, etc. were transformed into structural sections, plan layout, etc." He also offered a similar explanation of the early sketches and final schemes for his Student Union building (Fig.2.20). "Early sketches which simulated the microgeography of the site were transformed into a viable architectural solution." According to Pietila the final scheme - particularly the way the halls are arranged - shows how the topological patterns of natural space are intuitively followed. The landscape abstractions are concrete pictures of the structure of landscapes used to represent another set of concrete structures, the structures of spatial organisation. Thus the models used as heuristic devices have concreteness at two levels. The concreteness achieved by making a picture of something that is felt or experienced, namely the quality of natural spaces, and the concreteness which the model acquires through becoming applied to architectural design. These two levels of concreteness are demonstrated quite clearly in the abstract works of Aalto and the respective physical environments derived from them (Figs. 2.21a, b and 2.22 a, b). Obviously here abstract works are pictures in their own right rather than pictures of something like landscape.

Three matters arise from our discussion so far of models as psychological aids to discovery of form. Firstly if we ask why Pietila is using landscape rather than anything else as a medium of exploration we enter the psychological aspects of representation



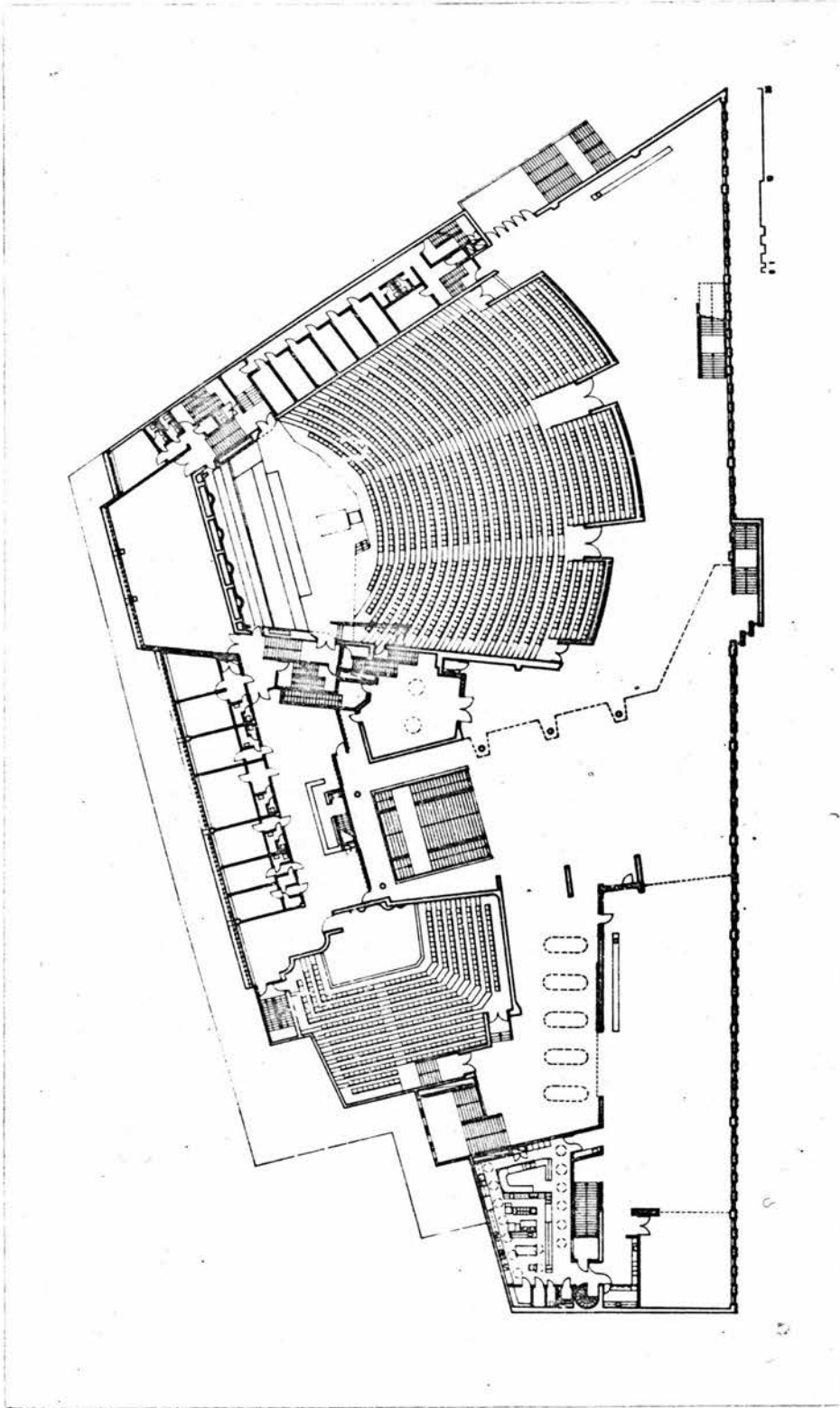
57 x 79 cm

1948

Oil, Öl, Huile

(source Aalto synopsis  
1970) FIG.2.21a



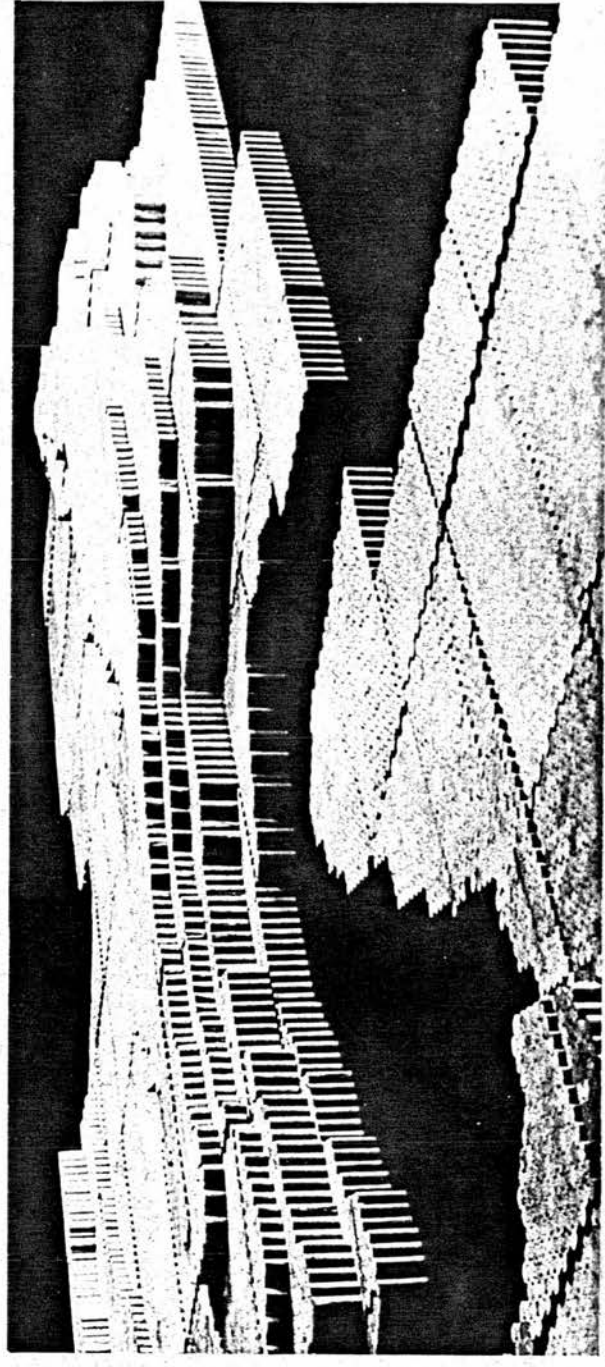


Aalto's Helsinki Concert Hall  
1962 - Floor Plan.  
(source: Aalto Synopsis 1970)  
FIG.2.21b

Villa Louis Carre, Bazoches,  
Ile-de-France, 1956-59,  
Terraced Landscaping.  
(source: Aalto Synopsis 1970)  
FIG. 2.22a



Graphic work in the form of wood  
relief which provided the  
intuition.  
(source: Aalto Synopsis 1970)  
FIG. 2.22b



which Gombrich<sup>39</sup> has explored in considerable detail. Secondly, having mentioned early on in this chapter the idea of models of visual characteristics we may be asked: are not the models of Aalto and Pietila simply about visual aspects of buildings? Lastly, the two illustrations from Aalto's work do not illuminate his statement that graphic abstractions enable him to release himself from the complexity of issues a design is expected to solve.

There is a definite parallel between Pietila's landscape abstractions and Gombrich's illustration of the hobby horse (Fig.2.23). The most suitable term for describing both is 'representation': the former of a horse by a stick, the latter of built environment by natural environment.<sup>40</sup> All image-making will of course be symptomatic of its maker to an extent, but an explanation of images solely in terms of the maker's portrayal of his visions, dreams and the inner world in general is unsatisfactory. The stick, after all, is not a portrait of a horse and to the child it is not even a sign signifying the concept of a horse, as it can in fact be used as a number of other things. So the stick is simply a substitute for a horse. Although the stick does not possess the formal or geometrical qualities of a horse, what makes it a horse is that there is just enough resemblance in the stick to make it rideable. In fact any rideable object could serve as a horse, and the process by which a stick is apprehended as a horse is personal and private and need not be communicated to anyone at all. Further, the process depends upon a certain intrinsic relevance the particular image has for its maker, in the sense that riding or the thought of riding matters very much to the user of the stick.



THE HOBBY HORSE ENGRAVING BY ISRAEL VAN MEKENEM ABOUT 1500.  
(Source Gombrich, *Meditations on a Hobby Horse*, 1971)  
FIG. 2.23

Thus the essence of Pietila's landscape abstractions is substitution. The common factor between the abstraction and the final building is primarily function, that is to say the fact that abstraction just makes it possible to explore spatial characteristics. In the case of Aalto his graphic work serves as a functional substitute. Textbooks on the psychology of thinking report that certain thinkers do use idiosyncratic schemes for representing complex matters and these tend to be images, vaguely formed patterns, or heuristic devices not easy to communicate; but all representational systems existed at one time only in the mind of original thinkers.

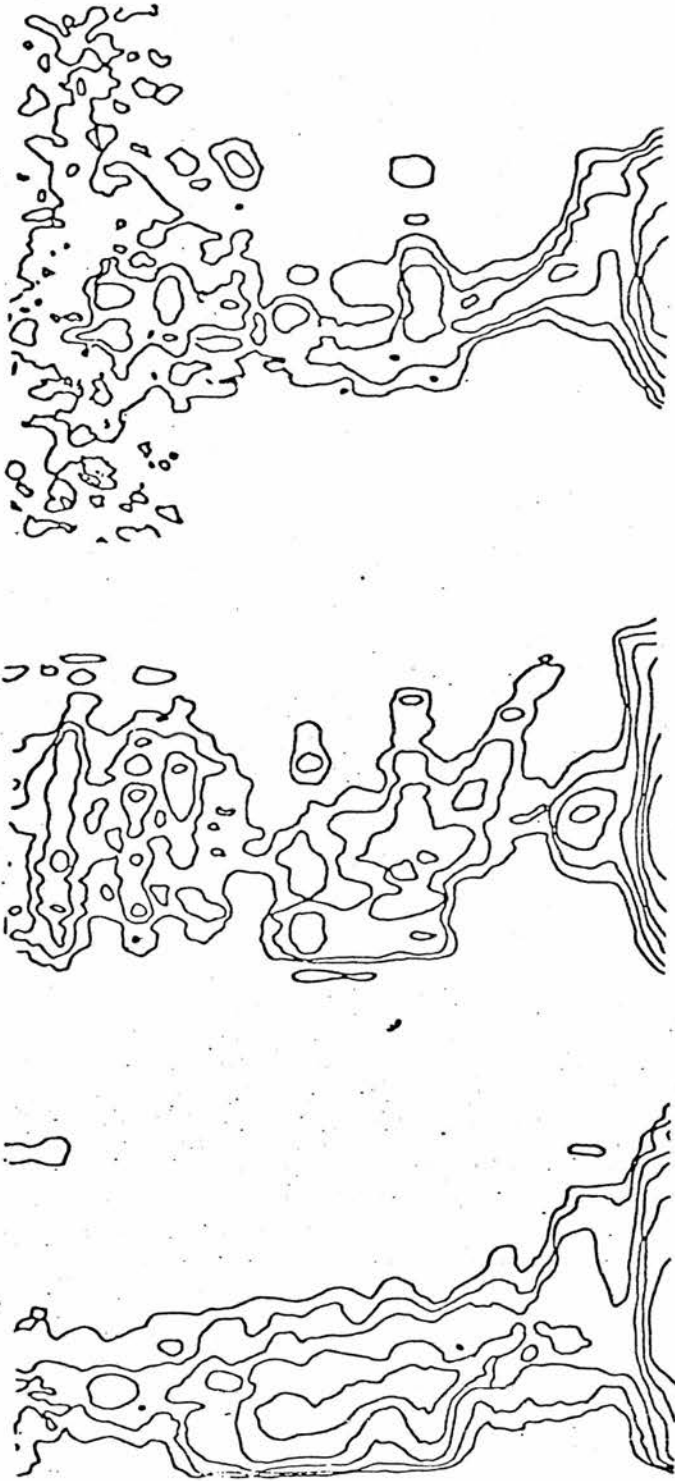
The abstract constructions of Aalto and Pietila should not be regarded as finite achievements. When one passes from the process of studying an existing building to putting forward an idea for a building the notion of visual shapes gives way to an abstract arrangement of components. Thus the early graphic work of designers acquires an interpretative significance. As the designer proceeds in his task his graphic work reveals, at least to himself, layers and layers of meaning. Landscapes certainly have intrinsic relevance to these two architects. Finland is sparsely populated; there are numerous lakes throughout the country; the country is still covered with dense forests and nature is still powerful. Awareness of the structure of landscape is basic.

Let us turn now to the question of whether Aalto's and Pietila's models are simply about visual aspects of design. We saw that all image-making is rooted in the creation of substitutes. Both art history and the psychology of art often describe the remoteness of the type of imagery with which we are concerned from any visual experience. Further, as C.H. Waddington<sup>41</sup> has suggested, we need

to distinguish between the two faculties that are in action when we perceive. In his study of the relations between painting and the natural sciences in this century Waddington uses Whitehead's account of the way we perceive to explain this distinction:<sup>42</sup>

"Every act of perception, he maintained, involves two modes: perception by 'presentational immediacy' and by 'causal efficacy'. By 'presentational immediacy' he referred to what we have been trained to think of as the immediate data presented to us by our senses - patches of colour seen with the eyes, noises of a certain pitch and intensity, sensations of hard, rough or soft surfaces, and so on. These are the 'sense data' of more old-fashioned philosophers, and were formerly regarded as the basic elementary facts of experience. But Whitehead claims that a more primitive element in perception is awareness, not of sheer sensations, but rather of entities which are perceived as having some potential effectiveness in the world. He argues that it is more elementary to perceive causally efficacious things, such as a chair (something suitable for sitting in) or a table (something to put things down on), and that it is a relatively sophisticated business to 'see' such things as mere coloured patches or other pure sensations: in fact, it takes training ...."

The way we use a graph is a simple example of perception by causal efficacy. When we look at a graph the phenomenon that it represents is more important than the picture itself. Transferring the perceptual process from one mode of perception to another facilitates the recognition of structure (i.e. orderly arrangement of parts). Fig.2.24 is a visual representation of the word 'you' spoken by three different people, as recorded by Bell Telephones. By transferring it into visual representation we are able to distinguish the finer differences between the three recordings. It is only legitimate that designers should use graphic work as a way of simulating various environmental elements. It is doubtful whether images of any kind are ever used by architects like Aalto purely for their presentational immediacy. In architectural design



SOUND SPECTRA OF 'YOU' SPOKEN BY THREE PEOPLE  
(Source: C.H. Waddington, Behind Appearance, 1969).  
FIG. 2.24

abstractions are attempts to strip bare certain aspects in order to emphasize certain others, particularly those that written language fails to transmit. Of course no architect can overlook aesthetic qualities like harmony, simplicity, elegance, complexity, and so on. The models of Aalto and Pietila concern themselves to some extent with aesthetic matters but their main purpose is to solve physical and spatial problems. There are enough examples which demonstrate how architects do use abstract constructions to simulate environmental characters and to represent physical organizations (Figs. 2.25, 2.26, 2.27, 2.28 and 2.29) and that these are not models of visual characteristics alone.

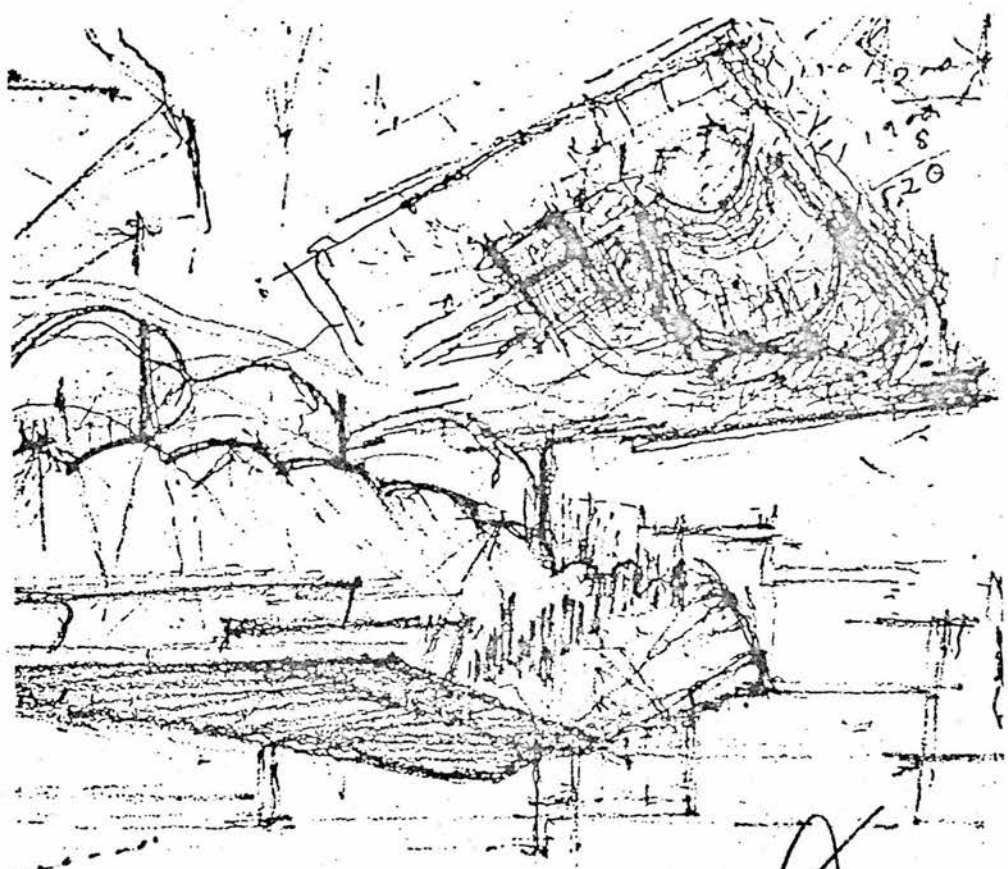
Lastly the notion of abstraction needs further clarification. Abstraction is the consideration of form apart from contents. What we achieve by model thinking is abstract thinking. A model offers certain structural analogies to the situation for which it is a model. The relation between the model and the actual situation is not that of a copy, but of analogy. It is a pre-requisite for anything being a model that it is not the same as the phenomenon or the design concept for which it is a model.

It is interesting to note what Ernst Hutten<sup>43</sup> has to say about models. He argues that the use of models in physics is very much the same as in modern art. In as much as it helps us in seeking a physically interpretable form, abstract art has the same purpose as the model in physics. The employment of models enables us to release ourselves from the complexity of issues we are faced with and consider the most essential or privileged factors. As suggested earlier the neutral aspects of models as heuristic devices and those viewed as prototypical solutions enable us to consider models

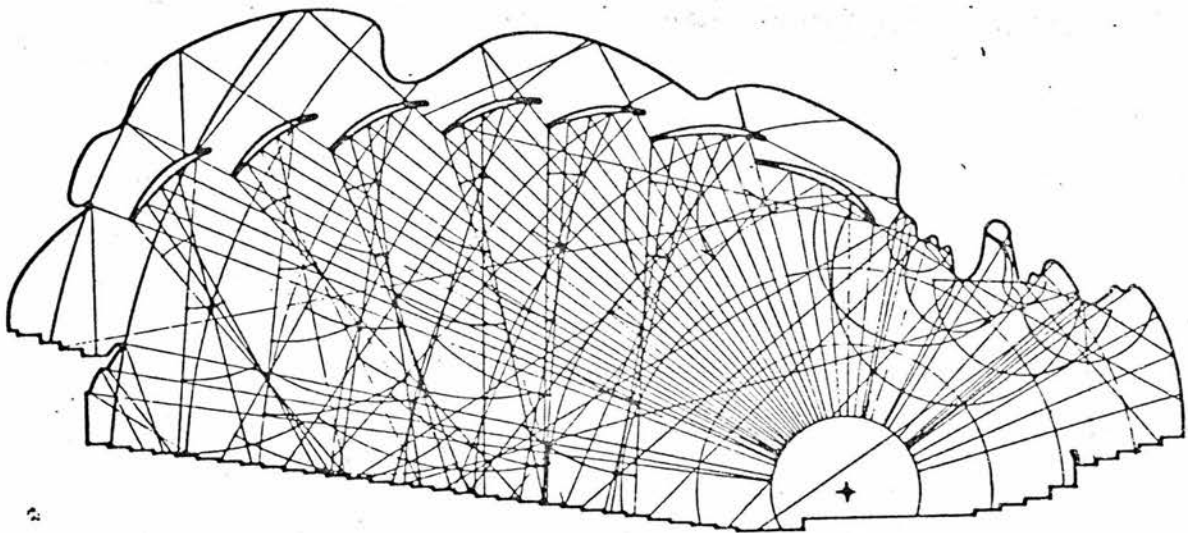




AN EXAMPLE OF AALTO'S GRAPHIC WORK AT THE EARLY STAGES OF DESIGN SUGGESTING THE  
FORMATIVE ROLE OF GRAPHIC WORK (Source: Aalto Synopsis, 1970)  
FIG.2.25

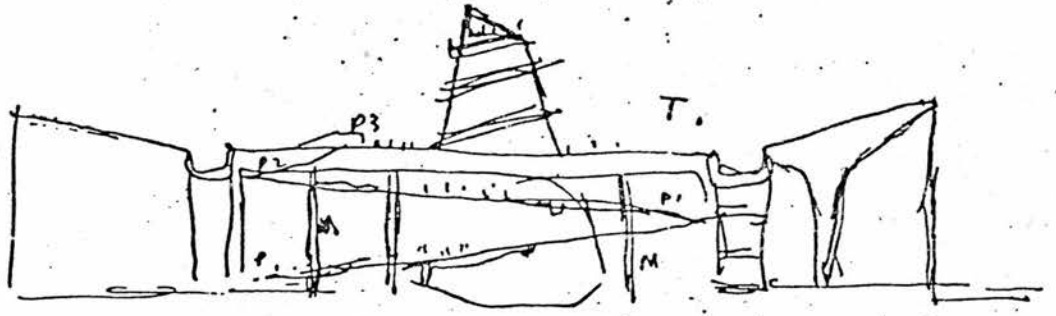


HELSINKI CONCERT HALL BY ALVAR AALTO, GRAPHIC EXPLORATION THAT PRECEDED FINAL DESIGN.

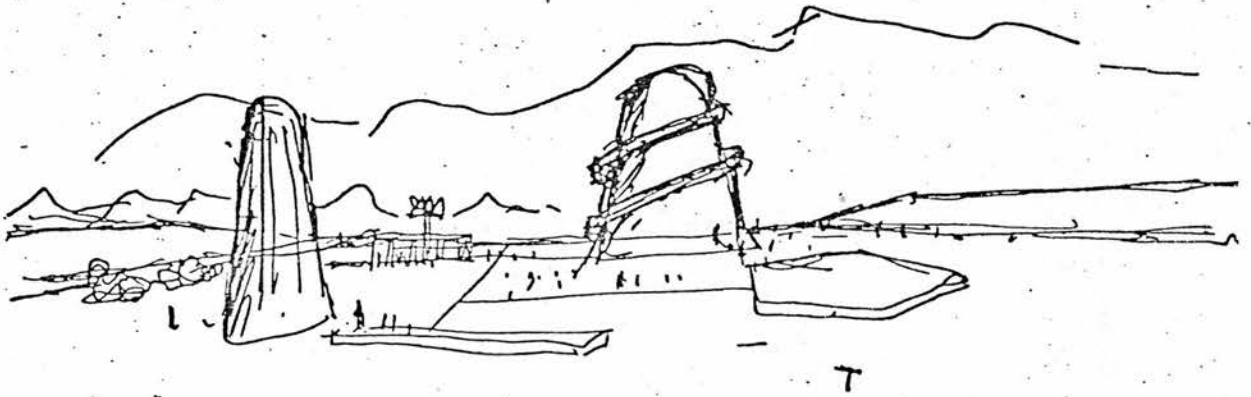


SECTION OF HELSINKI CONCERT HALL (ACOUSTIC DIAGRAM) BY ALVAR AALTO, 1962. (source: Aalto Synopsis, 1970).

FIG.2.26



Le processus d'ascension P1 P2 P3 a 133 de logs  
 et s'achève en elle par : son by jettant M par  
 tache et a passage de la salle : officier etc

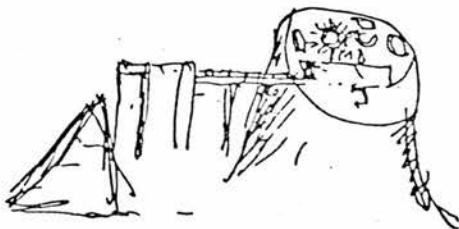


Le terrain T de Bombay.

Bombay  
 19053.

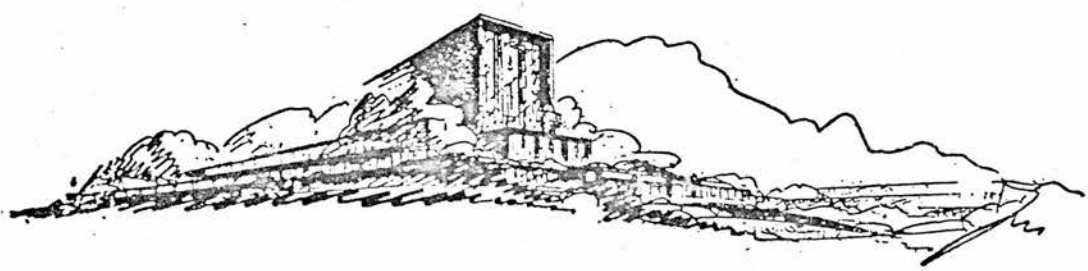
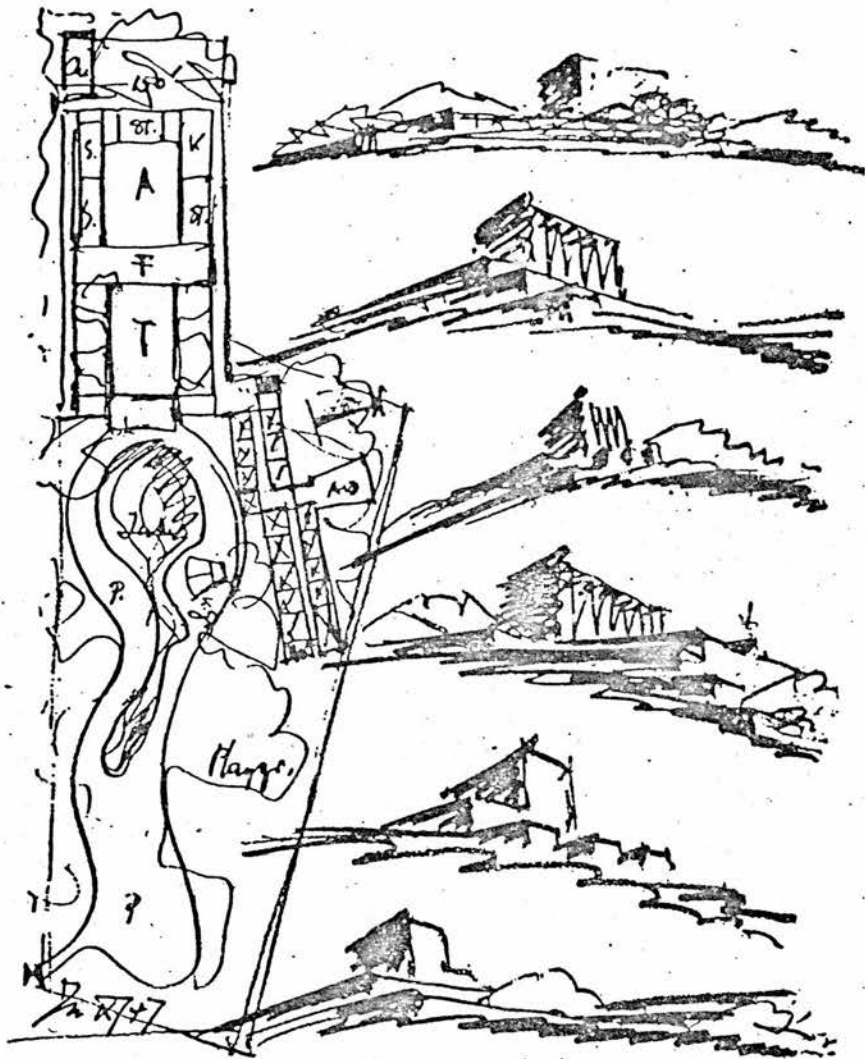


surveillance des vils  
 avant d'activer



ASSEMBLY BUILDING CHANDIGARH  
 LE CORBUSIER'S EARLY SKETCHES  
 (source: Le Corbusier 1910-1960).

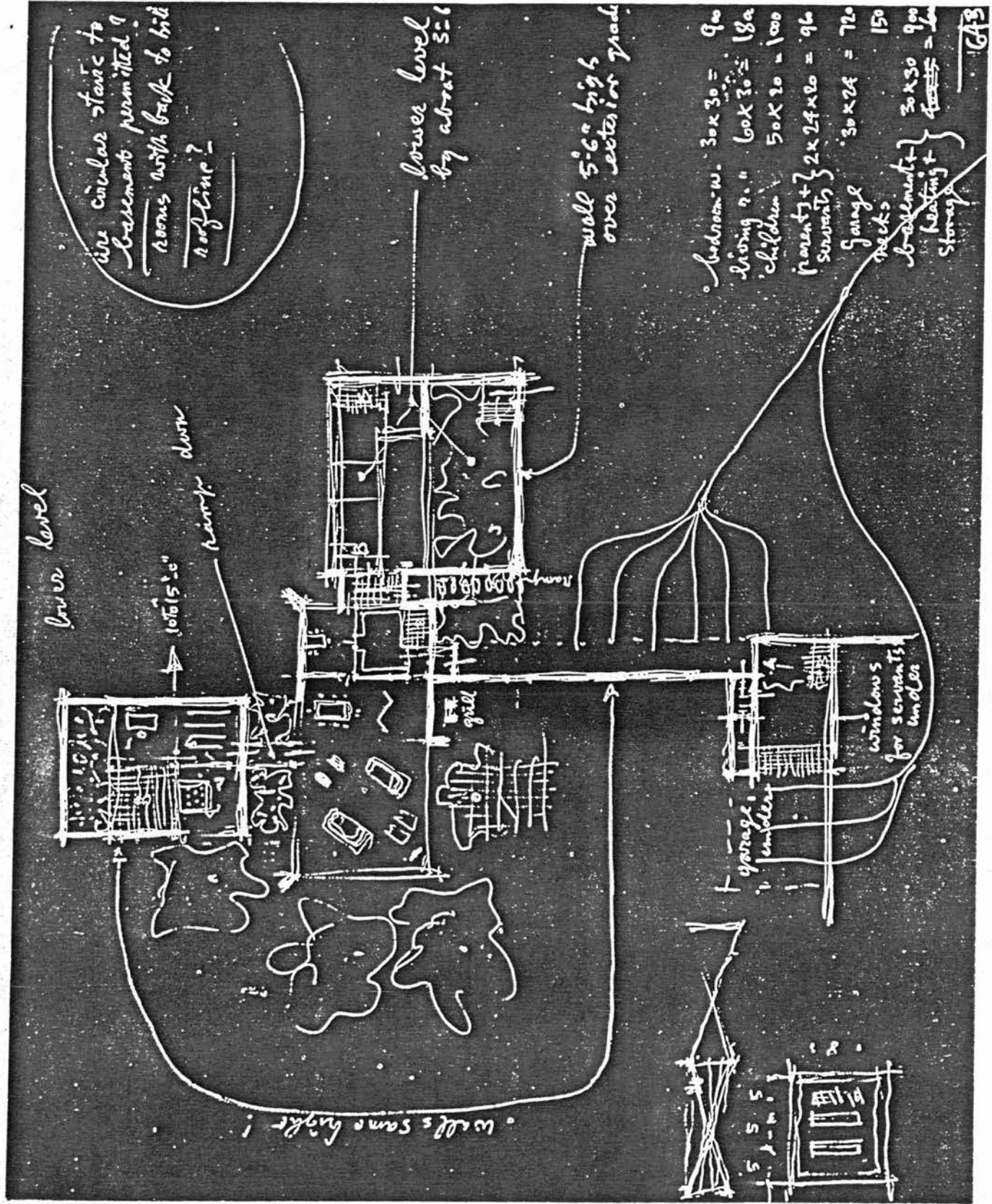
FIG.2.27



MENDELSON'S TEMPLE AND COMMUNITY CENTRE  
 HEBREW CONGREGATION OF WASHINGTON D.C., 1948. EARLY SKETCHES.  
 (source : Arnold Whittick, Mendelsohn, 1940)

FIG.2.28

SKETCH OF  
 FIRST IDEA  
 FOR USTINOV  
 HOUSE, VEVEY,  
 SWITZERLAND,  
 BY MARCEL  
 BREUR, 1959  
 (from Breur,  
 Genesis of  
 Design, 1966)  
 FIG. 2.29



as systems in a process of growth. Because of this they tend to be used in a predictive way. The use of models exemplifies working from the general to the particular and in a sense involves imposing a system upon the range of issues a design should deal with, and this modifies the kind of information we need. Thus the use of models is the exact opposite of an all-embracing analytical approach advocated by some methodologists and reflects more closely the way in which practising architects do design.

We mentioned the use of models in physics earlier. In science certainly there are instances where ways of working from the particular to the general are employed (e.g. experiments of unifactorial design, omission of friction at least in the first instance in certain mechanical problems). Ernst Hutten's word for this procedure is 'idealisation' (as opposed to abstraction), and he shows quite clearly how idealisations are employed for the time being and abandoned as soon as possible. They are never allowed to "become a fixed conception".<sup>44</sup> This suggests that working from the particular to the general, taking only a few factors into consideration at a time, is only a good recipe for gaining a quick understanding of the nature of the task in hand. Beyond that only the employment of models - that is to say abstraction - produces an informed commitment to an architectural idea.

We now have a clear picture of how inventive personal aspects affect the type of information needed for design, and we have reinforced our original hypothesis that strength of logic and concern for the range of problem requirements are not the only forces that direct architects towards solutions. Imposing models of sorts on the range of problem requirements reflects the spirit of architectural

vation and indeed the workings of the human mind in general.

Thus there is a two-way relationship between information and models in the process of growth. It is the understanding of this fact that gives the practising architect clues about what is the right kind of information and prevents him from frittering away valuable time in all-embracing analyses which are found to be highly redundant once the solution is reached.

## Chapter II : Notes

1. Those who are familiar with the philosophical notion of induction will notice that this question is a classical manifestation of the problem of induction. But to keep the terminology of the answer to this question as simple as possible the term is not introduced in the main text, although the answer itself owes a great deal to the following philosophical treatment of the issue:
  - (a) Wilson, Susan, Introduction to Logic, Parts I to IX, The Open University Press, Bletchley, 1971.
  - (b) Landau, Royston, "Towards a Structure of Architectural Ideas", Arena, June 1965.
  - (c) Medawar, Sir Peter, Induction and Intuition in Scientific Thought, London, 1969.
2. 'Deductive relations' as they are called in the language of logic.
3. Polya, G., How to solve it, New York, 1957, p.149.
4. This is indeed a traditional dictionary definition of 'induction'.
5. See, for instance, Gordon, Alex., "Approach to Architecture", RIBA Journal, April 1968, p.172.
6. Many of the points that follow on computers have been abstracted from "Vitruvius Computatus" by Mitchell, William J., in Environmental Design Research Conference - 4 : Proceedings, Volume I edited by Wolfgang Preisler, Pennsylvania, 1973, pp.384-86.
7. Magoroh Maruyama's paper on heterogenistic design provides a rare insight in this respect. See "Principle of Heterogenization and Symbolization; Implications for Planning and Environmental Design" in Environmental Design Research Conference - 4 : Proceedings, Volume II edited by Wolfgang Preisler, Pennsylvania, 1973, pp.18-34.
8. This is particularly so in the field of philosophy of science. For instance in an interesting comparison of methods put forward by Hume, Carnap and Popper, John Watkins suggests that the growth of science is inductive and irrational according to Hume's views; to Carnap it is inductive and rational and according to Popper it is non-inductive and rational. See Watkins, J., "Hume, Carnap and Popper" in The Problem of Induction edited by Imre Lakatos, London, 1968, pp.271-82.
9. Alexander, Christopher, et al., Houses Generated by Patterns, Berkeley, 1969.
10. Op.cit.
11. It may be thought that the phrase 'information contained in the designed object' is obscure. What is implied here is that products of design are conceived for a life span of a number of years and that generally speaking we derive a high level of satisfaction from surviving



older objects. In many cases reasons for our future satisfaction may not be apparent at the time of designing. This means that the content of design is always more than that of formulable problem requirements.

12. Abercrombie, M.L.J., The Anatomy of Judgement, Harmondsworth, 1969.
13. Head, H., "Disorders of Symbolic Thinking and Expression", British Journal of Psychology, XI (1920-21), part II, pp.179-93.
14. Bartlett, F.C., Remembering, London, 1932.
15. Oldfield, R.C., "Experiment in Psychology - A Centenary and an Outlook" in Readings in Psychology, ed. Cohen, John, Woking, 1964, p.36.
16. Norberg-Schulz, Christian, Intentions in Architecture, Oslo, 1966.
17. Abercrombie, M.L.J., op.cit.
18. Abercrombie, M.L.J., "Perception and Construction" in Design Methods in Architecture, ed. Broadbent, G., and Ward, A., London, 1969.
19. Kellogg, Rhoda, Analysing Children's Art, Palo Alto, 1969, p.114.
20. Abercrombie, M.L.J., "Perception and Construction", op.cit.
21. Ibid.
22. Kellogg, Rhoda, op.cit.
23. Oldfield, R.C., op.cit.
24. Summerson, Sir John, "Viollet-le-Duc and the Rational Point of View" in Heavenly Mansions, New York, 1963, p.141.
25. Ibid.
26. Giedion, S., Space, Time and Architecture, Cambridge, Mass., 1967.
27. Serenyi, Peter, "Le Corbusier's Changing Attitude Towards Form", Journal of the Society of Architectural Historians, Vol.XXIV, 1965, pp.15-23.
28. Op.cit.
29. Summerson, Sir John, op.cit., p.141.
30. Ponti, Gio, "Espressione dell'Edificio Pirelli in Costruzione a Milano", Domus, March, 1966.
31. Forster, Norman, "Architects Approach to Architecture", RIBA Journal, June, 1970.
32. The author worked for this firm for over three years and is familiar with their work and the underlying attitudes. Furthermore Mr. Epstein was invited by the Department of Architecture, Edinburgh

University, to lead seminars on his approach to housing and university planning.

33. Pietila, R., 'Approach to Architecture', talk given at the Royal Institute of British Architects in 1970. Paper not published but privately obtained by the author.
34. Aalto, Alvar, 'Abstract Art and Architecture' in Domus, 223-225, 1947, pp.3.-20.
35. Rokeach, M., The Open and Closed Mind, New York, 1960.
36. Mair, N.R.F., 'Reasoning in Humans: II The Solution of a Problem and its Appearance in Consciousness', Journal of Comparative Psychology, 12, 1931, pp.181-94.
37. Much of the discussion on form and content that follows has been abstracted from Langer, Suzanne K., An Introduction to Symbolic Logic, New York, 1967, pp.21-43.
38. Ibid.
39. Gombrich, E.H., Meditations on a Hobby Horse, London and New York, 1971, pp.1-12.
40. Ibid.
41. Waddington, C.H., Behind Appearance A Study of the Relations Between Painting and Natural Sciences in this Century, Edinburgh, 1968, p.123.
42. Quoted in ibid., p.114.
43. Hutten, Ernst, The Ideas of Physics, Edinburgh, 1967, pp.66-74.
44. Ibid.

### **III. COMMUNAL INVENTIVE ASPECTS**

### III. COMMUNAL INVENTIVE ASPECTS

Like other human activities the process of design is not sustained by totally objective knowledge. The preceding pages have tried to explain the reasons for this through a pragmatic analysis of architects' works. There has been an attempt to explain perceptions of architects in terms of psychological terminology. But a discussion of architects' perceptions alone cannot provide a complete explanation of determinants of design, which can neither be described as belonging to logic nor as expressive of a concern for the requirements of those who use the buildings. For instance as we noted in Chapter II movements such as Classicism, Revivalism, Eclecticism and indeed certain formalistic attitudes of present day architects cannot be explained in terms of the perceptions of individual architects at particular periods and require a different kind of explanation.

The idea that knowledge is socially constructed goes back to Hegel and Marx<sup>1</sup> and many distinguished scholars in diverse fields have extended this notion. Durkheim was concerned with the non-rational basis of human endeavours and the problem of collective consciousness.<sup>2</sup> Max Weber was interested in the same area and attempted an explanation in terms of a 'magical', irrational quality which gives certain men the power to attract the loyalty and devotion of their adherents.<sup>3</sup> Evans-Pritchard put forward the

idea of a social monitor of perception to account for the problem of collective consciousness,<sup>4</sup> and more recently Alfred Schutz suggested that the world of every day life is made up of background expectancies and called these the "world known and taken for granted".<sup>5</sup>

Many of these fundamental works and further developments on this theme, particularly by Michael Polanyi<sup>6</sup> and Thomas Kuhn,<sup>7</sup> make it possible to pursue the task of clarifying the nature of a variety of human actions. The body of concepts emerging from these works can be employed to study the operations of the architectural profession. But prior to considering some of these concepts we must explain why we turn to sociology of knowledge. For instance, it may be asked: does not the history of architecture deal with this matter? It is true that mainly using biographical devices historians have been able to illuminate wider aspects, such as dominant theories and styles of different periods. But historical studies somehow seem to concern themselves largely with celebrity architects and associated notions of excellent architecture<sup>8</sup> rather than the ordinary, which of course makes up the major part of our environment. Exceptional instances deal with ordinary architecture, and they fall into two groups. The first group deals with architecture without architects, that is to say vernacular architecture; it concerns the evolution of building methods through a process of trial and error, but is only in a limited way related to the practice of architecture. The second group tends to describe ordinary architecture as inappropriate borrowing of tricks from established masters. For the American critic Amestoy a whole spectrum of modern architectural works can simply be described as 'Pretty Palace Syndrome', 'Organic School', 'Precision

School', 'Brütal Guts School' and 'Architectural Memorabilis School'.<sup>9</sup>

The British critic, John Donat, has described a building as "the illegitimate offspring of a shot-gun marriage between Le Corbusier and Aalto".<sup>10</sup> In an essay entitled 'Modern Architecture and the Historian - or the Return of Historicism' Pevsner attempts to describe a range of important modern architectural works as some form of revival, and lists them under categories like neo-Liberty, neo-Gaudi, neo-School of Amsterdam, neo-German Expressionism, neo-Perret, and so on.<sup>11</sup> The attitude underlying this method of classification has to some extent stood in the way of a true understanding of why the majority of architects perform the way they do. It will be noticed that behind these three critics' attitudes is a certain concern with the visual aspects of architecture<sup>12</sup> which automatically bars a deeper understanding of the relationship between the major part of the architectural profession's output and its established accomplishments. The reason for this state of affairs can be traced to the early days of the modern movement. The first loyalty of the critics in the early stages of the movement was to the revolution itself. It was more important to overcome the ridicule and scorn with which modern buildings were greeted than to discriminate between buildings that were capable of laying the foundations for further practice of architecture. The modernists were so dedicated to the cause that ready-made visual images of what the result was going to look like were eagerly accepted. We are still trying to escape from this exaggerated emphasis being attached to the external appearance. Even now critics on the whole are more interested in pedigree identification than in the appraisal of individual works as part of a generalised evolution of ordinary architecture.

Another field which might be expected to throw some light on the collective consciousness of architects as a group is that of sociological studies of the profession. Its description demands subdivision. Firstly there are the kind of studies carried out by authors like Barrington Kaye<sup>13</sup> and Frank Jenkins.<sup>14</sup> They deal with the evolution of architectural practice, the shifting intellectual emphasis of the profession at different periods in history (for instance, according to Barrington Kaye, 19th century architects laid greater stress on artistic merit than on convenience), the complexity of architectural practice, the effect of practical matters such as estimates, contracts, competitions, methods of producing preliminary drawings, methods of calculating fees, and so on, on professionalism. These are useful in the general context of architectural practice but do not make any contribution to the subject matter of this chapter. The second type of sociological works deals with values held by different groups of architects, e.g. those who are in private practice, those working for government departments, and those who work for developers and builders; the political base of these values; values arising from the conflict between the dated idea of the architect as an artist and the more current idea of him as a technologist; values held by the élite of the profession and others; the relationship between attitudes towards change and the power to implement change, and so forth.<sup>15</sup> These are useful, but factors other than programme requirements which induce compulsions on designers cannot be reduced to a simple system of values. As will be seen later in this chapter these factors constitute a much more complex network, of which the sociological system of values is only a part.

## Tacit Knowledge and Architectural Design

Neither studies in architectural history nor sociological studies of the profession seem to offer any basis for the study of the relationship between knowledge and design, and it seems inevitable that illumination on it should come from the sociology of knowledge. Productive debates on issues raised by this field are likely to continue in the years to come, but for our purposes the position taken by Michael Polanyi<sup>16</sup> and subsequently by Thomas Kuhn<sup>17</sup> seems to provide a point of departure. Polanyi distinguishes between two kinds of knowledge: what is given in textbooks, maps, mathematical formulae, etc. is one kind of knowledge; while knowledge such as we possess before embarking on the act of doing something is another form of knowledge. The first is explicit and the second implicit. Polanyi's central thesis is that no knowledge is or can be wholly explicit and in the case of solving problems such as those in architectural design implicit knowledge looms large. Kuhn's view is that implicit knowledge is acquired by the act of doing rather than by acquiring rules for doing something, and this type of tacit knowledge does not consist of unanalysable intuitions, but rather it consists of tested and shared possessions by the members of a group of professionals. These are embedded in what he calls 'shared exemplars'.

The existence of shared exemplars in the field of design can be demonstrated by a consideration of the form of simple products of design activity - for example chairs. A simple comparison of chairs produced in different periods shows that the difference between them is not one of form in the sense of orderly arrangement



of components such as seat, back-rest and arm-rest, but that it is a difference in the materials used, methods of manufacture, appearance, and so on. One can carry this further and say that if all the chairs produced throughout the world are classified in terms of their form as opposed to differences in construction methods, jointing methods, materials used, etc. there will only be a limited number of prototypical forms or exemplar of chairs. Depending upon the materials used and the sensitivity of the designer to the potential of that particular material there will, of course, be slight variations within each prototypical form. In other words, in spite of the advances in ergonomics the prototypical forms of chairs remain unaltered, as the way human beings seat themselves has not changed much through the centuries. Designers share with everyone who has tackled problems of this kind a certain basic approach conditioned by recurrent design situations.

The kind of tacit knowledge embedded in exemplars shared by the community of designers and the ways in which it is put to use can also be illustrated with reference to the recent history of university planning in Great Britain.<sup>18</sup>

When the new universities were initiated in the early nineteenth-sixties the only precedents seemed to be: 1) the 'vista' type American campuses with buildings set behind avenues of trees (e.g. Berkeley and Birmingham); 2) campuses such as Indiana or Cornell with free grouping of buildings set in large park lands; 3) the more recent studies on the extension of existing universities (e.g. Leeds and the results of the Sheffield University competition); and 4) campus towns such as Oxford, Cambridge, England and Cambridge, Mass. The first was a formal idea embedded in the beaux-art tradition

and the modern movement was indeed a reaction against such formal concepts. The second, which created an independent island of buildings did not offer sufficient linkages and cohesiveness which at that time were felt necessary for a closely knit highly interacting academic world. The third precedent was undoubtedly influential, but the situation in Sheffield and Leeds involved additions and alterations to institutions deeply embedded in an existing urban tissue. The problem of building new universities in large open fields was felt to be quite different. The lessons that were derived from the older universities like Oxford and Cambridge were restricted to certain visual criteria; they were not thought to be prototypical solutions as they had evolved over a period of time and their processes were different from planning as such. None of these precedents were at that time thought to hold any clues on the nature of university planning and main ideas for university structures came from the emerging ideas in the field of town planning.

The four models of universities that can be distinguished from a study of the British new universities of the 'sixties are the precinct, the linked nodes, linear planning and grids or networks. The precinct creates traffic-free zones by setting the buildings on the boundaries with circumferential traffic systems. Sussex University is simply a series of precincts and this kind of planning had been employed in a number of new towns and had its original exemplars in such places as the Inns of Court, and Harvard Yard. York University is an example of linked nodes. The route between buildings that are set independently on site becomes a structuring element and the covered walk between buildings also carries the services on its roof. The town planning exemplar is of course, Ebenezer Howard's concept of satellite towns linked by

efficient transport routes. The idea of linear plan, that is the tendency to build along the arteries of transportation is very ancient indeed. Planning theories about this were begun by the Spanish engineer Don Arturo Soria y Mata in the 1880s.<sup>19</sup> There have since been several adaptations of it (e.g. the unexecuted proposal for the new town of Hook). Essex University closely follows Soria's proposals. The central transport route and a pedestrian deck over it become the equivalent of the 'backbone' for development suggested by Soria. Lancaster goes further in proposing a pedestrian spine with buildings on either side of it, and beyond these vehicular access roads terminating in cul de sacs. The two main flanking roads are linked together by an underpass. Networks or grids tend to treat universities more as building types than layouts and derive a plan from an arrangement of dominant spaces serviced by an integrated system and a movement system into a grid system, rather like many of the cities with gridiron plans.

As will be seen later on, a closer study of the evolution of one of these models can suggest a great deal about the nature of design process. But for the present the point worth noting is that the potential of these new models is sufficiently high to take the attention of the architects away from the four precedents described earlier. At the same time these new models were open-ended enough to leave room for adaptation by individual architects. The present interest of the architectural profession in these four models is so widespread that we can reasonably predict the nature of any new university project; the new solution is very likely to be based on one of these models or a combination of them.

Interestingly enough this explanation of the practice of design

agrees closely with some established psychological findings about creativity. According to these findings a really creative architect's response to a particular problem consists not of bizarre and remote solutions, but usually of relatively ordinary solutions in large numbers.<sup>20</sup> What this really means is that these architects are aware of all the possible prototypical forms for a particular architectural problem and hence do not waste their energies on inventing new forms. Here the question 'how do new forms get invented' arises, and on this we shall have something to say later.

It should immediately be pointed out that the use of the word 'model' or 'prototype' in this chapter is not inconsistent with the term 'model' used in the last chapter. As issues raised by the neutral, interpretative analogies of models discussed as part of the personal inventive aspects get settled through repeated application in the real world, these models gain the status of established accomplishments which provide bases for further practice of architectural design. Thus the early design-related fact-gathering (e.g. in the case of Leeds) is more random than the one which subsequent design instances make familiar. Furthermore in the absence of a reason for seeking new and unfamiliar information early fact-gathering is usually restricted to data that lie ready to hand. But in the absence of an interrelated theoretical and methodological belief which permits selection, evaluation and criticism of these facts, no design solution can be derived. If that body of beliefs is not already inherent in that collection of data - in which case they are more than mere facts - it must be supplied from outside, perhaps from the current metaphysics (history shows that in the field of architecture metaphysics of one sort or another is always present),

by another field (e.g. planning in the case of universities) or by personal, heuristic models explained in Chapter II.

The most important conclusion that can be derived from the examples of the design of chairs and university planning<sup>21</sup> is that the major part of architects' work rarely aims to produce new ideas<sup>22</sup> and yet designing is not simple replication of established prototypical solutions. To see how this can be so it should be borne in mind how very limited in scope and precision a particular model can be at the time of its appearance. Models gain acceptance because older models have reached a saturation point due to repeated application and therefore new models seem more successful in solving a few problems which architects have come to recognize as acute. The phrase 'seem more successful' is critical. For instance, in the early days of the modern movement architects felt that the lack of fresh air and open spaces in older housing layouts were critical problems, and the tower block set in an uninterrupted greenery seemed to them a solution. To seem more successful, therefore, is not to be either completely successful with a single problem or notably successful with a large number of problems. Indeed as is now well known the tower block set in uninterrupted open space created more problems than it solved. Thus what we mean by the success of a model - whether it is tower blocks, linear planning, precincts, Ebenezer Howard's concept of satellite towns, or constructional systems like SCSD or CLASP - is largely a promise of success inherent in all these incomplete examples. The majority of architects' work consists in the realisation of that promise.

Let us now attempt to classify and illustrate the nature of the issues with which an ordinary architectural practice is usually

concerned. There seem to be at least three classes of activities which architects perform in the process of design, namely: determination and/or consideration of significant facts; finding practical uses for theoretical ideas exemplified by emergent models; and articulation of these models.

Determination and/or consideration of significant design-related data is usually directed towards the class of facts which a model has shown to be particularly revealing of the nature of a design problem. They are not always determined by the designer, but emergent models make them worth considering as important factors in the process of design. These significant factual considerations include: in university planning, walking distances between buildings, movement of pedestrians and vehicles; in housing, number of storeys, methods of refuse disposal, ways in which open spaces are used by tenants and privacy; in laboratory buildings, integration of service and structure; and so on. Clearly formulated theories in architecture are rare. As an example, however, we might point to the consideration of theoretical ideas on territoriality and later developments (e.g. 'defensible space') by architects. There are of course many other less easily used and perhaps more controversial theoretical ideas such as theories about imageability of buildings, daylight and systems of proportion. It should be noted that, directly or indirectly, faith in theoretical ideas of this sort is promoted by the emergent models.<sup>23</sup> Thus architects work both with significant facts and theory, and their work does not produce a building which is just a source of new information but a clearer model obtained by the elimination of uncertain features contained in the original prototype. This then is the third class of activity,

namely that of model articulation, but a detailed discussion of it must be deferred until later. It should be noted that consideration of significant facts, finding practical uses for theoretical ideas and model articulation as the three foci of architectural practice are never permanently distinct but for our analyses we had to consider them under separate classes.

These three classes of activities exhaust the works of an architectural practice. This way of explaining the work of architects may be taken to mean that their work involves no novelty or invention whatsoever; but of course this is not the case, since there are instances where design produces invention. However this thesis is concerned with the explanation of how the overwhelming majority of architects carry out their task, and it would be a digression to consider invention or novelty in design in this context. Further, it must be appreciated that situations producing invention of forms are few and far between: even Le Corbusier's productions - both verbal and physical - can be traced back to older ideas. The idea of a roof garden was put into practice extremely effectively by the Duke of Montefeltro at Urbino during the Renaissance;<sup>24</sup> Le Corbusier's Mundaneum of 1929 was directly based on the Acropolis;<sup>25</sup> it is well known that two of his utopias of 'Ideal Paradise' and 'Ideal City' go back to Plato's 'Kronos' and 'Republic' respectively.<sup>26</sup> To these traditional associations Le Corbusier did add his witticism and a liking for 'polar opposites' so that the sources are not, in many cases, used as directly as these examples would suggest, but in a kind of 'inside-out', 'topsy-turvy' way<sup>27</sup> and this makes it doubly difficult to know what exactly is an invented form. One thing is certain: problems calling for invention of forms

are not to be had for the asking. After all, the inventiveness of Joseph Paxton is to be found only in his Crystal Palace; in all his other commissions he shows a totally conventional response. As Marston Fitch<sup>28</sup> suggests, the following sets of circumstances were absolutely essential for the emergence of novelty:

"a concrete and specific program calling for continuous, well-lighted floor space; sharp limits to the funds and time available; the suitability of the structural system on which he had already spent so much time and energy. Even the eight days allowed for preparing the drawings were auspicious. They allowed no time to worry about appearance, so that the finished building shows a beautiful innocence of current architectural controversy over idiom and cliché. As a result, the building was as lean and functional as a greyhound, revealing only in its smallest details (column caps, tie bars, brackets) the inprint of Victorian taste. In his later works these controlling factors were missing..."

#### Designing as Anagram Solution

The most important conclusion that can be derived from our discussion so far is that the major part of designers' works rarely aims to produce new ideas and yet designing is not simple replication of established prototypical solutions. Established models of university planning, as we have seen earlier, do enable us to anticipate the outcome of a new project an architect may design, but the manner in which the final scheme may be a synthesis of established models or derivative of a single older model can only remain a speculation. But once the architectural idea comes into existence it is possible to recognize the characteristics that relate it to the historically emergent prototype or model. In other words, the anticipated may be achieved in an unprecedented



way.<sup>29</sup> All this would suggest that designing is something similar to 'anagram' solution. The word anagram is used in the ordinary dictionary sense, that is a word or phrase formed from the letters of another. Bringing the task of designing to a successful conclusion involves the generation of complex technical, formal and spatial anagrams. Therefore, a major part of an architect's work consists not just of using known spatial, constructional, and service systems, but of re-arranging the elements in these systems to produce different but meaningful results. The demands that anagrams of this sort make of the architect are what keeps him occupied and interested. As anagram solution proceeds, the emergent model gets refined, and this refinement is both practical and theoretical and engages not only a major portion of the architectural profession, but also the academics and critics. Thus for instance we can regard the Nuffield Foundation's work<sup>30</sup> on the design of laboratories as studies directed towards model refinement.

So far in this chapter we have evolved a theory that explains certain tacit but very practical aspects of design and this theory has two distinct and interrelated parts which may be described as follows. Firstly there is a kind of historical continuity in the overwhelming majority of architectural creations. This continuity results because architects derive their solutions from concrete models and not from abstract theories or new information. It is of course true that certain tacit conventions predispose an architect to respect certain models rather than others and transform them into suitable solutions to the problems at hand. We will discuss these tacit conventions later on, but here it should be understood that examples from a wide variety of design instances can be cited

to demonstrate that emergent models serve as bases for further practice of architectural design. We have already seen this in connection with university planning. The existence of emergent models in the field of housing<sup>31</sup> and public buildings<sup>32</sup> and commitment to these by architects can also be demonstrated in a similar manner. To go further back in history, Walter Horn<sup>33</sup> in a thorough historical analysis has demonstrated the origins of the medieval bay system of Romanesque and Gothic churches in the aisled, bay-divided, all-purpose timber structures that existed in Germany, England, Holland and Scandinavia in the Middle Ages. He has suggested that the tradition of bay division and skeletal construction of these timber antecedents was not simply applied mechanically, but had to be given a new significance corresponding to the prevalent conception of feudal, ecclesiastical and celestial order, and indeed the subsequent commitment to the bay system on the part of medieval builders could be traced back to these conceptions. Perhaps these conceptions were not as veiled and inaccessible to investigation by non-architects as the tacit conventions of the present day architectural profession. At a more general level we know that the rediscovery of Classic architecture by Renaissance architects and, to a lesser extent, their theme of 'ideal city'<sup>34</sup> furnished the basic alphabet and grammar of the idioms of Renaissance, Baroque, Rococo and Neo-Classical revivals. A more specific example is the evolution of the tempietto as a prototype. Bramante derived his version of tempietto from Francesco di Giorgio's experimental projects which in turn were based on the Teatro Marittimo at Tivoli; Bramante's aesthetic principles and his 'logic of geometry' in transforming the older models helped in

inducing certain commitments towards their re-employment.<sup>35</sup> To take an even more concrete example it is possible to describe the origins of the American balloon frame construction<sup>36</sup> and the Canadian plank wall construction in a similar sort of way.<sup>37</sup> There is a parallel between these constructional systems, but for the sake of brevity we shall only describe the latter. Until about the middle of the nineteenth century North American wooden structures had their walls constructed using logs with intersecting corners, or grooved posts using logs or horizontal posts or with frames infilled with brick, stone, or other materials. At later stages weather boarding was applied to the last method, sometimes omitting the infill. Since nails were expensive, all three methods employed bulky members which were assembled with mortice and tennon and pegs. With the advent of machine-made nails, balloon frame construction using mass produced, efficiently distributed dimensioned timber of small cross-section (2"x4"x6") held together by nails largely displaced the older construction. In Canada however, and particularly in Quebec, a modified form of grooved-post wall construction using nails to hold horizontal members and the mortice-and-tennon connection for the vertical and horizontal structural members continued to be used. The model for this construction is obviously the older grooved-post with horizontal boarding between the grooves. This model has been traced to the Denmark of Viking times from where it spread throughout Europe and migrated to Canada with the fur traders.<sup>38</sup> This shows clearly that ideas are not simply superimposed on new situations but are usually given new interpretation suited to the spirit of the time, which in this case was that of the machine age. In other words, there is evidence of historical

continuity in all design ideas.

We now turn to the second part of our theory in which we suggest that models are not simply replicated as solutions to design problems but rather that elements of a model are manipulated to give different but meaningful results in much the same way in which we manipulate letters in solving anagrams. What is a meaningful result is determined by the architect's tacit knowledge we mentioned earlier. To give this part of the theory more substance we need to consider it at two levels, both arising from our concern that whatever theory we may construct should provide more in the nature of argument than mere analogy. First, we should consider in what ways the term 'anagram solution' highlights the nature of design and its relation to tacit knowing, and second, we ought to demonstrate more clearly, using concrete design examples, how the manipulation of architectural elements takes place.

Although the word 'anagram' here is used metaphorically it does provide a cogent schema for the process of design. Psychologists have used the anagram extensively in their research in problem-solving. Their findings, for instance, on the effect of the length of anagram on the solution, the effect of familiarity with the word and the frequency of occurrence of the word, do seem to illuminate certain aspects of design and indeed its relation to the theory of knowledge. Take the length of the anagram: Kaplan and Carvellas<sup>39</sup> attempted to determine the number of 3 to 10 letter anagrams solved by their subjects in 100 seconds; all the short anagrams with 3 or 4 letters were solved within the time, but an increase from 4 to 5 letters resulted in a fall of total anagrams solved, whereas an increase from 8 to 9 letters resulted in a smaller not greater fall. Reasons for this are that longer words include a repetition of

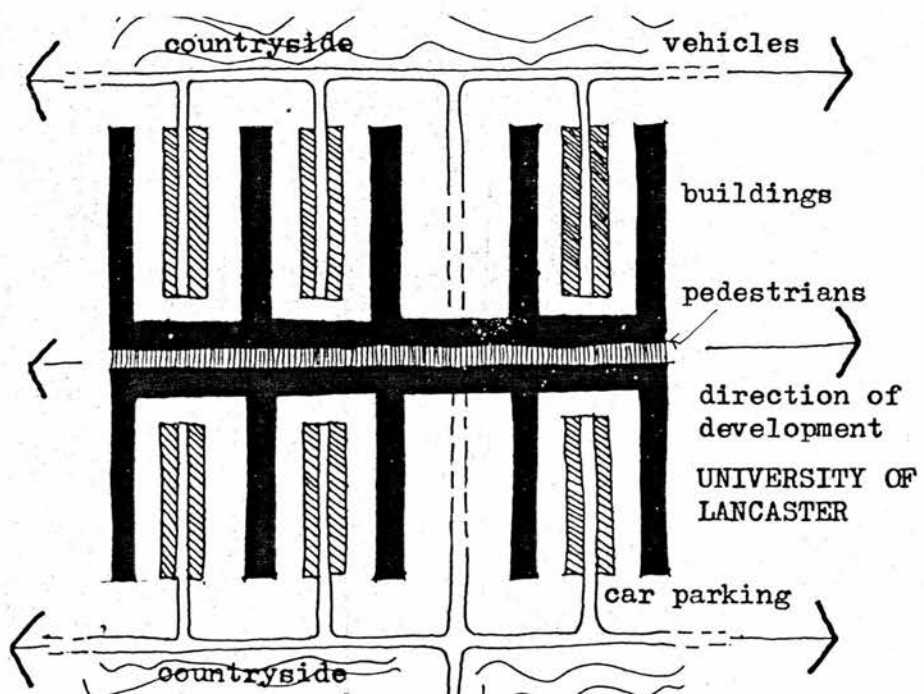
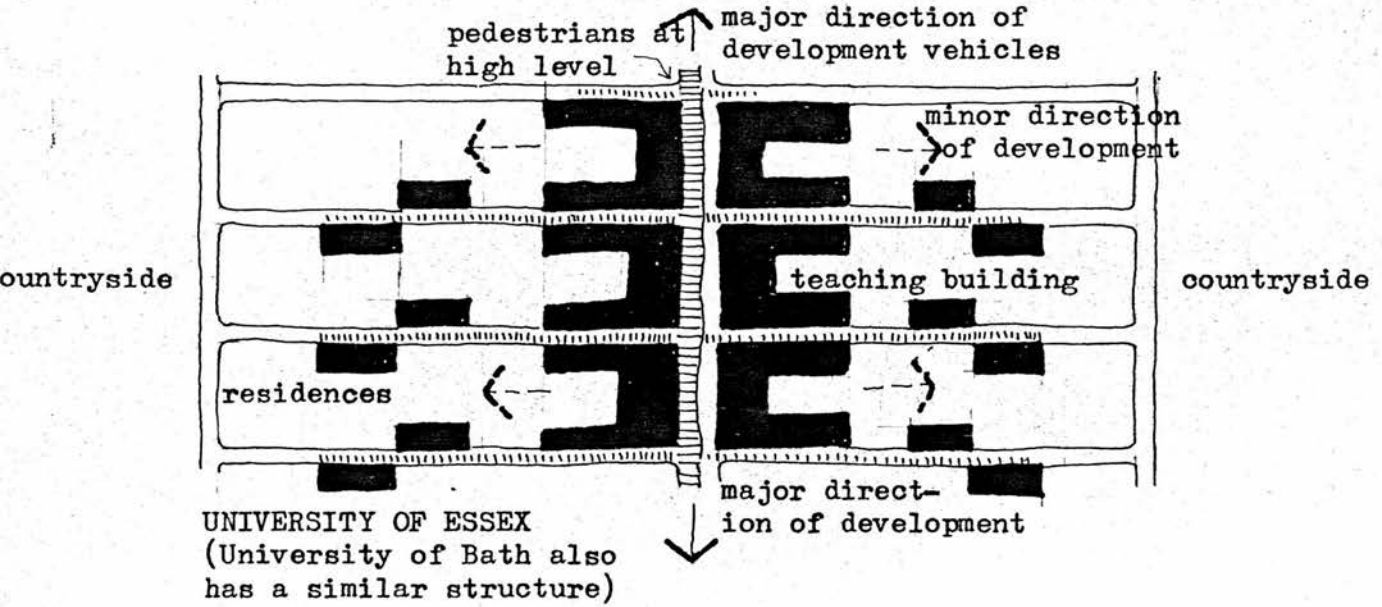
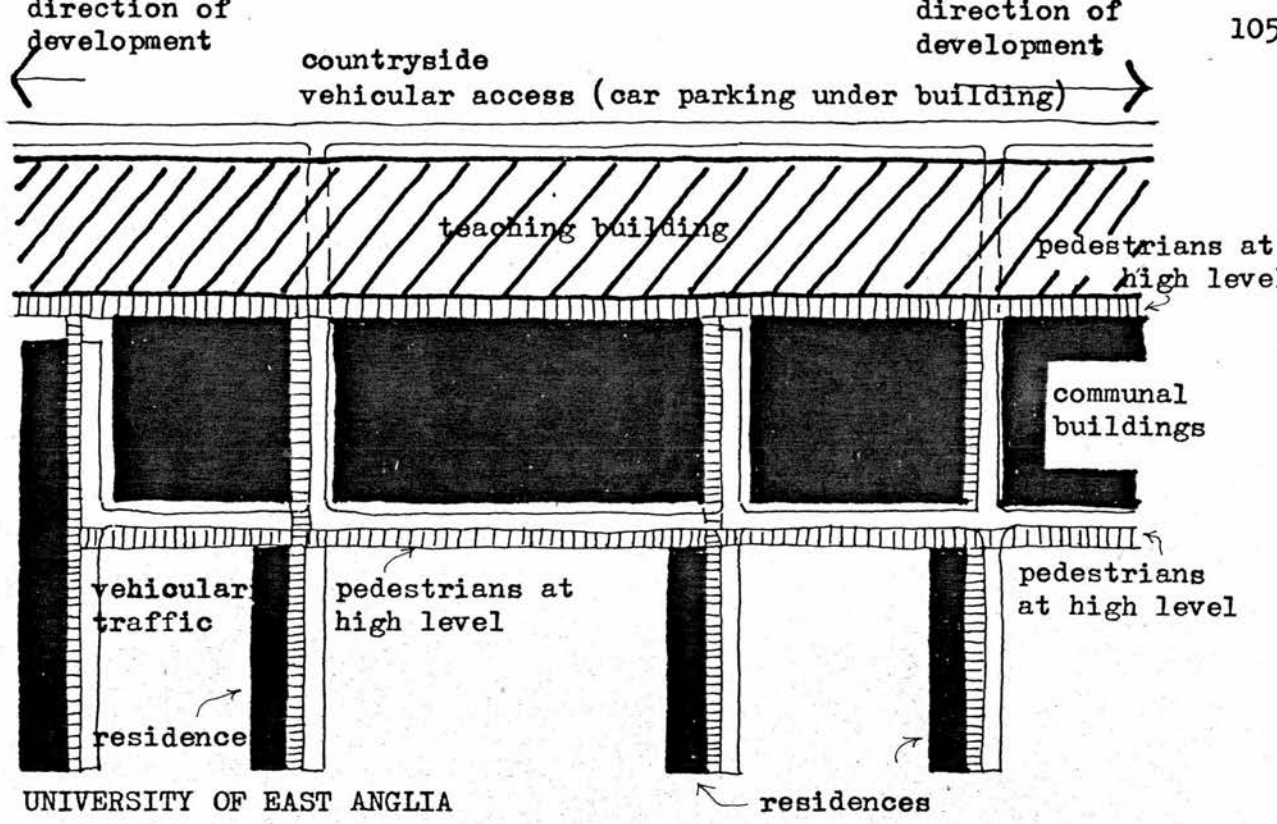
letters, thus cutting down the number of possible letter orders; also people usually begin with familiar combinations of 3 or 4 letters and the longer the words the more frequent are familiar suffixes such as 'tion', 'ory', 'ness', etc. which can be manipulated as units. Mayzner and Tresselt<sup>40</sup> found that the effect of the familiarity of the solution word, as well as letter order, was very large. Further, if the anagrams have three solutions and the subject must obtain all three, the first solution will be the highest frequency word, and the last the lowest.<sup>41</sup> There are many combinations of letters that do not appear as the beginnings of English words, and moreover vowels are not as common as consonants at the beginning of a word. A well-read subject is likely to rule out such beginnings. Obviously this 'rule-out' factor overlaps with other factors, but by controlling some of these complications Gribben<sup>42</sup> demonstrated that the 'rule-out' factor considerably influenced the solution of both high and low frequency words. Lastly the influence of previous learning on solutions to anagrams has been accurately specified by Wiggins and by Dominowski and Ekstrand. Wiggins<sup>43</sup> demonstrated that exposure to low frequency words before attempting a particular anagram can promote it at least temporarily to the top of the hierarchy. Dominowski and Ekstrand<sup>44</sup> found that even a common associative word of the solution word presented before an anagram is attempted increases the availability of the solution word itself.

The same sort of characteristics seems to be built into the process of design and indeed some of the generalisations that emerge from these experiments on anagrams seem to substantiate some of the points on the sociology of knowledge mentioned earlier. The generalisation that can be made from experience on the effect of the length

of words on anagrams is that while it is true that complex problems are more difficult than simple ones, the increase in difficulty is often lessened by non-random relations within the problem materials and by non-random tendencies or dispositions among the people solving the problem. This means that in architecture readily available solutions to bits of a complex problem are often deployed in order to simplify the task in hand; emergent models either constitute such solutions or contain their major elements. In spite of contradictory findings that are emerging from research on man-environment relations, design must go on, and indeed it does go on. The problem of having to commit themselves to a design idea even though information to which design should respond may be of a contradictory kind compels architects as a group to avoid overt disagreements about the fundamentals of what architecture is supposed to be and this compulsion gives rise to a non-random network of habits, attitudes and ways of seeing the architectural task which architects acquire as a group. In the absence of reliable data on problems of man-environment relations it is this network that leads them to solutions of various sorts. In anagrams, familiarity with solution words influences the solutions, and in architecture the designer's familiarity with model solutions acceptable to the architectural community has a great effect on the solutions proposed for particular problems. 'Rule-out' factors operate more or less in the same way as in anagrams - unacceptable models (e.g. vista-type layouts, or buildings set in landscape as self-contained entities as solutions to university planning) are automatically ruled out. The emphasis on previous learning demonstrates how the process both in anagrams and in design is dynamic. A low frequency word can be promoted to the top of the hierarchy

simply by exposure of the word itself and to a lesser extent by an associative of the solution word. In architecture too, as we shall see, particular models tend to be promoted by exposure of the model itself or associated principles in professional journals, conferences, etc.

Turn now to the problem of comprehending real-world designs as anagrams. Models are of course forms in the sense of orderly arrangements of parts, and more precisely we may say that models consist of elements and relations. This way of splitting the model is a matter of expediency since it enables us to look at design at different levels. A light fitting can be considered as consisting of lamp, holder, shade and/or diffuser, etc. as elements arranged in a certain relation to each other. At a higher level a study bedroom consists of elements such as desk, chairs, bed, bookshelf, pin up board, window, walls separating rooms, light fittings, rugs, socket outlets, etc. arranged in a certain orderly manner. At a still higher level we may say a hall of residence is composed of elements like study bedrooms, toilets, showers or baths, common rooms, dining rooms, circulation elements (corridors, staircases, etc.), access systems (pedestrian and vehicular), services systems, etc. arranged in a certain relation to each other. We can go on employing this way of describing design solutions at whatever level we want. Obviously qualities such as privacy, meaning of elements and relations are integral parts of this notion of form, and these qualities are considered in detail in Chapter V. For the time being a great deal can be gained by looking at the design process as though it were prior to qualities like these (we shall abandon this 'idealised view' as soon as possible).



SCHMATIC LAYOUTS OF UNIVERSITIES (source: Michael Brawne, 1970) FIG.3.1



Let us consider a concrete example of design in order to demonstrate the anagram characteristics of design. Emergent models are forms because they are more than a simple summation of elements and we may say a form has model characteristics when its relational characteristics persist even though the elements themselves and/or their location change. Thus in the case of universities with linear plan we may show buildings, open spaces, traffic movement, pedestrian movement, services system and phasing of buildings as elements and determine how they are manipulated to produce designs which are different but all quite related to the original model. Fig.3.1 shows this and it is largely self-explanatory.

#### Components of Architects' Tacit Knowing

Having suggested that the majority of architectural works are directed by historically emergent model solutions, that the process of design in all these works is to do with adapting and manipulating the components of known systems, and that tacit conventions of a certain kind predispose architects to respect certain emergent models, we must now specify these conventions in detail.

As Polanyi<sup>45</sup> has suggested we have to reject the idea of wholly explicit knowledge. Whether it is attempting anagrams or architectural design, human beings will always be ahead of data and use all the means within their reach - sensory images, symbolic generalizations, verbal formulations with all their overtones and undertones, social conventions and imperatives, and values - including all the lore of practices and procedures of any field. While this means

that tacit knowledge cannot be formulated in an absolute, once-and-for-all way, it should not prevent us from understanding the implication of its existence and functioning at a particular point in time. In order to substantiate this view we might identify for the field of architecture the following network of habits, attitudes and ways of seeing<sup>46</sup> as essential components of an architect's tacit knowing:

1. Metaphysical Beliefs:

- (a) set of received beliefs
- (b) mythical beliefs
- (c) standards and regulations
- (d) ways of seeing
- (e) organising principles that govern perception

2. Sociological Paradigms:

- (a) symbolic generalisations
- (b) values
- (c) shared models

3. Shared Constructs:

- (a) representational aids
- (b) dominant technical aspects.

Some detailed discussion of each of these components is necessary in order to clarify how they affect the nature of architectural design.

Metaphysical Beliefs: these are the sort of abstract notions which architects accept without much questioning and as a matter of course. Many of them are taken as absolute truths and therefore

take on a metaphysical status. Further specification of elements within this category will establish more clearly their effect on the process of design.

(a) Set of Received Beliefs

Through their training, architects develop a shared definition of what their profession is all about, and this aids them in the interpretation of problems and formulation of solutions. In other words, implicit social organisations play an important role in sorting out problems of knowledge within the field of architecture. This process, which involves shared communication and shared interpretation of particular design instances, is based on different kinds of social links. For instance, in the early stages of his career an architectural student may rely entirely on his limited experience and his individual make up in formulating solutions to architectural problems. But as his training proceeds and as he exposes his work to his tutors, the set of received beliefs begins to have a strong hold on his design thought. At some stage of his development the student begins to take for granted models that are acceptable to the architectural community and those who teach him will be anxious to see that the student's attention is drawn away from models that are not acceptable. But students receiving direction from their tutors represent only one type of social link. There are many others, such as informal communication between architects, formal collaborations, intellectual ties, communication through learned journals and so on, which serve to strengthen the force of received beliefs.

(b) Mythical Beliefs <sup>47</sup>

All human endeavours have a mythical component, and normally the

least likely the event giving rise to a myth, the most readily acceptable is the myth. The very substance of myth is its non-rationality; faith in it demands the absence of doubt. Myth must not be regarded as a defect; it is rather a mode of communication amongst the members of a given group. In all mythical systems vital episodes recur in several different versions. For instance we find the conviction that the human body provides the ideal standard of measurement not only in Vitruvius but during Renaissance times, and more recently in Le Corbusier's works (both in his writings and in his buildings). Another marked characteristic of mythical systems is that we will meet in all of them lasting series of binary discriminations as between moral/immoral, legitimate/illegitimate, good/bad. Architectural theory is full of such distinctions and adherence to such beliefs is what convinces the architects that they and they alone possess the skills of design. In architectural theory throughout the ages one encounters many binary discriminations such as good/bad, honest/dishonest, pure/impure. For instance, binary discriminations between good and bad appear in Le Corbusier's writings in connection with flat roofs and pitched roofs, horizontal windows and vertical windows; and in the 18th and early 19th century Western architecture was highly influenced by a widespread feeling that the classical forms of Greece were pure and those of Rome were impure.<sup>48</sup>

### (c) Codes of Practice, Standards and Regulations

In many instances these take on a metaphysical meaning, in the sense that the underlying assumptions and accepted ways of interpretation are taken on faith. While it is true that the effect of mandatory standards (e.g. those on daylight, visual privacy, staircase access

for housing schemes in Britain) is to put pressure on architects to conform, the occasional emergence of an interpretation slightly different from the norm suggests that the profession on the whole takes the mandatory regulations as something absolute. Further, compulsion towards a single way of interpreting even suggested standards as opposed to mandatory ones (e.g. on sunlight), and the general reluctance to take advantage of the existing machinery for relaxing such regulations suggests that codes of practice, standards and regulations can assume mythical qualities.

#### (d) Ways of Seeing

Some points about architects' ways of seeing have already been made in Chapter II in connection with the works of Viollet-le-Duc, Le Corbusier, Aalto and Pietila; our analysis of some of these architects' design process using the kind of approach Gombrich<sup>49</sup> has followed suggested that their ways of seeing must be regarded as root-characteristics of any creative activity.

#### (e) Organising Principles that Govern Perception Itself

Many architects hold the view that various forms of 'grids' and 'modules' make good design easier. Justifications such as 'grids bring unity to design' are often employed. It should be noted, however, that the use of grids or modules is not peculiar to the 20th century.<sup>50</sup> These techniques were known to the medieval masons; Cesarino's illustrations in the 1521 edition of Vitruvius employs grids. Vignola used grids to draw comparative orders and Doric porticos. Jefferson and Durand used them extensively in the 18th and early 19th century. Systems of proportion, simple relationship diagrams using lines and circles are other organising principles which in their own small way affect the final synthesis in architectural design.

Sociological Paradigms: sociologically viewed elements in our network are a collection of architects' habits which help them in deriving anagram solutions. They may be based on intellectual formulations, mechanical aids in the process of design, or shared generalisations. Depending upon the particular design situation any or all of these habits may be involved. Further specification of sociological paradigms include

(a) Symbolic Generalisations

These are the sorts of generalisations that are employed without question or dissent by the community of architects - for instance Frank Lloyd Wright's dictum that "the inner nature of architectural problems always contained a solution in itself". Such a statement suggests a range of specific actions for its adherents, and the same applies to statements such as 'form follows function', 'the structure (the load bearing elements) must be honestly expressed', 'architectural space is one in which it is evident how it is made', 'the building should reveal the social organisation inside it' and the like. Rhetorics like these are, in the long run, habit-forming. These generalisations are not peculiar slogans of the twentieth century. To the architects of the Renaissance Gothic was 'monstrous and barbarous'.<sup>51</sup> In the nineteenth century, Pugin felt that Gothic was structurally efficient, constructionally honest, artistically coherent and unified, and as a style uniquely suited to Christian worship, whereas Renaissance was pagan.<sup>52</sup>

(b) Values

This term is used here in the strict sociological sense and includes the kind of findings a sociologist establishes when studying a particular group; for instance differences in values between

architects working for government departments, architects in private practice and those working for building development firms, the political base of their values.<sup>53</sup>

### (c) Shared Models

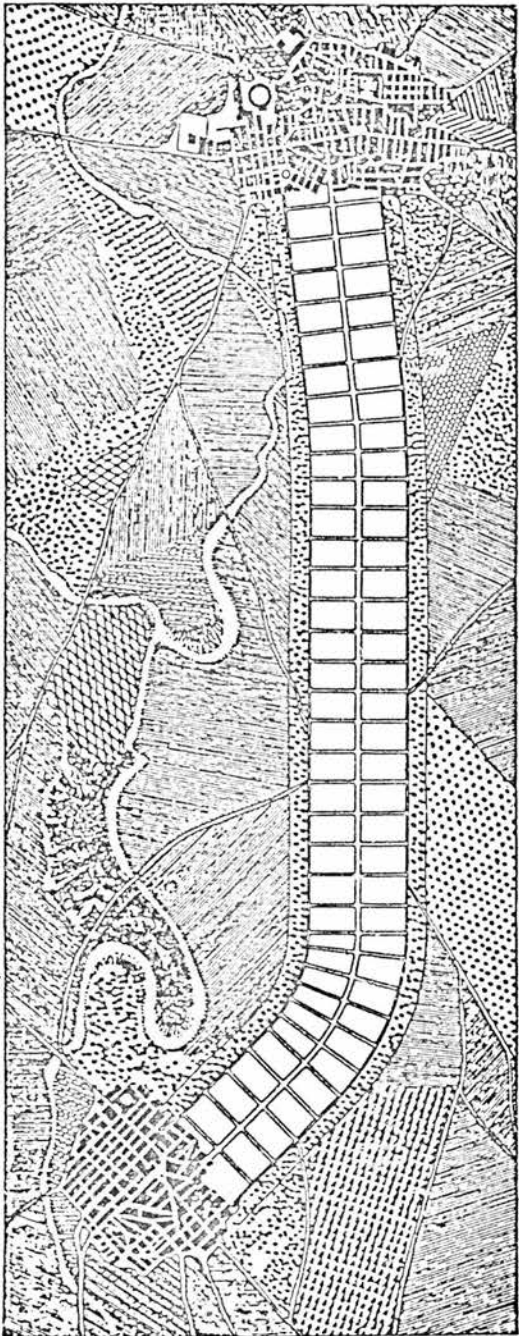
These have been mentioned already; but shared models form the most important part of our discussion and therefore deserve a more detailed treatment than the other components in the network. Wolflin in his Principles of Art History<sup>54</sup> remarks that all pictures owe more to other pictures than they do to nature. Something analogous is true of architectural design; that is to say all architectural designs owe more to other designs than to the nature of architectural problems. The major part of architectural solutions are derived from past accomplishments which the community of architects accepts as established, and these provide models for its further practice. But a model, in order that it may gain the status of an established accomplishment, should be sufficiently new to attract a group of adherents away from the older model and be open-ended and not too refined to allow anagram solution to proceed without too much difficulty. This fact has already been demonstrated with reference to the four models of university planning, but it can be elaborated in greater detail. In order to save space we will not attempt such an elaboration for all the four models,<sup>55</sup> but simply look at the evolution of linear planning. George Collins<sup>56</sup> has carried out an extensive study of Arturo Soria y Mata's (1844-1920) theory of linear planning, his pilot project at Madrid and later applications of linear planning throughout the world, and from his studies we know a great deal about the origins of the idea, how it became known abroad and how it was adapted by other designers.

The essence of Soria's concept of linear planning was as follows: the spine of his layout was a single principal street of 40 metres width and of infinite length. This was intersected at 300 metres intervals by secondary streets of 20 metres width forming large blocks of 40,000 to 60,000 square metres. The spine was to be used by trolleys during the day and by freight cars during the night. The blocks were to be subdivided into moderately sized plots and the buildings of moderate height on these plots would be separated from each other by vegetation and from the street by a 5-metre strip of greenery. Large plots for the wealthy faced the main spine and smaller ones the parallel secondary street, but the rich and the poor would live in close proximity. Under the spine and the street were services, and some of the large plots were devoted to communal facilities. The city would be an endless band of about 500 metres width connecting the old centres (see Fig.3.2). This idea of using a transportation system as an organising element was later followed by Carlos Carvojal Miranda in Chile (1908-29), by Captain J.W. Petawel of England (1909-11); by Milo Hastings (Fig.3.3) (between 1909-19), Edgar Chambless (in 1893) and Arthur C. Comey (in 1923) in America, by Professor Miliutin in Russia (as an architect of the 1928-33 five-year plan) (see Fig.3.4), by the British Mars group (1937-42) (see Fig.3.5); in the 'forties by Hilbershimer (Fig.3.6) and Le Corbusier with his Ascoral Associates (Fig.3.7). The point worth noting is that none of these is a simple replication of Soria's model; they have been adapted to suit particular situations, but the principles that are common to all are that they coordinate the transportation routes and minimise cross currents of traffic while combining the benefits of urban



# TEORIA DE LAS CIUDADES LINEALES

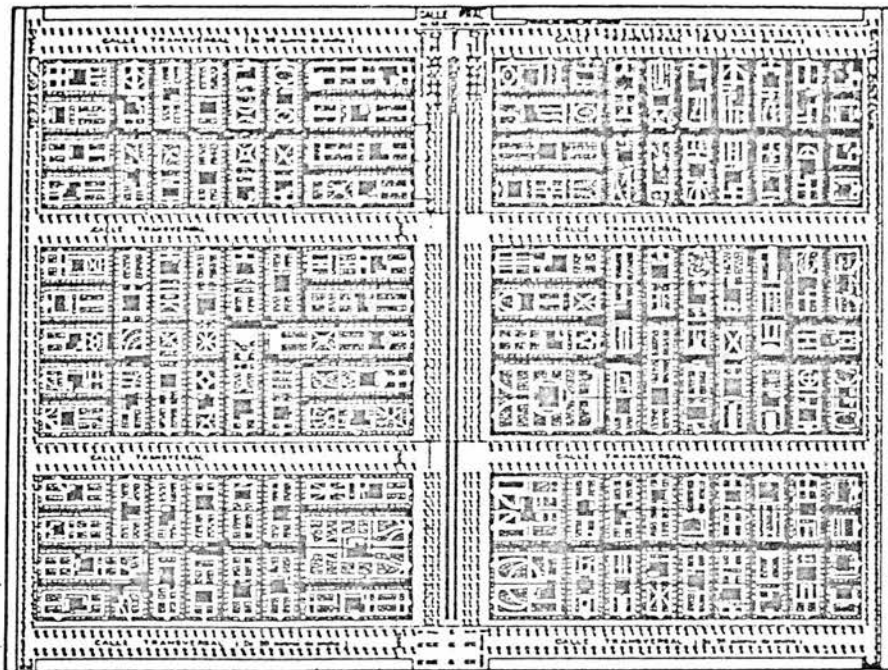
LAMINA 3



SCHEMATIC REPRESENTATION OF CIUDAD LINEAL (Source: George Collins, The Ciudad Lineal of Madrid, 1959)



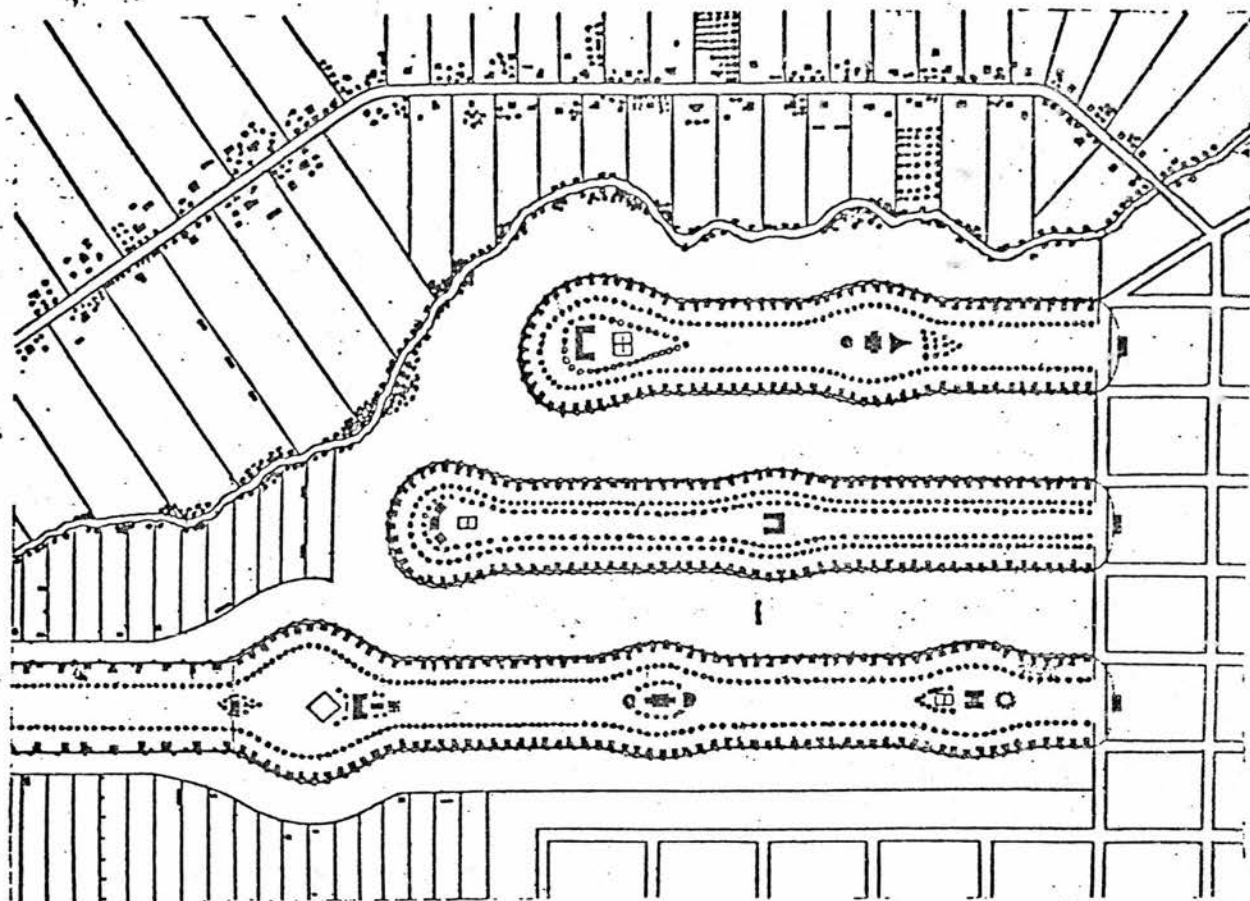
TYPICAL CROSS SECTION OF CIUDAD LINEAL  
FIG. 3.2



ARRANGEMENT OF STREETS AND PLOTS, CIUDAD LINEAL, MADRID  
 (source: George Collins, *The Ciudad Lineal of Madrid*, 1959).  
 FIG. 3.2 (continued)

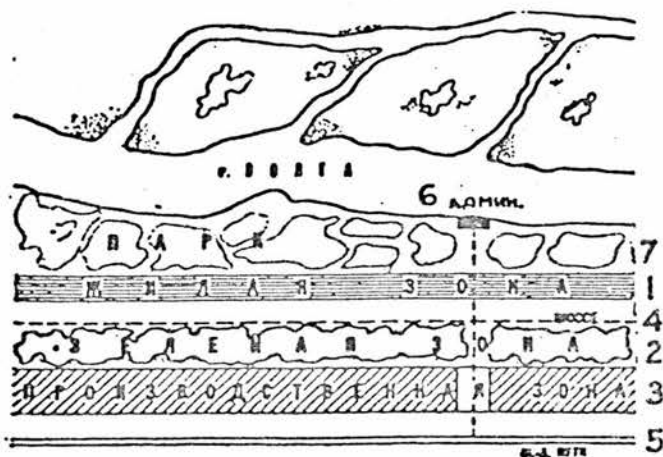
and mural living. Even in Lancaster University, where the spine is entirely pedestrian, all these principles apply. Incidentally, we must note that the pedestrian route and the vehicular routes at Lancaster are rearranged, but nevertheless they follow the axial route as in Soria's model and here we truly see the 'schema' of anagram solution in operation. Fig.3.8 shows the development plan of Lancaster University, Soria's linear plan and the plan of a medieval town using the same notation to denote elements.

Arturo Soria and his associates spread their ideas in several ways. They ran a periodical called 'La Ciudad Lineal'; they actively participated in international congresses; articles on the lineal city of Madrid appeared in the English periodical Garden Cities and Town Planning, and Benoit Levy of France wrote several articles on their work in his own country, in England and in the



Between 1909 and 1919 Milo Hastings in America evolved his own version of linear plan. In his plan houses are to be arranged along the inside of long 'U' shaped road loops penetrating the countryside. Houses will face a common park that fills the interior of loops. Incorporated under the single streets are various services.

PLAN BY MILO HASTINGS (from: Journal of AIA, VII, 1919).  
FIG.3.3

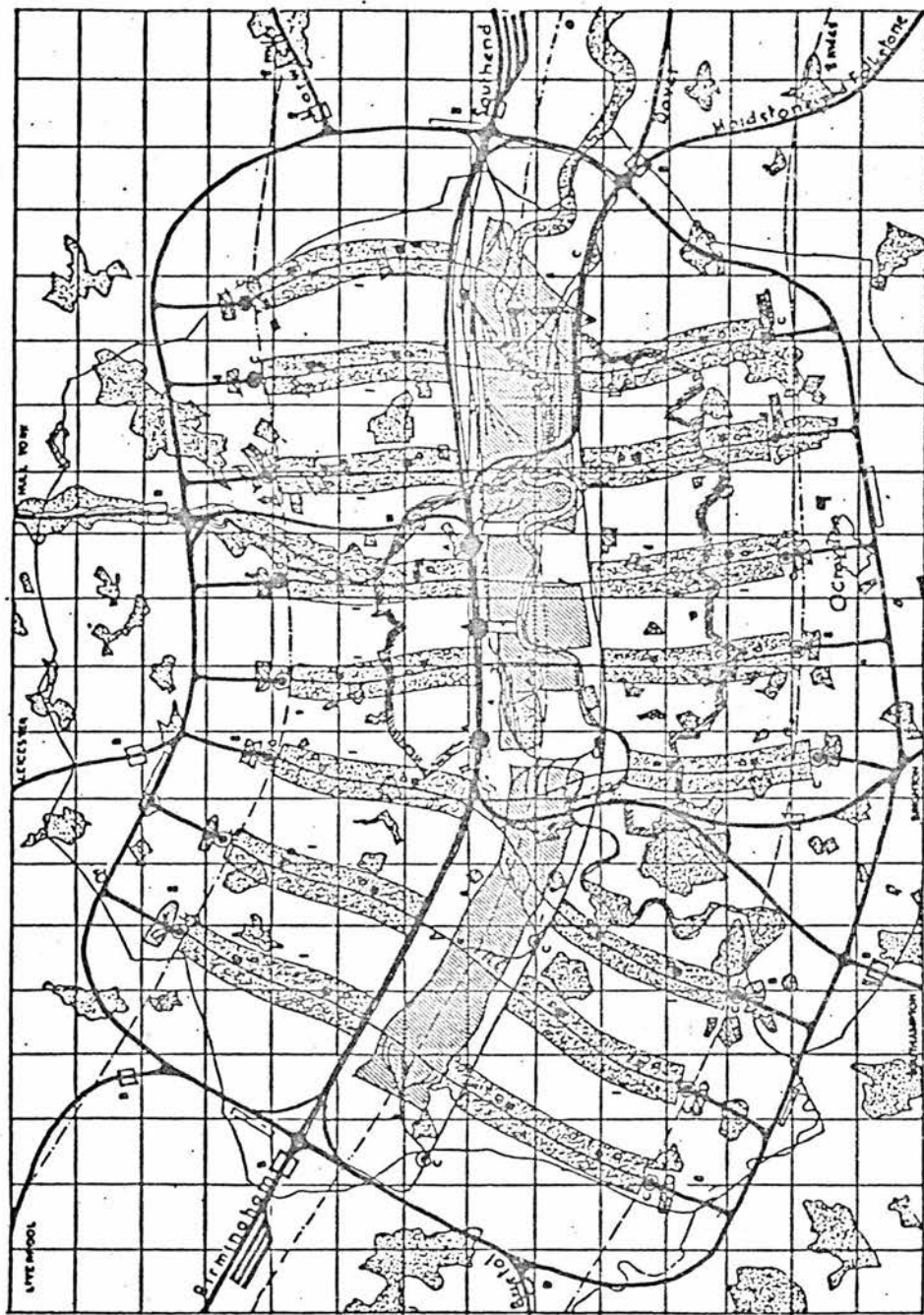


Professor Miliutin's plan for linear Stalingrad in about 1931 consisted of parallel strips of a residential zone (1) which included also schools and public buildings, a green belt (2), an industrial zone (3), an arterial highway (4) and the railway (5). 7 denotes countryside and 6 the river Volga.

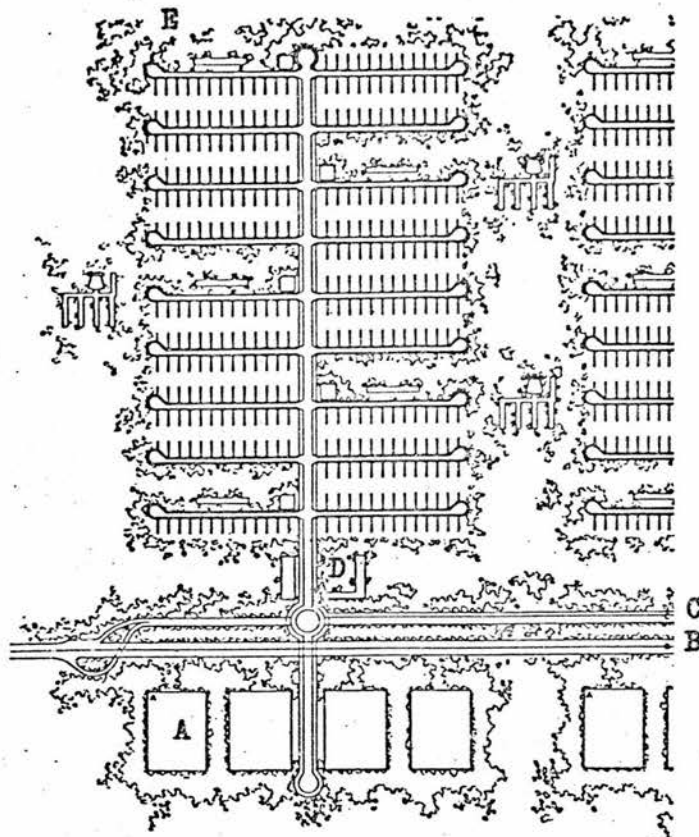
MILIUTIN'S PLAN FOR STALINGRAD (from George Collins, Linear Planning throughout the World, 1958-59).

FIG.3.4

Modern Architectural Research group suggested that Industry, commerce and administration of London be set up along its primary east west artery of Thames and railways, and that the residential zones be laid along a series of secondary axes. At the outer ends these secondary axes might contain industrial units and would be connected by a circular railway freight line.



THE MARS PLAN FOR LONDON, 1938-1942 (from the Architectural Review XLI, 1942 p.142) FIG.3.5



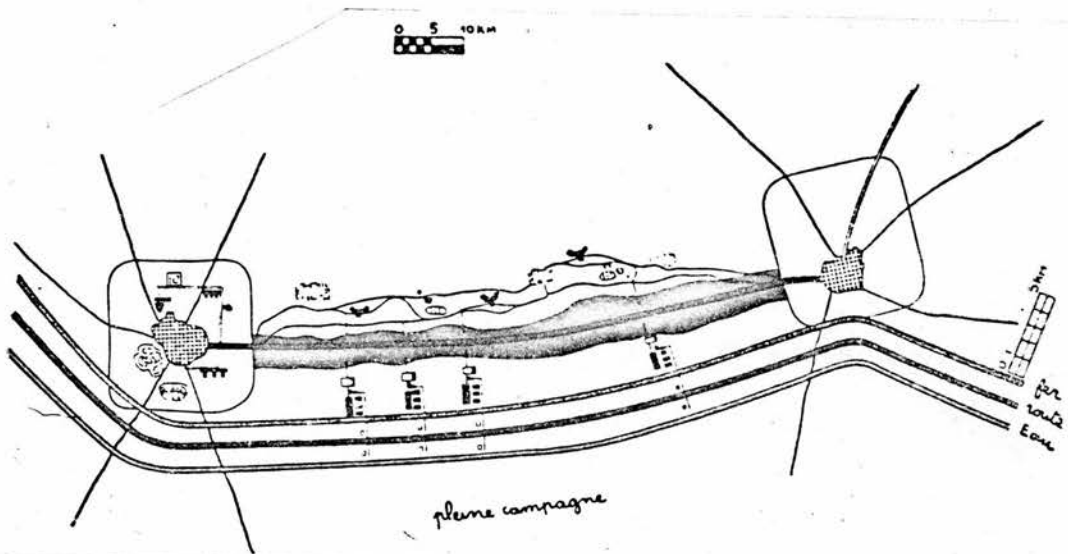
Hilbersheimer's linear plan is rather similar to the Mars plan in that the regional city is developed as skeletal offshoots from a main artery of transportation.

A. industry B. main highway C. local highway  
D. commercial area E. residential area  
F. schools in park.

A SETTLEMENT UNIT OF HILBERSHEIMER'S LINEAR  
PLANNING OF THE 1940s'  
(from Hilbersheimer, *The New City*).

FIG.3.6

United States. Of course followers of certain ideas need not be linked to one another directly. It is not necessary to know a particular person in order to be influenced by him. Ties between adherents of linear planning were created more indirectly on the basis of common interests in the principles which linear planning embodied rather than by propinquity or the status enjoyed by Soria and his associates. Journals and other publications provide a kind of repetitiveness which ensures that ideas are disseminated

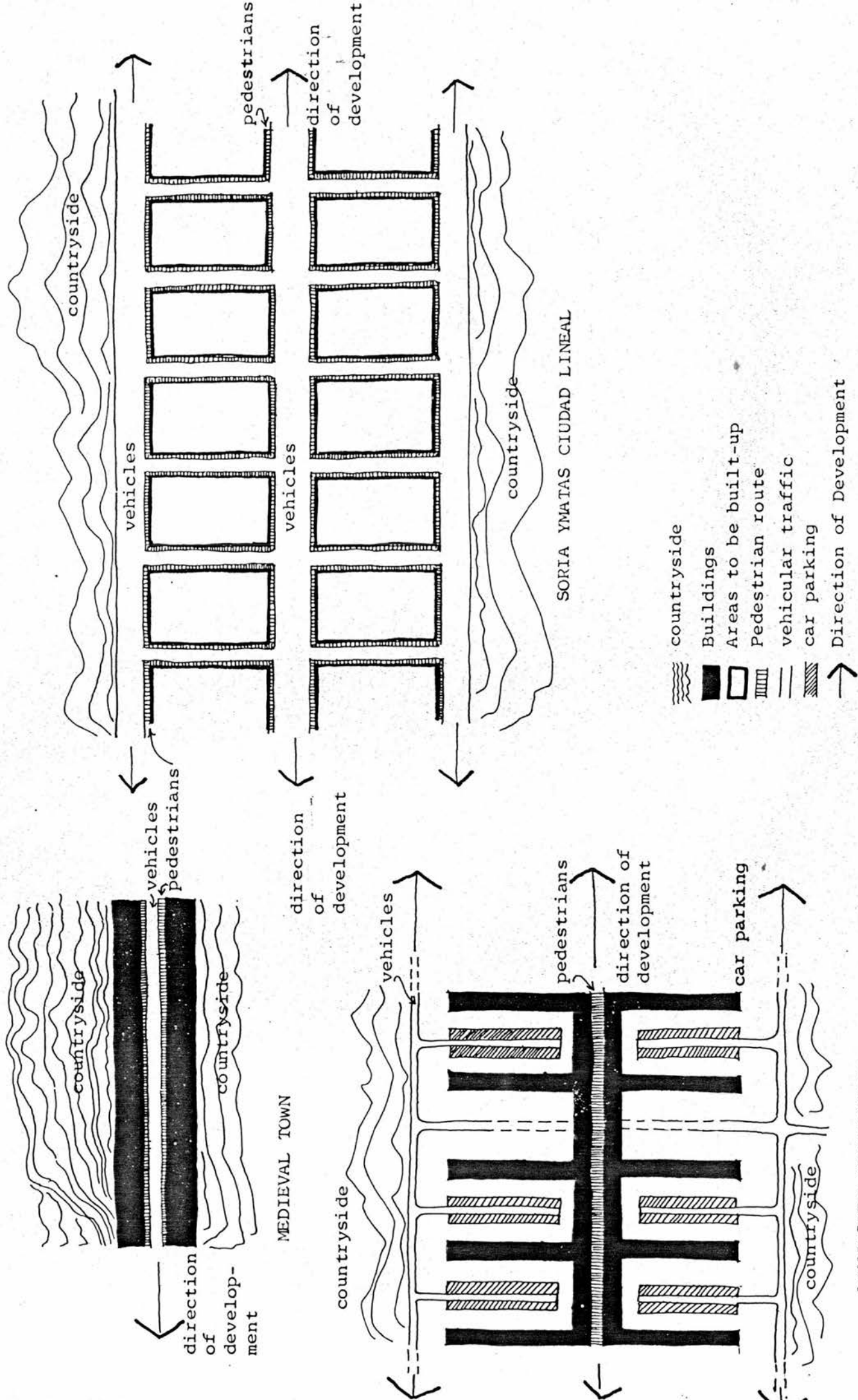


In the industrial city of Le Corbusier and Ascoral settlement units branch off at intervals from transportation arteries which in turn connect the old concentric cities.

THE INDUSTRIAL LINEAR CITY OF LE CORBUSIER  
AND ASCORAL ASSOCIATES ABOUT 1948

(source: Le Corbusier, Oeuvres Complètes)

FIG.3.7



LANCASTER UNIVERSITY

LINEAR DEVELOPMENTS  
FIG. 3.8

and groups are prevented from becoming an isolated cult. Thus linear planning started off as a visionary idea with its only executed example in Madrid. But it did have a promise of success and the major part of the architectural profession's activity consists in the realization of that promise. The most compelling of all constituents of our network then are exemplified by the generalised models of this sort. While they continue to be respected they aid the individual designer and limit the range of acceptable solutions.

Shared Constructs: apart from the models discussed above, the architect as an individual belonging to a closed group acquires a multitude of commitments and compulsions at lower and more concrete levels. These have been named shared constructs. The sub-components of shared constructs are

(a) Representational Aids

These are commitments to accepted ways of representing an architectural idea. The mere fact that one produces drawings before one builds must to some extent influence what one conceives. For instance we know that three-dimensional representation affected architecture and painting profoundly from Renaissance times up to the end of the 19th century. There is also evidence for the fact that presenting buildings of the past with the aid of cross-sectional isometric diagrams started by Auguste Choissy led to the perception of buildings as complex objects composed of simple shapes.<sup>57</sup> There are many modern buildings in which axonometric representation has had a considerable influence on the design idea.



(b) Dominant Technical Aspects

A second and perhaps the most important element of shared constructs is represented by the dominant technical aspects that provide stimulus for architectural ideas. We are not concerned with the special technical problems a particular design task may present; our concern is rather with the generalised commitments a designer has to certain technical aspects, regardless of the design task. This also includes the dominant concern of a group of architects for particular technical aspects at certain periods of history. Some examples may clarify this. The architect's concern for external and internal proportions of buildings during the Renaissance is well known. In Baroque and Rococo the dominant concern was with the quality of natural light, and one sees a similar preoccupation with the natural light in many of Aalto's works. Investigations in history should reveal many such technically-based constructs which are shared by the community of architects and which strongly influence the nature of architecture.

This completes our description of the network of the architectural community's habits, attitudes and ways of seeing. This list is by no means exhaustive; it is only intended to illustrate the kind of implicit factors that affect the nature of design. It is these factors that enable an architect to be ahead of data on design problems and suggest solutions of sorts. It is the existence of tacit knowledge resulting from them that induces shared commitments and compulsions of a metaphysical, theoretical, methodological, technical and representational kind on architects.

### Relevance of Inventive Aspects

The preceding sub-sections and the last chapter carried our schematic description of how design is actually done as far as it can go, and now we may summarize the implications of such description. The essential significance of different types of information is only to a limited extent understood by all the participants in the building process. The nature of design is such that we may expect the architect to select even further from the data whose worth is appreciated by everyone. Observable patterns in the process of design as it is done suggest that architects impose architectural systems of a kind upon the range of design requirements, and this modifies the degree of importance attached to each piece of information. It is in this respect that implicit knowledge rather than explicit knowledge looms large. Of course, early fact-gathering in a field of design where there are no precedents tends to be random, and every kind of data that is available is collected, but at later stages of development of a design type, data collection becomes more purposeful and less time consuming. Thus emergent models in a particular design field offer a sense of direction for the fact-gathering activity of an architectural practice. But emergent models in the majority of instances are implicit or submerged; whilst one can observe evidence for their existence in architects' explanations of their design, in critics' reviews, and so on, the description of the model itself is quite difficult.

As has already been pointed out, emergent models are not objects for replication; neither are they solution-images (e.g. a study bedroom suggested as the only and the most obvious solution to student living). A model is a systematic repertoire of

ideas contained in an established architectural example. It suggests further issues, taking us beyond the specific problem requirements in response to which it originally emerged and it is this suggestiveness and deployability that makes a model something more than a solution-image.<sup>58</sup> The description of a model requires some key terms and expressions with clarification of relations between elements, and these get supplemented as model refinement proceeds. For instance, we used coordination of traffic and pedestrian movements, minimising cross-currents of traffic, mixing the benefits of urban and rural living, avoidance of disturbance to already completed areas by subsequent building activity, etc. as the key phrases to describe linear planning. If a particular model is to become a useful speculative tool these phrases and key terms employed for its description must be sufficiently rich in their implicative power. Thus it is no coincidence that adherents of Soria y Mata or Ebenezer Howard's original ideas have been stimulated into producing interesting practical applications that bear the label of their respective masters.

Of course there is always the danger that models will acquire a metaphysical status and will be permanently insulated from testing through practical application and evaluation. The more persuasive an emergent model, the greater the risk of it becoming a self-certifying myth. But even the worst of emergent prototypes like the tower blocks seem to yield to the demands of experience, and because of this the danger of models becoming straight-jackets is considerably reduced.

If our schematic description of the design process and the part played by models in it has caught the essential structure of

design activity, then some interesting consequences for the study of design-related information follow. The primacy of models suggests that search for form is less important than a concern for what can be called 'process'. For example, in the case of design of chairs, originality shows itself first in such things as material used and methods of manufacture, and these in turn are affected by social factors like who makes the chair, how many people can have it, and so on. Changes in the technical and social aspects of the process lead to modifications in the form of the prototype - this indeed is the essence of our concept of neutral analogy; but in spite of these changes a new chair will fall within one of the finite range of emergent prototypical forms. This primacy of social and technical aspect of process over form has been shown to be historically typical for all branches of design. This does not mean that 'form' is unimportant; it means, rather, that - excluding some rare instances - commitment of designers to emergent models is strong, and that progress in design is achieved only through changes in 'process'. So a brief-writer or an architect who formulates his own brief must work with emergent models, and information on the two aspects of the process in a nested and overlapping way. In a reasonably developed design field, identification of emergent models and their description should provide key terms and phrases pregnant with design implications which facilitate the choice of the most appropriate model, which in turn offers directions for design-related fact-gathering.

The main argument so far has been that analysis of inventive aspects can increase our understanding of the process of design. In the next chapter we wish to show how this understanding can bring practical improvements to the process of brief-making.

## Chapter III : Notes

1. See a) 'Hegel's Philosophy of Mind', translated from the Encyclopaedia of the Philosophical Sciences by Wallace, W., Oxford, 1874 and b) Carl Marx, Early Writings, translated and edited by Bottomore, T.B., New York, 1964.
2. See Durkheim, Emile, Education and Sociology, translated by Fox, S.D., Glencoe, Illinois, 1956.
3. See Max Weber : The Interpretation of Social Reality, edited with an introductory essay by Eldridge, J.E.T., London, 1970.
4. See Evans-Pritchard, E.E., Anthropology and History, Manchester, 1961.
5. Schutz, A., Collected Papers : I The Problem of Social Reality, The Hague, 1967, pp.13-14, 33, and 61-62 (first published in 1967).
6. Polanyi, Michael, The Study of Man, London, 1959.
7. Kuhn, Thomas, The Structure of Scientific Revolutions, Chicago and London, 1962.
8. Analysing writings published in the Journal of Architectural Historians over a period of ten years from 1958 to 1967 inclusive, John Mars comes to similar conclusions. See 'Where Architectural Historians Fear To Tread', Journal of the Society of Architectural Historians, Vol. XXVIII No.1, March 1969, pp.3-8. See also Richards, J.M., 'The Hollow Victory, 1932-1972' in the RIBA Journal, May 1972, pp.192-97. Richards explains clearly how historians still find it difficult to escape the cult of 'the individual' and the 'celebrity architect'.
9. Amestoy, Joseph, 'Architectural Reflections', American Institute of Architects Journal, September 1967, pp.66-67.
10. Donat, John, World Architecture I, London, 1964, p.234.
11. RIBA Journal, April 1961, pp.230-40.
12. From his survey of literature on architectural history John Mars comes to the conclusion that the majority of articles he has analysed write history in a "skin-deep", "boneless" way, and he accuses them of "façadism". Mars, John, op.cit.
13. Kaye, Barrington, The Development of the Architectural Profession in Britain, London, 1960.
14. Jenkins, Frank, Architect and Patron, New York, 1961.
15. For an extensive list of works on this type of studies see Campbell, Sheila, 'Architectural Values as a Measure of Design Decision Making' in Raman. P.G. (ed.), Architecture and Social Sciences, Edinburgh, 1973, pp.134-57.

16. Polanyi, Michael, op.cit., p.11.
17. Kuhn, Thomas, op.cit. See also the enlarged second edition of 1970, particularly the postscript, pp.191-2.
18. The reference for the explanation of the four models and their precedents is Brawne, Michael, 'The New Universities - An Appraisal', Architectural Review, Vol.147, No.878, April 1970, pp.250-85.
19. See Soria y Mata, Arturo, Cosas de Madrid: Appuntes y Comentarios Municipales, Madrid, 1935.
20. McKinnon, D.W., 'The Nature and Nurture of Creative Talents', American Psychology, Vol.17, 1962, pp.484-95.
21. Similar analyses in terms of historical prototypes can be carried out for other building types as well- e.g. public buildings, housing layouts, halls of residence, and so on. Indeed if we trace the development of any selected building type or ideas on building process backward in time we are likely to encounter some minor variants of the pattern illustrated here from developments in university planning.
22. The majority of ordinary practitioners are indeed intolerant of those invented by others.
23. Interest in territoriality grew largely as a result of problems posed by anonymous open spaces that modern block-planning and tower blocks had produced. Studies in imageability were provoked by sterile environments created by modern buildings. Interest in day lighting was related to the healthy environment that modern movements attempted to produce. Enthusiasm for proportional systems was revived by the modern movement partly because of modular coordination called for by mass production and certain aesthetic principles exemplified by some of the successful modern buildings. See Millon, Henry A., Wittkover, Rudolf, 'Architectural Principles in the Age of Humanism: Their Influence on the Development and Interpretation of Modern Architecture', Journal of the Society of Architectural Historians, Vol.XXXI, No.2, May 1972.
24. The author owes this suggestion to Giancarlo De Carlo's talk on Urbino to some students of architecture at Edinburgh University in Urbino, April 1974.
25. Serenyi, Peter, 'Le Corbusier's Changing Attitude toward Form', Journal of the Society of Architectural Historians, Vol.XXIV, 1965, pp.15-23.
26. Ibid.
27. Summerson, Sir John, 'Antithesis of the Quattrocento' in Heavenly Mansions, New York, 1948.
28. Fitch, James Marston, American Building, Boston, 1947, p.152.
29. Literature on rational methods of design often uses the term 'problem-solving' to describe design activity. The usefulness of this

term obviously depends on the meaning in which it is used. If it is used in a broad sense that includes creative thinking, reasoning and making judgements, it is far too general to be useful for the particular act (the act of designing) this thesis tries to describe. If, on the other hand, the term 'problem-solving' is used in the sense which involves an analytical approach such as 'A causes B and that causes C which results in D' then one cannot deny that designing involves problem-solving components. But we do know that designers derive a great deal of satisfaction from designing, and problem-solving components of this sort cannot provide an explanation for the fascination designing possesses.

30. Nuffield Foundation, Division of Architectural Studies, The Design of Research Laboratories, Oxford, 1961.

31. Emergent models may be labelled as high density/high rise, high density/low rise, low density/low rise, and so on.

32. Significant examples of public buildings seem to fall within one of the following prototypes: clusters, closures and fusion. Key descriptors for each model with considerable design implications may be developed.

33. Horn, Walter, 'On the Origins of the Medieval Bay System', Journal of the Society of Architectural Historians, Vol.XVII, No.2, May 1958, pp.2-23.

34. Rasmussen, Eiler, Towns and Buildings, New York, 1951.

35. Rosenthal, Earl, 'The Antecedents of Bramante's Tempietto', Journal of the Society of Architectural Historians, Vol.XXIII, No.2, May 1964, pp.55-74.

36. Field, Walker, 'Origins of the Balloon Frame', Journal of the Society of Architectural Historians, Vol.V, No.4, October 1946.

37. Ritchie, T., 'Plank Wall Framing, a Modern Wall Construction with an Ancient History', Journal of the Society of Architectural Historians, Vol.XXX, No.1, March 1971, pp.66-70.

38. Ibid.

39. Kaplan, I.T., and Carvellas, T., 'Effect of Word Length on Anagram Solution Time', Journal of Verbal Learning and Verbal Behaviour, No.7, 1968, pp.201-6.

40. Mayzner, M.S., and Tresselt, M.E., 'Anagram Solution Times: a Function of Letter Order and Word Frequency', Journal of Experimental Psychology, No.56, 1958, pp.376-79.

41. There is no way of course of knowing which words are familiar to which subject; but words that come up more frequently in ordinary language must be more familiar to people generally, and frequency of occurrence of millions of words has been counted for other purposes and from this it is possible to select the most frequent and the most infrequent words.

42. Gribben, J.A., 'Solution-word letter sequences in anagram solving', Journal of Experimental Psychology, No.85, 1970, pp.192-97.
43. Wiggins, J.G., 'Some Relationships between Stimulus Structure and Ambiguity in the Solution of Anagrams', Journal of Clinical Psychology, No.12, 1956, pp.332-37.
44. Dominowski, R.L., and Ekstrand, B.R., 'Direct and Associative Priming in Anagram Solving', Journal of Experimental Psychology, No.74, 1967, pp.84-6.
45. Polanyi, Michael, op.cit.
46. The names given for the individual elements have been adapted from Kuhn, Thomas, op.cit. and Masterman, Margaret, 'The Nature of a Paradigm', in Lakatos, I., and Musgrave, A., Criticism and Growth of Knowledge, Cambridge, 1970, pp.61-71.
47. Ideas on 'myth' expressed here have been abstracted from Leach, Edmund, Genesis as Myth, London, 1969, pp.7-24.
48. Collins, Peter, Changing Ideals in Modern Architecture, London and Montreal, 1965.
49. Gombrich, E.H., 'Meditation on a Hobby Horse or the Roots of Artistic Form' in Law Whyte, Lancelot, Aspects of Form, London, 1951.
50. The examples that follow have been dealt with in some detail by Collins, Peter, 'The Origins of Graph Paper as an Influence on Architectural Design', Journal of the Society of Architectural Historians, Vol.21, No.4, December 1962, pp.159-62. See also letters to the Editor on this matter in Journal of the Society of Architectural Historians, Vol.XXII, May 1963, p.107.
51. Panofsky, Erwin, Meaning in the Visual Arts (1930), English Translation, New York, 1955, p.189.
52. Fitch, Marston, op.cit., p.101.
53. For a detailed bibliography on works of this kind see Campbell, Sheila, op.cit.
54. Quoted by Gombrich, E.H., op.cit.
55. Details on the origins and further development of models that have been labelled 'nodes' may be found in Batchelor, Peter, 'The Origins of the Garden City Concept of Urban Form', Journal of the Society of Architectural Historians, Vol. XXVIII, No.3, October 1969, pp.184-200. Some details on the other two models may be found in Moholy-Nagy, Sibyl, Matrix of Man, London, 1968.
56. Collins, George R., 'The Ciudad Lineal of Madrid', Journal of the Society of Architectural Historians, Vol.XXVIII, No.2, May 1959, pp.38-53 and 'Linear Planning throughout the World', Journal of the Society of Architectural Historians, Vol.XXVIII, No.3, October 1959, pp.74-93.



57. Jordy, William H., 'The Symbolic Essence of Modern European Architecture of the 'Twenties and its Continuing Influence', Journal of the Society of Architectural Historians, Vol.XXII, No.3, October 1963, pp.177-87.

58. Adapted from Stephen Toulmin's statement in connection with models in science. See The Philosophy of Science, London, 1953, pp.38-9.

## **IV. INFORMATION AND DESIGN**

#### IV. INFORMATION AND DESIGN

In order to show the relevance of inventive aspects to brief-writing we begin by considering how briefs are written conventionally. Brief-makers, be they architects or administrators, are concerned with the description of the nature of the building required as exhaustively as possible, and most design guides and checklists are used as aids to that description. Activities which users are expected to carry out and resources required for these activities are traditionally treated separately. In architecture, space forms a major part of the resources required for different types of activities and therefore spaces are given 'use-names'. Thus use is closely related to the behavioural conception<sup>1</sup> of activity and the data on it are a set of typical averages derived from statistical treatment of the observations of behaviour. The building required is then described in terms of a taxonomy, giving an account of spatial and functional characteristics such as size, volume, opening for light, air, communication between spaces, and so on. This in essence is the process leading to a schedule of accommodation which constitutes the major part of a traditional brief. Design activity is seen as something that involves the establishment of a systematic fit between built space and activity. Standards and regulations to some extent work against the notion of fit between space and activity. There are two reasons for this: first, standards and regulations themselves do not make explicit

the assumptions on which they are based; secondly, designers on their part make no attempt to uncover the intentions behind regulations and standards; instead, designers often regard them as disadvantages from which it is difficult to free oneself. Space standards themselves are based on statistical averages of observable behaviour which are then converted into normative elements. In this sense there really is very little difference between standards and the way a schedule of accommodation is usually derived.

A number of methods for collecting information about space requirements normally precede the process of brief-making. The Room Data Sheet Method devised by a number of architects working in hospital planning, the Activity Data Method devised by the Ministry of Public Building and Works (1966) and the Royal Institute of British Architects' method (1965) are a few examples. As the name implies, RDS takes the room as the basis and accepts it as part of a schedule of accommodation. ADM is more fundamental: it attempts to record details of the activities that are to take place. The RIBA's method of studying user requirements attempts to identify, besides the activities, the equipment required and the people involved in the activities to be carried out in the proposed building. There are many combinations and adaptations of these three methods that are in vogue in the architectural field. The usual kind of questions that these methods aim to answer are: who is doing what, where and how?

In the field of architecture there are many who would express scepticism about the methods described above, but their reservations usually concern the methodology and not the principles behind the idea of a schedule of accommodation derived from a consideration of users' activities. Those who reject these methods do so on

grounds of practicability and of benefits not being proportional to the effort expended. Since there exists no informed critique of these methods at a fundamental theoretical level, the credibility of these methods never gets settled; their application in practice becomes more a matter of fashion than of conviction about their usefulness. This is not the place to settle such a vast issue,<sup>2</sup> but even mentioning the usefulness of data collecting methods brings us to the relation between different types of data and inventive aspects. Our aim here is not to suggest that the schedule of accommodation can be discarded; it is rather to suggest that some of the simplifications that inevitably result when one employs a schedule can be avoided by the inclusion of qualitative formulations.

An exhaustive description of the required environment is neither useful nor desirable; after all, there is a limit to the amount of data human beings can absorb; persistence in absorbing too much will result in what is known in psychology as 'cognitive stress'. Psychologists suggest that we never see new information as unique but always connected with past information it resembles.<sup>3</sup> Here lies the importance of models, and if the designer is going to have difficulty in shedding his commitments to personal as well as communal models, what is the point in attempting an exhaustive description of the nature of the building required in a neutral language? The relationship between new and old information strengthens our assertion that a brief-writer should work with emergent models<sup>4</sup> and design data hand-in-hand, but it does not provide any basis for linking the two in a practical way. However if we stop to ask what happens between information and its transformation into design we realise that information and design are

not discrete categories; that is to say any thought about design-related information is also a thought about design itself. Further, those key statements we used in Chapter III to describe a model are in fact design concepts. When we talk about seeing new information in some way connected with old information, it is these concepts that provide the link between the two. In the process of design it is hard to know where information stops and concepts begin, and where concepts become concrete ideas. Somewhere in this process the skills of the designer also play their part. Although skilled performance is closely connected to information processing, there are some difficulties in relating it to the idea of design information and concepts.<sup>5</sup> Appendix 4 deals with design skills and it is worth pointing out that the content of this appendix stresses the importance of pre-existing patterns of response or lower-level models. Although information, concept and design are highly inter-related categories, in order to study them closely we must consider them individually and examine their role in the process of design.

### Information

We have mentioned certain types of information (e.g. functional-practical, information on qualitative aspects, inventive information) without attempting an explicit definition of it. As the objective so far has been to understand the nature of design and to describe the context and the complexity of the issues involved, this was justifiable. However we have now reached a point where the task is to make certain practical suggestions and therefore it is important

to be clear about the term 'information'.

There is a considerable literature on information systems for designers, yet it is very hard to find a definition of what is meant by information for design. Ever increasing literature on information systems for design suggests that designer and information scientists have only an implicit idea of what kind of data are useful in the design process, and consequently everything that is vaguely suspected to be useful for design is supplied to designers. The structuring of it all is largely left to the ability of individual designers and brief-writers.

The emergence of the whole subject of information theory and of psychologists' attempts to apply it to the study of man has led to widespread confusion between the notion of information per se and various formulae used in calculating its amount.<sup>6</sup> This does not mean that information theory does not offer any insights useful to the field of design, but rather it means that in the application of it to the problems of translating briefs into design solutions we cannot give any precise mathematical formulations. There are however some general insights which some of the basic principles of information theory (particularly those on the notion of 'noise' or redundancy, and on the idea of equating information in this technical sense largely with unpredictability) offer; but they are too general to be applicable to the subject matter of this thesis.

In ordinary language the word 'information' has different meanings. It can, for instance, mean communication or exchange of knowledge; it can simply be a warning or advice or notice or a hint; it can convey the idea of documentation and records, intelligence and news, messages and reports, and so on. From these different interpretations

of the term 'information' we need to select a meaning and present a definitive statement which applies particularly to our study. The central concern of this study is with all those aspects that determine form: form in the sense of 'orderly assemblage of parts'. Information can be said to be relevant to design, if the situation or event that particular information describes determines form in space and/or time regardless of where the information originates. Thus a short definition would be simply 'that which determines form'. At the early stages of design activity the form in question is a representation of some state of affairs. In this case our short definition becomes 'that which logically determines representational activity'.<sup>7</sup> Some of the key phrases used to arrive at this definition must now be clarified. The phrase 'determination of form in space and/or time' takes into account the importance of factors like phasing, future provisions, adaptability, and so on. Exchange of views and ideas between client, architect, users and consultants can be regarded as a complex scheme of information transmission, some of which can determine form, and hence the inclusion of the phrase 'regardless of where the information originates'. Further, as has been pointed out in Chapter I, clients' attitudes to the provision of design-related information is varied, and architects often supplement the information they get from clients with information from other sources and with inventive information. Lastly it may be thought that there is contradiction in the idea of inventive information and information defined as something that logically determines representational activity. In recognizing, formalising and specifying inventive information we are attempting to account for it as logically as possible.



It seems that information can determine form in two ways: a) by a process of arrangement of parts; and b) by a process of selection. An example of a) would be a study bedroom whose form is determined by the designer from information on basic requirements of the user, i.e. the need to sleep, the need to study, the need to rest, the need to entertain friends, and so on. An example of b) would be selection of a form of study bedroom from recommendations in a design guide. At the early stages of design both processes of form determination are present, but depending on who the architect is, case a) or case b) predominates the process.

One of the problems of data collection is to know whether a piece of information is relevant to design or not; this problem is particularly acute in the case of social aspects of architecture.<sup>8</sup> Our definition of information strengthens the two-way relationship between information and its transformation and can be used as a criterion for choosing the relevant information and for discarding the irrelevant. In discussing information, architects and methodologists often speak of 'all the information needed for design'. A definable point in any sequential array of information can be formally considered as informationally sufficient; for instance the quantity of information necessary for deciding whether A is equal to, greater than, or smaller than C is:  $A > B$ ,  $B > C$ . This is the informationally sufficient array of information, and any subsequent data or repetition of these data would be redundant. However convincing this may be from a logical point of view, it is highly misleading from the psychological point of view of information for design.<sup>9</sup> The psychological informational sufficiency with respect to design depends upon the strategy of information utilization a designer will

adopt, and upon the manner and rate at which he will use the information. In short it will depend on the concepts embodied by the model solutions which an architect considers as most suitable for the problem he is tackling.

### Concept<sup>10</sup>

In the past when 'concept' was considered a generalised mental image there was no problem of definition. Attempts to go beyond the idea of incommunicable mental pictures have to face the difficulty of producing a definition acceptable to all fields which deal with the idea of concepts. For instance, philosophical writings suggest<sup>11</sup> that abstraction is consideration of logical form of contents, and that such abstracted forms are concepts. Consider for instance how many motions follow the general pattern called 'oscillation'. The swing of a pendulum, the swaying of a tall building, the vibrations of a violin string, all these are examples of oscillation. Now if we omit all references to tall buildings, violin strings and pendulum, we would probably define the form-type as 'rythmic movement to and from'. Thus when we consider the form of various things or events and call it by a name that does not suggest any particular thing or event we are deliberately abstracting form from all things that have it, and such an abstracted form is 'concept'.

Bruner et al.<sup>12</sup> suggest that a certain group of psychologists accept this definition and elaborate it as follows: 'concept' is defined by the common elements shared by a collection of objects,

and attaining a concept 'inductively' is similar to producing a composite photograph by superimposing instances on a common photographic plate until everything idiosyncratic has been removed and all that is common emerges. Another group of psychologists feel that a concept is not the common element in a group of objects, but is rather a relational thing, a constituent part of the process. Bruner et al. suggest further that entering into the details of such a controversy is relatively unproductive. It is more useful to regard 'concept' as a matrix of inferences between sign and what it signifies, so that one goes far beyond observable properties of an object or event that simply help one to name it. We see the plan of a building with an open court, all the habitable rooms have windows facing the court and none facing the outside; we infer that it is an inward-looking building. We infer further that such a building is probably located in a place which does not offer an attractive outlook or that it is a building for users who prefer to shut themselves off from outside onlookers. Thus we may define concept as the network of inferences that are or may be set into play by an act of categorization.

A comprehensive definition of concept then is that it is an abstraction. It is a hypothetical construct. One who has a concept can do things that others cannot do. Achievement of a concept is demonstrated by use of abstraction for classification, communication and indeed design, according to the standards of a particular culture or group. Reference to culture or group is important, for concepts are relative. What one generation of architects regards as sound and objective concepts may be regarded as irrational by the subsequent generation. In recognition of this fact we shall give contemporary as well as historical examples in our explanation of

different types of concepts and their relevance to brief-making and design which now follows.

Four types of concepts can be distinguished: class concepts, dimensional concepts, explanatory concepts or principles, and singular concepts.<sup>13</sup>

**Class Concepts:** Knowledge is highly ordered. Knowledge of the concept of windows implies knowledge of their position in a cognitive structure. Windows are a subordinate part of what can be called physical control devices; other subordinate elements of physical control devices are walls, roofs, rooflights, ventilators, doors. Windows in turn have their own subordinate classes: sash windows, timber windows, steel windows. Thus class and category here are synonymous, and they are discrete structures; they vary qualitatively from one another: columns, rooms, beams, corridors. Unidimensional classes are defined by one feature or one attribute only: red objects, massive things, brittle materials. But most class concepts tend to be multidimensional: long dark unfriendly corridors, inward looking arrangement of rooms, in situ concrete, framed multistorey block of flats. Thus class concept is "either a set of elements satisfying some criterion or else the criterion itself".<sup>14</sup> We may illustrate the properties of classes with reference to physical control devices. If we regard the purposes of these as filtering, forming barriers, offering switching mechanisms, offering connection,<sup>15</sup> a window possesses the attributes of a filter, switch and connector. A window acts as a filter to heat and cold, and as a visual connector; and since it can regulate both these by being open or closed it serves as a switch.

The language of logic and psychology makes three principal distinctions between conjunctive, disjunctive and relational classes.<sup>16</sup> A conjunctive class is defined by the presence of several attributes. Pugin attempted to set up a conjunctive category for churches: all churches should have pointed windows, steep pitched roofs and spires.<sup>17</sup> To give an example from contemporary practice of design, the brief for a children's home may state that the proposed building must attempt to combine the virtues of one's own home with the requirements of group living.

More difficult to grasp is the disjunctive class defined by any one of two or more attributes. Alberti<sup>18</sup> - following his recommendation of a number of desirable plan shapes for churches - suggests that plans derived from a square may be enriched by one chapel at the far end or, in addition, a central chapel at each side, or an odd number of chapels at each side. For a circular plan he suggests the addition of six or eight chapels, and for polygonal plans one chapel for each wall, or one each to alternate walls. At the early briefing stage of a housing project an architect may suggest to his clients either to build an entirely low rise development or, if they want to build a mixed development using some tower blocks, he may suggest that they choose the tenants for the tower blocks extremely carefully and provide as much compensatory provisions as possible for the inconvenience created by this type of block.<sup>19</sup> According to many case studies<sup>20</sup> elderly people spend a great deal of time sitting by the window observing the outside world; in view of this, a brief for an old people's home may suggest that the main rooms of flats must look onto a busy thoroughfare or into a well designed internal area (e.g. courtyard) of lasting interest.

The main difficulty in the acquisition of disjunctive class concepts is caused by their arbitrariness; that is to say the lack of relation between those attributes which can substitute one for another.

The relational class is characterised by a specifiable relationship between defining attributes rather than by the simple presence of these features. All systems of proportion in architecture are relational concepts. In one of his projects which modified an existing environment based on his ideas on defensible space, Oscar Newman suggests that public seating in the centre of a public path must be provided in such a way that it is "at a distance from dwellings sufficient to eliminate conflicts over use, but close enough to be under constant surveillance by residents".<sup>21</sup> Building regulations specify certain relations between riser and tread of staircases.

What is particularly instructive about psychological findings on class concepts is that the manner in which a person classifies new instances depends to a large extent upon concepts he has constructed out of instances he has already encountered. In other words, when one learns to categorise a set of events one is doing more than simply learning to recognise instances encountered; one is also learning a set of rules that may be applied to other instances.<sup>22</sup> After all, when a student of architecture learns about emergent model solutions he also learns something about the circumstances in which these models may be used as solutions. Unidimensional classes are more easily learnt than multidimensional ones, and of the latter conjunctive classes are easier to learn than disjunctive and relational classes. We know that legal writings use a considerable amount of disjunctive and relational classes in order to

avoid ambiguity and very often to such an extent that the text becomes incomprehensible to the layman. But in architectural brief-writing the exact opposite happens. The temptation to write the brief in terms of unidimensional and conjunctive classes can be too strong to resist. For instance in the example of public seating and public path mentioned in connection with Oscar Newman's work, a brief-writer is more likely to employ one of the following statements rather than a relational description: 'anonymous public seating must be avoided' or 'public seating should not interfere with the privacy of residents'. If statements such as these are to avoid ambiguity they need to be expanded, giving more information about the design situation. Such an expansion is highly likely to employ multidimensional classes, more particularly disjunctive and relational classes. Now the implicative power of emergent models is largely due to the fact that they embody multidimensional concepts. Thus coordinated traffic and pedestrian movement, minimisation of cross currents of traffic, combining the benefits of urban and rural living, avoidance of disturbance to already completed areas by subsequent building activity, etc. which we used for describing linear planning are in fact examples of multidimensional class concepts.

**Dimensional Concepts:** Making sense of the environment involves not only organising things and events into abstract classes but also positioning them in abstract dimensions. Class concepts and dimensional concepts have a great deal in common, but generally classes or categories are discrete and dimensions tend to be continuous. Narrow corridors, expansive open spaces, gloomy rooms, compact lay-out are a few examples. Since the relevant perceptual

qualities such as size, colour, loudness, etc. are involved in the definition of most dimensional concepts in most human activities they do not pose any special problems. But those based on abstract dimensions - for instance degree of privacy, environments that create a high degree of impact on the users - do pose problems to which we give a detailed consideration in Chapter V.

**Explanatory Concepts or Principles:** Oscar Newman's personal space concept is in fact a principle and involves a higher order of complexity than the types of concepts explained so far.<sup>23</sup> A principle aims to state interrelations between dimensional and class concepts, and takes the form of a proposition whose truth values may be established. For example: a clear definition of spaces as public spaces and private and personal spaces (using highly obvious physical elements such as curbs, bollards, fences, etc.) leads to a better maintenance of these spaces.<sup>24</sup> In the long run principles are much more important than concepts, but concepts play a more direct part in the process of design; principles help us to understand and predict events, while concepts help us to identify the events and refer to them and as such are crucial for our explanation of the model-based thinking of the architect.

**Singular Concepts:** The distinction that psychologists make between this category and concepts in general is that singular concepts are a cluster of mental images, memories, perceptions, affects, associations, based on either personal experience or acquired through communication with others.<sup>25</sup> For instance it is common to speak of one's own idea of a home, a good life, a good book. Singular concepts have much in common with symbolic generalisations; but the former are personal, while the latter involve group commitment.



Much research and discussion on productive thinking<sup>26</sup> suggest that 'synthesis'<sup>27</sup> in general is governed both by a process of sampling from class items previously learnt<sup>28</sup> and by a conceptualised ideal or model which is in fact what the subject anticipates to be a desirable solution.<sup>29</sup> This is very much a conclusion we ourselves reached in the last two chapters through the study of design instances, but in the case of architectural design it is very difficult to establish class items that have been learnt previously. In our explanation of class concepts we argued that there is a link between concepts and emergent models. Psychological studies enable us to strengthen that argument. In The Psychology of Thinking Johnson<sup>30</sup> points out that in the case of complex problems 'synthesis' resembles a multidimensional concept, in that the descriptions of the product are analogous to the attributes of a concept. A model is a conceptual achievement. It is a general conceptualisation of solutions, not a particular solution, very much like a class concept. Like in class concepts, knowledge of models is a cognitive acquisition dependent upon past experience, training and social communication. Class concepts are standard and fixed in a particular culture, whereas models are 'transient' and difficult to standardise. While class concepts aid classification of objects and communication about objects, models guide production of solutions and to a certain extent communication about solutions.

It is these facts about models or conceptual ideals in general that tie the notion of concepts with the notion of information for design. Our observations in Chapters II and III distinguished between personal and emergent communal models. Certain types of personal models, for instance those used as heuristic devices, are

of course difficult to identify; but other types of personal models and all the emergent models can be at least roughly identified, and their attributes specified. Even when models are implicit or submerged a close scrutiny of successful<sup>31</sup> buildings of sufficient similarity to the one proposed should yield extremely relevant design concepts. The explanation that design is model-based has so far been essentially a description of architects' thought processes. In this chapter we see the possibility of transforming that description into the beginnings of a method. In the case of Epstein's attempts to apply linear planning principles to the universities of Lancaster, Ghana and Warwick we have seen that the model and these diverse situations possess at least a few analogous properties. In stretching the concepts by which a model is described we simply exploit the existence of these structurally analogous properties. Through the inclusion of concepts which are precise we can help the architect to identify and develop model solutions to fit particular circumstances. The extension of the notion of information for design to include complex but precisely formulated concepts can also determine the validity of the proposed solution by enabling us to check the extent to which the proposed model and the field of application are isomorphic. Thus we move away from the idea of a fit between activity and space which underlies the traditional approaches of brief-making to a richer situation where the aim is to produce a 'goodness of fit' between the major attributes of emergent models and their field of application.

We end this chapter by pointing at the difference between concepts and information. Concepts are attributes of models and as such give directly certain features of built form. Information on the other

hand only helps us to determine built form and in itself is not 'form' or a feature of 'form'. While concepts compel the designer to settle down to immediately obvious solutions, information enables him to keep a free and open mind and use it to stretch and develop concepts further and further. About this aspect of information there is a great deal more to be learnt but the scope of this thesis permits us to consider it only with reference to information on qualitative aspects of design.

## Chapter IV : Notes

1. What is implied here is that behavioural conceptions can lead to simplifications which may affect the quality of design. A brief illustration may strengthen this point: 'dining' can be regarded as an activity requiring resources; following the approach of anthropologists it can also be regarded as interaction between people, objects and environment. The latter view is obviously more multidimensional than the behaviourist view. As we proceed we shall discover how important differences of this kind can be.
2. We can regard ADM, RDS, etc. as extensions of behavioural research and as such they can produce highly relevant design-related information for specialised areas like an operation theatre in a hospital or a photographer's dark room. It is pointless to pretend that data on every kind of space can be gathered using methods of this kind. The drawbacks of ADM, RDS, etc. as by-products of behavioural research are discussed in Appendix 3.
3. Bruner, J.S., "On Going Beyond Information Given" in Contemporary Approaches to Cognition, Harvard, 1957.
4. The reason why only emergent models are mentioned here is that certain types of personal models - particularly those that are used as 'heuristic devices' - are unlikely to be accessible to the brief-writer, unless of course he is also the project architect. Further, since they are idiosyncratic, communication about this kind of models is likely to be difficult.
5. The same applies for the notion of 'techniques'. It is also possible to link the elements - information, concept, skill and techniques - with the sequence of design operations and talk about information needed at the analysis stage, concepts leading to synthesis, etc. Other than being of academic interest, such complex links seem to be of little practical value.
6. There are however some psychological works which offer a clear and helpful explanation of the difference between the two and it is from one of these that our later definition of information has been developed. See for instance
  - (a) Gleason, Henry Allan Jr., Workbook on Descriptive Linguistics, New York, 1955, pp.266-83.
  - (b) Mackay, D.M., "Information Theory and Human Information Systems" in The Impact of Science on Society, a UNESCO Publication, 1957.
7. This definition of 'information' has been adapted from Mackay, ibid.
8. The acuteness of the problem of using data from social research has been analysed by Brolin, Brent C. and Zeisel, John, in "Mass Housing, Social Research and Design" in Architectural Forum, July/August 1968, pp.67-71.

9. The discussion on informational sufficiency is based on the treatment of it by Bruner, J.S., Goodnow, J.J., and Austin, G.A., in A Study of Thinking, New York, 1956, p.65.
10. The main references for the ideas on concepts expressed here are:  
 (a) Bruner, J.S., et al., ibid.  
 (b) Dienes, Z.P., and Jeeves, M., Thinking in Structures, Stroudsburch, Penn., 1965  
 (c) Johnson, Donald M., Systematic Introduction to the Psychology of Thinking, New York, 1972.  
 (d) Rietman, W.R., Cognition and Thought, New York, 1965.
11. Langer, Suzanne K., An Introduction to Symbolic Logic, New York, 1953, p.43.
12. Bruner, J.S., et al., op.cit., pp.62-64.
13. (a) Bruner, J.S., et al., op.cit.  
 (b) Johnson, Donald M., op.cit.
14. Rietman, W.R., op.cit., p.98.
15. These attributes are taken from Norberg-Schultz, Christian, Intentions in Architecture, Oslo, 1963, pp.112-14; but his interpretation of each attribute is slightly different from ours.
16. (a) Bruner, J.S., et al., op.cit.  
 (b) Langer, Suzanne K., op.cit.
17. This example was suggested by Geoffrey Broadbent in a privately obtained paper.
18. Wittkower, Rudolf, Architectural Principles in the Age of Humanism, London, 1949, pp.3-4.
19. Research by Pearl Jephcott has identified what type of families living in tall blocks seem to be reasonably satisfied and what kind of compensations for the inconvenience caused by these blocks may be provided. See "Homes in High Flats - Some of the Social Issues" in Architecture and Social Sciences edited by Raman, P.G., Edinburgh, 1973, pp.71-95.
20. Haynes, K.J., and Raven, J., "Old People - Study of Living Patterns" in The Architects' Journal, 26th October, 1966, pp.1051-66.
21. Newman, Oscar, Defensible Space, New York, 1973, pp.167-69.
22. Bruner, J.S., et al., op.cit.
23. Newman, Oscar, op.cit.
24. It can be argued that some of the concepts used to describe linear planning can be developed into principles. This is true, but the process by which concepts are transformed into principles is complex. Let us consider our example of personal space. As we have

already pointed out, interest in territoriality grew largely as a result of problems posed by anonymous open spaces which the modern block planning and tower blocks created. From this interest grew certain researches about open spaces around buildings which now offer the principle about personal space. Until this process is complete concepts remain concepts, serving as components of emergent models.

25. Johnson, Donald M., op.cit., p.36.

26. Problems treated under 'productive thinking' tend to be those which do not have a single correct solution and have to be discussed in terms of the degree of suitability for the situation, originality, and so on.

27. Psychology of productive thinking normally uses preparation, production and judgement to describe the sequence of operations involved. These are rather similar to analysis, synthesis and evaluation. In order to keep the terminology as simple as possible the term 'synthesis' which is familiar to architects will be employed.

28. This is known as 'production by response hierarchy' in the language of psychology.

29. Johnson, Donald M., op.cit., p.331.

30. Op.cit., pp.331-32.

31. These should include buildings that are considered successful both by the profession and by their users.

# **V. INFORMATION ON QUALITATIVE ASPECTS OF DESIGN**

## V. INFORMATION ON QUALITATIVE ASPECTS OF ARCHITECTURE

The idea of quality in architecture is connected to the fact that the purpose of buildings transcends the satisfaction of merely utilitarian requirements. The object of this chapter is to define this 'quality' which we all recognise in successful buildings and to examine how brief-making can benefit from such definition.

Architects can and do create qualitative features in their designs without being able to offer a credible explanation of what these are and how they are conceived; this is rather similar to native speakers' capacity to produce complex sentences without being able to explain or even being aware of their underlying phonological and grammatical structure. In suggesting this parallel the tacit assumption is that the creation of architectural quality is governed by some kind of orderly, dynamic and law-like structure. How valid is this assumption? If it is valid, how does one construct that structure? Having constructed it, how does one know if it embraces widely differing examples of architecture in a meaningful way? Other than offering an academic explanation of the so-called qualitative aspects of architecture, what other useful purpose can this structure serve, anyway?

The answers to these questions are to some extent contained in the nature of our proposed structure, and therefore it seems best to begin by making its outlines explicit. A study of theories of architecture<sup>1</sup> in different periods of history suggests that there



are two recurrent, diametrically opposed views about quality in architecture. On the one hand there is the view that increasing the effectiveness of the functional/practical aspects of architecture is what produces pleasant buildings, while on the other hand there is the view that quality in architecture involves enhancing the interest of users in the building through the creation of special effects using mass, space and light. The view taken in this chapter is that it is not necessary to think of these two extremes as mutually exclusive; it is in fact more profitable to accept that quality in architecture involves both, and on this basis construct our structural approach. The phrases 'increasing the effectiveness of the functional/practical' and 'enhancement of users' interest through the creation of special effects' can be regarded as two distinct functions of qualitative features of architecture, where both extremes appear in closely connected ways. For instance, a well designed foyer of a concert hall serves to increase the effectiveness of the functional/practical because it enables efficient ticket-checking, allows people to wait in comfort for their friends, and so on. At the same time it is also an inviting place and a transition place from the public world of the streets outside to the isolated world of the concert hall; it also aims at preparing the concert goer for an intense, formal occasion. Although it could be argued that the latter characteristics are also concerned with the functional/practical aspect, it cannot be denied that producing inviting spaces involves the creation of certain special effects.<sup>2</sup>

Past architectural theories reveal further that qualitative aspects of architecture are described (a) with respect to factors

such as mass, space, line, solids, voids, landmarks, paths, rooms, volumes, roof lines, edges; and (b) with respect to factors such as privacy, friendliness, dullness, monotony, and dignity. Both (a) and (b) represent a variety of unrelated terminologies and in order that they may be incorporated in a structural view of architectural quality it is important to devise a system of universal categories as opposed to familiar terms like the above, so that the latter may become sub-categories of the former. We suggested in Chapter III that it is expedient to call entities such as those given in (a) as 'elements', since this term can accommodate several types of these at a variety of levels. Terms such as privacy, friendliness, etc. are abstract concepts, so we will simply call them 'abstracts'. We have already pointed out that in describing buildings we not only refer to elements but also to relations between them. Thus the term 'relations' designating meaningful ways of ordering and distributing elements can be used as a component of our structure. Lastly, in describing the quality of any environment it is very difficult to overlook the interaction between objects and users - that is to say the quality of an environment cannot be considered in isolation from any of the actions and events that take place in it. It may seem superfluous to state that a space must be created keeping in mind the actions and events in which the space itself or its elements will play a part. But the temptation to concern oneself only with the behavioural and ergonomic notion of a series of isolatable activities as opposed to the anthropological view of social interaction in which users and objects bring about actions and events is sometimes difficult to resist.

Elements, actions, abstracts and relations give us universal categories of features of an environment.<sup>3</sup> By combining these with qualitative functions we obtain a function/feature model which enables us to explain qualitative aspects of design in a precise way. Fig.5.1 shows this model, and to see how it can help in describing environments let us examine our example of a foyer a little further.

	Elements	Abstracts	Relations	Actions or Events
Increase effectiveness of functional/practical	A	C	E	G
Enhance interest	B	D	F	

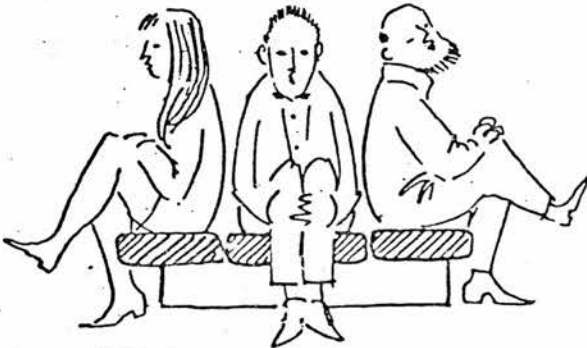
FUNCTION/FEATURE MODEL OF ARCHITECTURAL QUALITY  
FIG.5.1

Item A refers to functional/practical aspects such as efficient ticket-checking, and waiting in comfort; items B and D are concerned with the fact that it should be an inviting place and that its character is such that it puts the concert goer in the right mood for an intense, formal experience. Traditionally, of course, actions and events are not considered relevant to the formulation of qualitative aspects of design. But consider the following criticism of the foyer in the Queen Elisabeth Hall by Yehudi Menuhin:

"... acoustically the foyer is a jungle. If it is full of people it sounds like a bird house at the zoo. It seems to me not sufficient account has been taken of the presence of people talking in it."<sup>4</sup>

Consider also the criticism summed up by the two cartoons in Fig.5.2. All these are concerned with actions and events: cartoon I shows the need for functional effectiveness with respect to actions and events that take place in a foyer; cartoon II is partly to do with

the failure to create interest in the act of conversation through better seating arrangement. Both are of course connected with elements (foyer and furniture in it), but we can only apprehend the features of these elements which make a contribution to architectural quality through a description of actions and events in which these elements are involved. With respect to items C and D, very often abstracts are not important in themselves but what is important is what is being said using them, and what is being said is usually concerned with elements and relations (e.g. compactness). In rare cases however certain qualities of environments need not be very closely connected to the tangible elements and their relations. An extreme example of where qualities of environments are created in this manner is when set designers try to capture a variety of environments through abstract means, that is to say without employing any realism. Something like monumentality, for instance, can be just an image. Although we may be able to trace components of that image to physical features, these need not be the ones which we



'If they do sit down they cannot have a proper conversation'

FIG.5.2 (II)



'I could have wished that the design of the bar had been thought out differently!..'

FIG.5.2 (I)

conventionally associate with elements used for creating monumental buildings. Also, in any ordinary talk about qualities such as, for instance, privacy or cosiness, there is only an implicit reference to physical features. For these reasons it seems more desirable to list abstracts as separate categories; however in the example of the foyer a requirement such as that it should allow efficient ticket-checking belongs to A as well as to C, and the formulation that it should be a welcoming place belongs to both B and D.<sup>5</sup>

Item E deals with the functional effectiveness of particular elements with respect to other elements, for instance the requirement that circulation between foyer and auditorium must be smooth and effective. Lastly, with regard to item F, it may be suggested that the atmosphere of the foyer must be in sharp contrast to that of the concert hall. This feature/function model is thus a way of considering and describing the qualitative side of architectural requirements. Although qualitative requirements are rather subtle and intangible, the proposed model enables us to be clear about requirements of this kind. It is a way of considering qualitative aspects of design in all their complexity and in their dynamic relation to other factors. Qualitatively speaking, an environment or setting becomes a frame of reference within which actions and events take place; it is an organiser of both physical facts about the environment and of possibilities for actions and events. Thus the role of qualitative features of architecture is not merely psychological, but is to be seen as playing a social, aesthetic and, in many ways, a practical part in actions and events.

Qualitative features of design are certainly to do with a frame of reference in the mind of users and all the physical properties of

the environment as well as the actions and events that take place in it are involved in the imprinting of that frame of reference. Substantial group agreement on what that frame of reference is in a qualitatively desirable environment does exist and can be discerned through the employment of our hypothetical function/feature classes. By this it is not meant that such classes can be proved to exist in the mind of users, like Platonic archetypes, but that features of a qualitatively successful environment can - through systematic study - be seen to embrace these classes in unambiguous ways. This is the gist of our theory about qualitative aspects of information. One very obvious limitation inherent in the nature of this theory is that topics such as aesthetics, symbols, meaning, and so on cannot be covered by the function 'enhancement of users' interest and creation of effects'. These topics are certainly part of architectural qualities, but our attitude here is that what is analysable must be analysed, and to do so is not to deny or ignore the existence of the unanalysable. Problems of aesthetics<sup>6</sup> are personal and controversial and we make no attempt to include them in our theory. However some aspects of symbols and meaning can be analysed, and are included in our model.

#### Symbols and Meaning as Components of Architectural Quality

Symbols are creative outgrowth of man's nature. They represent concepts that he cannot or chooses not to deal with directly. They are frequently used to signify the mysteries of life, cosmos and God. Architectural history reveals a variety of symbolizations.<sup>7</sup>

Erect stones of the Megalithic period symbolized the procreative forces; massive walls at different times in history have symbolized power; the imperial palaces of Rome symbolized the divine order represented by the emperor; and the Christian Church adopted much of the Roman symbolism. The paleo-Christian basilica attempted to represent heavenly Jerusalem; the Gothic cathedral stressed the importance of heavenly aspects further. The architecture of the Renaissance was also based on a number of symbolic ideas (e.g. Vitruvian man defining a circle and a square as representing the reconciliation of divine perfection and earthly existence<sup>8</sup>). According to Norberg-Schultz<sup>9</sup> the development of this kind of symbolization was halted by the nineteenth century tendency to devalue symbolic features of past forms through misuse (e.g. the use of domes and pediments to dignify museums, banks and other institutions). Norberg-Schultz suggests further that with the need of modern architecture to create meaningful environments the demand for cultural symbolization has come to the fore once again. However the situation seems much more complex than this. In his The Eclipse of Symbolism<sup>10</sup> Fingesten suggests that in an age of intense scientific enquiry symbols representing man's fears, respect and devotion seem to become less useful. Since symbols stand for something beyond themselves, they seem out of harmony with the empirical temper of our times. It is of course possible that in an ensuing age interest might turn from science to faith and superstition, and symbolism might again become widespread; but it is hardly advisable to develop a system of what future architectural features may symbolize on the basis of such a conjecture. It is true that symbols representing man's fears, respect and devotion are only one

type. At lower levels there are many other kinds of symbols which are very much part of actions and events in which human beings participate; but architectural writings rarely attempt to make any distinction between different kinds of symbols. There has been a great deal written about symbols by distinguished authors in many fields - but the insights these works offer have not yet penetrated the field of architecture.<sup>11</sup>

Human beings select by one means or another stimuli which reach their brain. Information changes form as it moves along the path from stimulus-object to percept within the mind: for instance, there is a difference between our knowledge of a particular house and the mental concept 'house'. Thus percepts and concepts are mediated, but they are still directly linked to stimulus-object; symbols are one step removed from this immediacy. Symbols are not the only things which represent other phenomena. In fact it is customary to call the class of objects employed to refer to or to represent something else as a sign, and to treat symbols as a type of sign.<sup>12</sup>

There are three primary factors involved in the use of signs:

- 1) a stimulus (that is any object, event, quality or relation that can be perceived) which may be employed as a sign;
- 2) that which sign refers to, calls attention to, or causes some organism to take account of, which is called a referent;
- 3) for a sign to function, an organism must grasp the relationship between it and the referent it stands for. Any such organism is an interpreter.

Thus when a factory worker (interpreter) hears a whistle (sign) he knows that it is time to stop the work (referent). If an object is



to function as a sign, the interpreter must shift attention from the object itself to its referent - that is to say the factory worker does not pay any attention to the intrinsic qualities of the whistle itself. Here lie at least some of the difficulties of using architectural elements as a sign - and therefore as symbols - particularly if the intrinsic qualities of architectural elements as objects draw attention to themselves.

The classification of different kinds of signs depends upon the attributes one selects. But to understand signs in connection with architecture it is necessary to focus attention upon the relationship between a sign and its referent. On this basis three kinds of signs may be identified<sup>13</sup>: icon, index and symbol. Icons represent formal associations, that is to say when a statue acts as an icon it is the physical resemblance that relates an icon to its referent. Percepts and concepts involve natural relationships to phenomena, and so it is with index. Clouds are a sign (index) of rain, snoring is the index of someone sleeping. We constantly employ this type of sign in our normal adaptation to the environment. The third kind of sign is the symbol. It is distinguished from the other types of sign by virtue of an arbitrary relationship between stimulus - object and referent (in contrast to the formal relationship of an icon and its referent, and the natural relationship of an index and its referent). The wave of our hand which is a symbol is not related to the departure of a friend (referent) in the same way that smoke is associated with fire, or clouds with rain. The relationship is much more arbitrary, but symbol involves implicit rules or meanings for attaching it to a particular referent. Modern architects, when they attempt to create symbols, seem to be

unaware of this basic characteristic. For instance Eero Saarinen's TWA Terminal at Kennedy Airport is supposed to symbolize flight. But in actual fact it is not a symbol, because it attempts a direct relationship between its own form and that of an aircraft. So the most one can say is that it makes a half-hearted attempt to be an icon, and as such it may or may not have on the users the effect which the architect intended. There are many other examples in modern architecture which suggest that designers have not understood the nature and consequence of the human use of symbols. First, symbols reduce our dependence upon immediate sensory experience. Second, our ability to communicate depends largely upon symbols, and since a wide variety of stimulus-objects produced by human beings can be used as symbols (closed eyes, raised arms, buildings raised on a podium, clapping of hands, etc.) it is necessary that all the users know or are aware of the implicit rules or meanings for attaching these stimulus-objects to referents; otherwise the intended communication will not occur. This suggests that an architect can hardly create symbols through his design, and that he has to use symbols which have already evolved in society. This does not mean that man cannot create new symbols, but rather that he does so only under certain circumstances (usually when drastic changes in society are taking place) and even then it takes a long time for society to understand, accept and use the meanings linking the symbol and its referent. Lastly, as we have already mentioned, symbols not only reduce our dependence upon sensory experience but also allow us to create worlds which have no empirical reality at all.

We are now moving away from a consideration of symbols as those founded on man's fears, respects and devotions, to a consideration

of them as a type of sign playing an important part in the interaction between man and objects. The arbitrary nature of symbols at this level makes the understanding of the meanings which link symbols and referents important for effective communication. It is necessary to probe deeper into the idea of meaning in order to say anything useful on the symbolic aspects of architecture.

There is considerable controversy surrounding architectural literature which deals with the issue of meaning.<sup>14</sup> These works attempt to derive their explanations and methods from semiology, linguistics and structural anthropology. Our view is that the meaning of architecture and of its components can be effectively considered directly as qualitative features. In applying some of the insights coming from other fields, many works, while clarifying certain issues, also introduce new confusion which could be avoided by a direct attack.

Three types of meaning can be distinguished,<sup>15</sup> namely the meaning of relational systems, referential meaning and emotive or connotative meaning. We will consider each of these as encountered in architecture. We begin by considering the meaning of relations, for this is much less understood than the other two and therefore more likely to lead to misunderstanding; and also because structurally speaking referential and emotive meanings seem to follow naturally the meaning of relations - that is to say the former two may be said to begin where the latter leaves off.

#### Meaning of Relations

When we think of meaning it is almost inevitably in terms of elements of architecture; for we take relations between different

elements for granted, since they seem to be merely a set of arbitrary rules about arrangements - rules that must be followed if one is to design a building that meets certain practical requirements; but in itself the manner in which elements are put together has no meaning. For instance, in an attempt to analyse the meaning conveyed by the form of a hall of residence<sup>16</sup> Charles Jenks considers appearance of architectural elements such as the total linear form, linear glass wall, linear concrete wall, concrete volume, precast walls, concrete sheds, metal funnel, and so on but not the interrelationship between them. He does not see specific arrangements of these elements as having any meaning by themselves. A close look at a simple design will soon convince us that the arrangement of elements does carry some meaning. If we think of the rings shown in Fig.5.3 as walls, the breaks as openings, the six dots as stools and the other shapes as altars, icons, kneeling benches, coat racks and baskets, only certain specific arrangements will produce a chapel. Although the function of praying can happen with any arrangement of these elements, the building receives the significance of a chapel only when the elements are distributed in a certain order.<sup>17</sup>

Likewise, the converse should also be recognised, that is to say the same architectural arrangement may have many different meanings. This is no better illustrated than by Herman Hertzberger's assertion<sup>18</sup> that "A form's yield can be increased without the need to do less than justice to its primary function. Therefore a form must be capable of interpretation in the sense of being conditioned to play a changing role. It must be made such a way that the implications are posed beforehand as hidden possibilities evoked without being openly stated. Everything must be so formed that one can make it

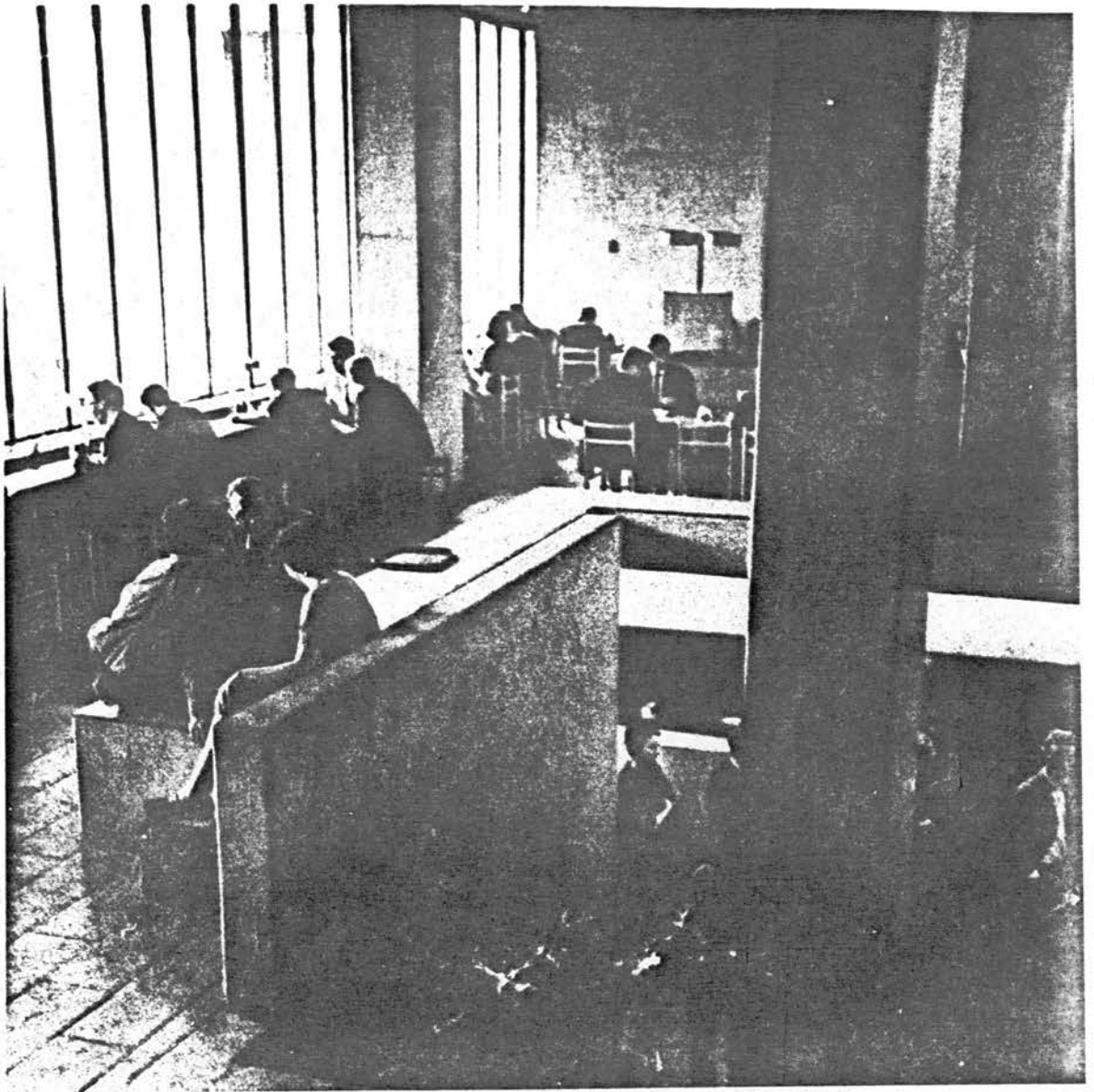
relevant to himself according to his own interests and in this way it may contain separate, adequate implications for everyone." The restaurant in his student hostel in Amsterdam (Fig.5.4) illustrates the fact that a concrete shelf arranged at a certain height can be interpreted both as a bench and as a table.

It may seem unnecessary in this connection to refer to the idea of meaning at all, particularly since it appears that convenience rather than anything else makes it possible to use the shelf both as a bench and as a table. There is however more to it than this. Function tends to be fixed across cultures, whereas meaning can vary. The same concrete shelf if provided in a place where matters are more formal will have an entirely different significance. Once the function of objects gets established it is difficult to know where meaning has stopped and where function (or utility) has taken over. Questions of meaning are certainly subtle and it may well be that meanings of objects cannot be considered in isolation from functions of objects, but the process of design can benefit a great deal by regarding meaning as though it is prior to function.<sup>19</sup>



PLANS FOR A CHAPEL  
(source: William S. Huff, 1966)

FIG.5.3



HERTZBERGER'S STUDENT QUARTERS AT WEESPERSTRAAT, AMSTERDAM  
(source: Architectural Record, July 1968)

FIG.5.4

## Referential Meaning

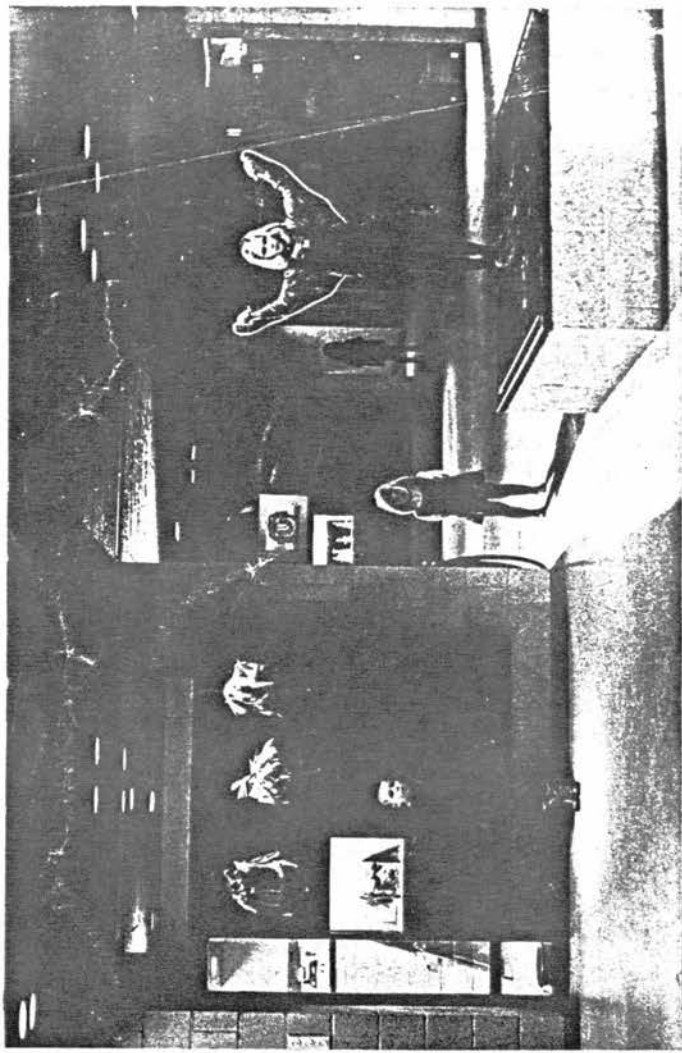
This type of meaning is generally accepted as the dictionary meaning, although a good dictionary may give some indication of connotative or emotional meaning as well. There is a problem in considering referential meaning of architectural elements. Much confusion has been created by the tendency of investigators to identify meaning totally with the words used to designate the object and to think that once the words have been studied the problem of meaning has been solved. The object and its situational meaning must be studied independently of language. After all, objects must have signified something in the pre-linguistic period of the human race. Words too have meaning, but that constitutes a separate problem. The meanings of words are to be found in the process by which they enable the originally established meanings to recur in the absence of the objects and as such they are a part of human communication. The meaning of architectural elements arises from social interaction when the object is present and not when it is absent.<sup>20</sup> Other than this general difficulty, in architectural contexts referential meaning poses problems only when an architect has to choose between alternative elements which seem to have equal validity - for instance between double bedrooms and what has come to be known as 'duplex rooms' among architects who design halls of residence; between living/dining rooms and separate living rooms and dining rooms in housing; between bed-sitting rooms and separate bedrooms and sitting rooms in old people's homes.<sup>21</sup> Undoubtedly the question of economics comes into decisions of this kind, but an analysis of what each alternative can mean to the users concerned can provide a more profound basis for decision-making.

### Emotive or Connotative Meaning

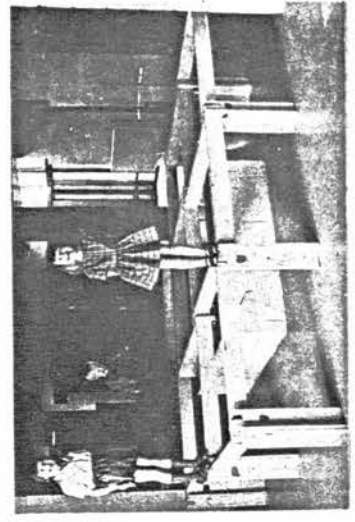
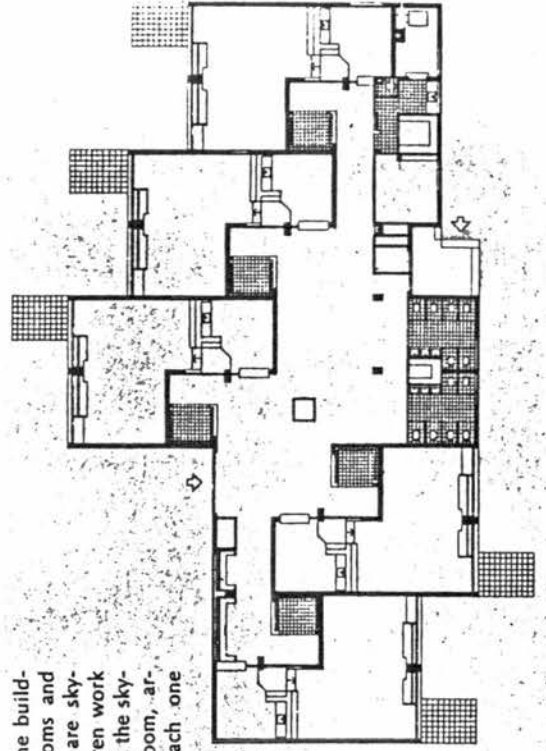
We not only grasp what elements such as study bedroom, living room, or a home, and abstract conceptions like privacy are, but react to these emotionally: sometimes weakly, sometimes strongly, sometimes positively, sometimes negatively. In this way elements and abstract embodiments serve as prompters of reaction and behaviour by the user. The existence of this aspect of meaning is illustrated by the example shown in Fig.5.5. It shows how a simple blockwork podium in the central point of a hall in a school can have several connotations and prompt a variety of behaviours by the users. As the designer of the building puts it, "the children take it for granted. They use it to sit on, as a table, to stand on, to make announcements or just to become taller people".<sup>22</sup>

It is a mistake to think that connotative meaning resides in the nature of architectural elements or in the abstracts we mentioned earlier. There are at least two principle sources which are responsible for the generation of connotative meaning: (1) association with users: as mentioned in Chapter I, for some people the living room of a house could be a symbol of graceful living, while for others it may simply be a place with a television set and a few comfortable chairs; (2) circumstances of usage: the same elements in different circumstances can carry quite different connotations. That is to say the nature of the context has an effect upon the connotations which people put on physical features. To take an extreme example, an experiment conducted in widely differing parts of Africa shows that in jungle areas blue sky is a favourite element<sup>23</sup> which connotes 'sunshine', 'life' and 'blessing'; while green areas in desert zones, with their associations of foliage, water,





The most active plans in the building are where the classrooms and hall merge. These places are sky-lighted, for here the children work in the hall. On the exterior, the skylights identify each classroom, articulating the place of each one within the building.

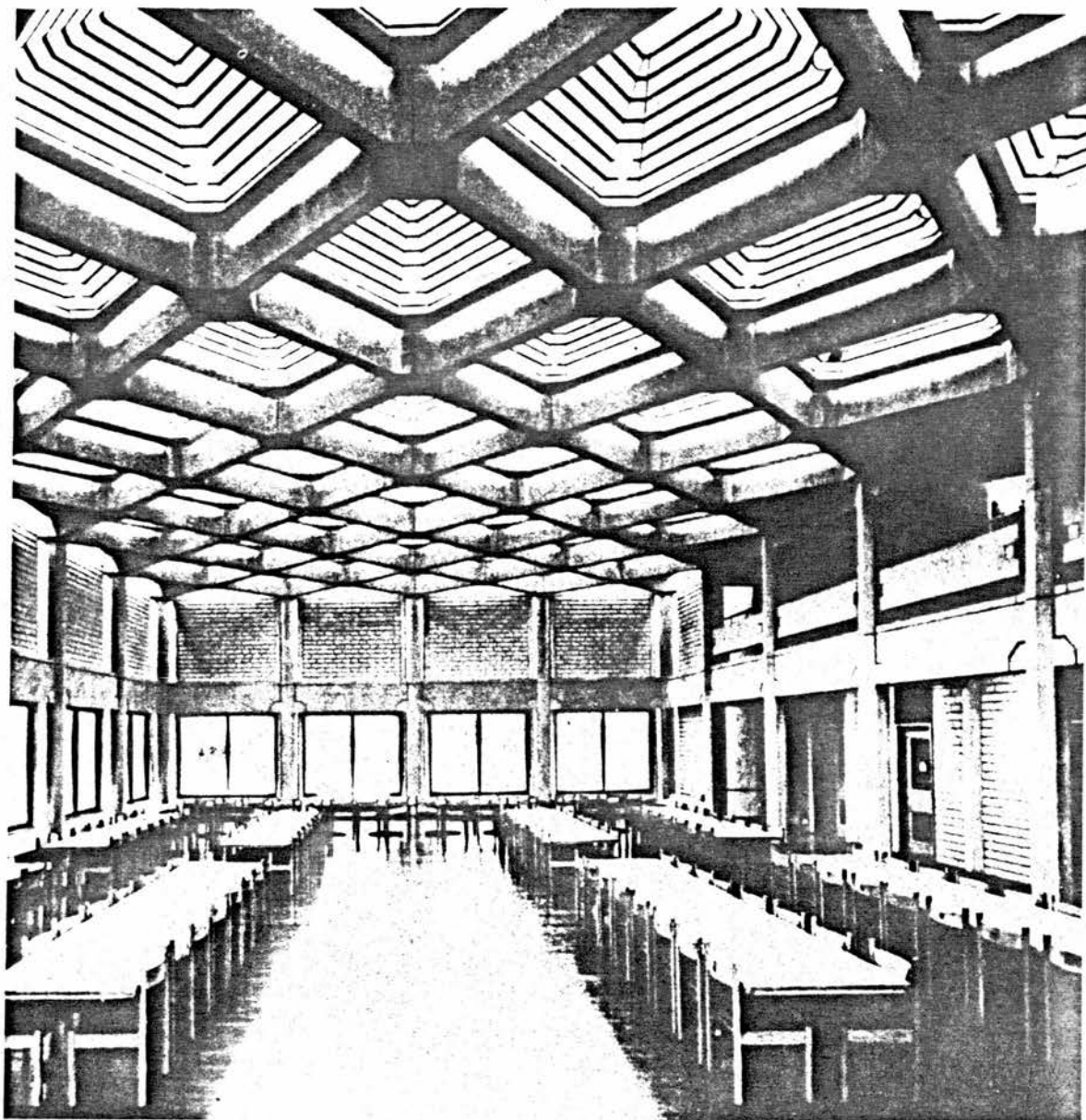


HERTZBERGER'S MONTESSORI  
PRIMARY SCHOOL AT DELFT.  
(Source: Archi tectural Record  
July 1968)  
FIG. 5.5

etc. carried the same highly valued connotations of 'blessing' and 'life'. Units in a block of flats which was well known in the area for its gloomy appearance were highly valued by the residents themselves; in comparison to what they used to have (in many cases cold and damp units in tenements with outside toilets) the present flat was a considerable luxury.<sup>24</sup>

Finally, it is possible to notice in many elements of a building such things as formality, informality, casualness, intimacy, and so on. These are quite different from abstracts like privacy, friendliness, etc.; they are an integral part of connotative meaning and can be labelled as levels of elements. The difference between levels such as formality and informality is often shown in the choice of elements, the expression they receive, and the interrelation between them. Factors like these, together with the type of users and the context in which the building or an element is placed, produce certain connotations. For instance compare the dining room in Fig.5.6 with the one in Fig.5.4. The former is steeped in the academic tradition of a formal refectory and the latter takes account of present day students' inclinations towards informality.

It would be convenient if connotations which buildings or their elements can have could be established in an objective way. Unfortunately, no adequate method of measuring connotative values of buildings and of their architectural elements is available. Perhaps the least inadequate ones are those developed from the works of Osgood, Suci and Tannenbaum.<sup>25</sup> They tested the reaction of many persons using a matrix in which scales from 1 to 10 marked off the polar contrasts of pairs of adjectives such as good-bad, beautiful-ugly, strong-weak, light-dark, high-low, warm-cold, and so forth.



DINING ROOM, ST.ANTHONY'S COLLEGE, OXFORD  
(source: RIBA Journal, August 1971)

FIG.5.6

Then each subject was given a list of words to evaluate on all those scales; words such as patriotism, love, communism, revolution, woman, mother, and many more. Each term had to be evaluated on all scales whether the subject thought it appropriate or not. The evaluations were then tabulated and subjected to highly sophisticated statistical analyses by computer so as to draw for each evaluated word a kind of 'profile' of the connotations. One might expect that people's reactions to words would be highly individual, but in fact a high degree of agreement was found, so that in most cases there is a typical 'bell curve' of reactions. In measuring connotation of words, Osgood et al. found it convenient to use three different types of scales: 1) evaluation as represented by adjectives like good-bad, beautiful-ugly, clean-dirty, pleasant-unpleasant, private-public, happy-sad, etc.; 2) potency as represented by heavy-light, hard-soft, masculine-feminine, etc.; 3) activity as represented by free-constricted, positive-negative, warm-cold, etc. A number of research workers in the field of architecture have used this method to obtain preference profiles of alternative designs, and have employed these profiles as a guide for decision-making.<sup>26</sup>

Our review of symbols and meaning has brought to light a number of shrewd and suggestive observations from other fields. There certainly are difficulties in dealing with symbols at high levels. But a consideration of symbolic aspects of objects and situations at lower levels (that is to say consideration of interaction between objects and users as symbolic interaction based on socially constructed meanings) enables us to include at least a part of symbolic aspects in our function/feature model of architectural

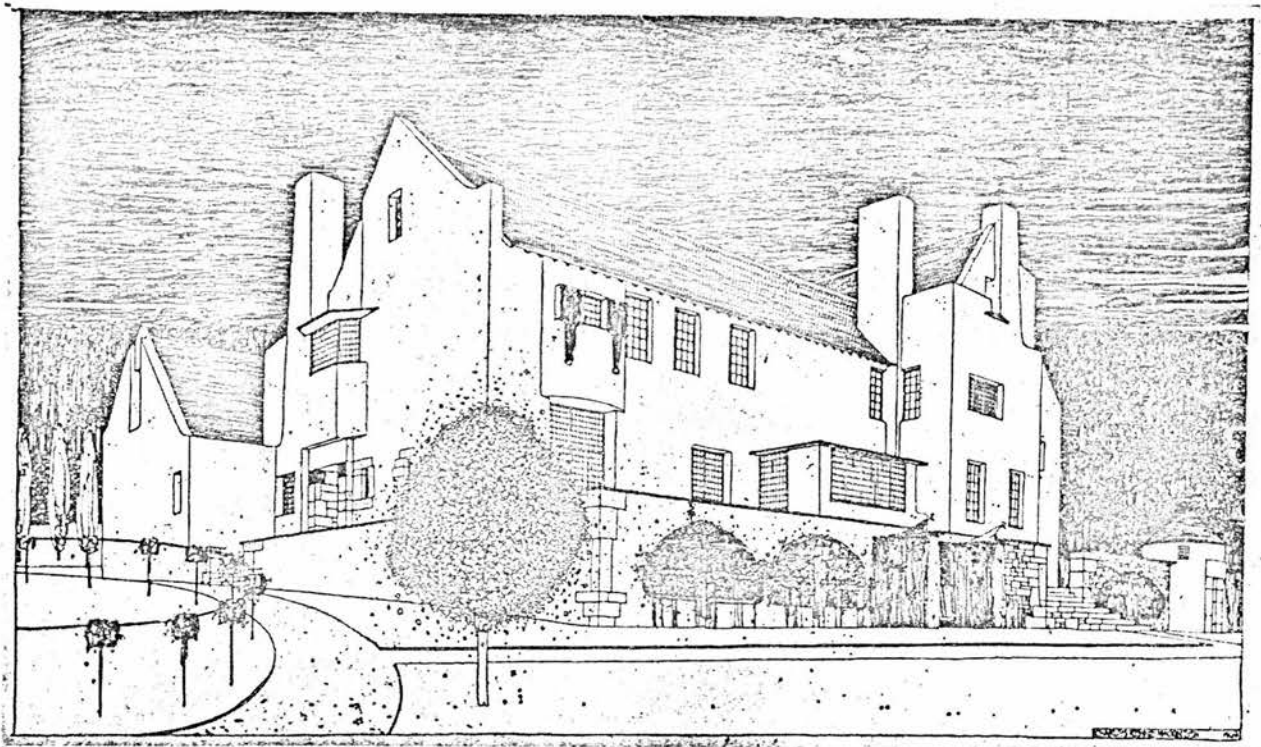
quality. Symbolic aspects and the associated notion of meaning at this level can legitimately be seen as part of the function of enhancing users' interest and increasing impact and effects created by features of an environment. However in order to show more clearly all the qualitative functions of various features of an environment we have to look at examples of successful architecture more closely.

#### Qualitative Features of Architecture in an Illustrated Example

Any building considered successful would have served us well as an example. Mackintosh's Hill House has been chosen partly because there does seem to be agreement as to its architectural quality between the architectural profession and the client who commissioned the project, and partly because of the availability of data on this project.

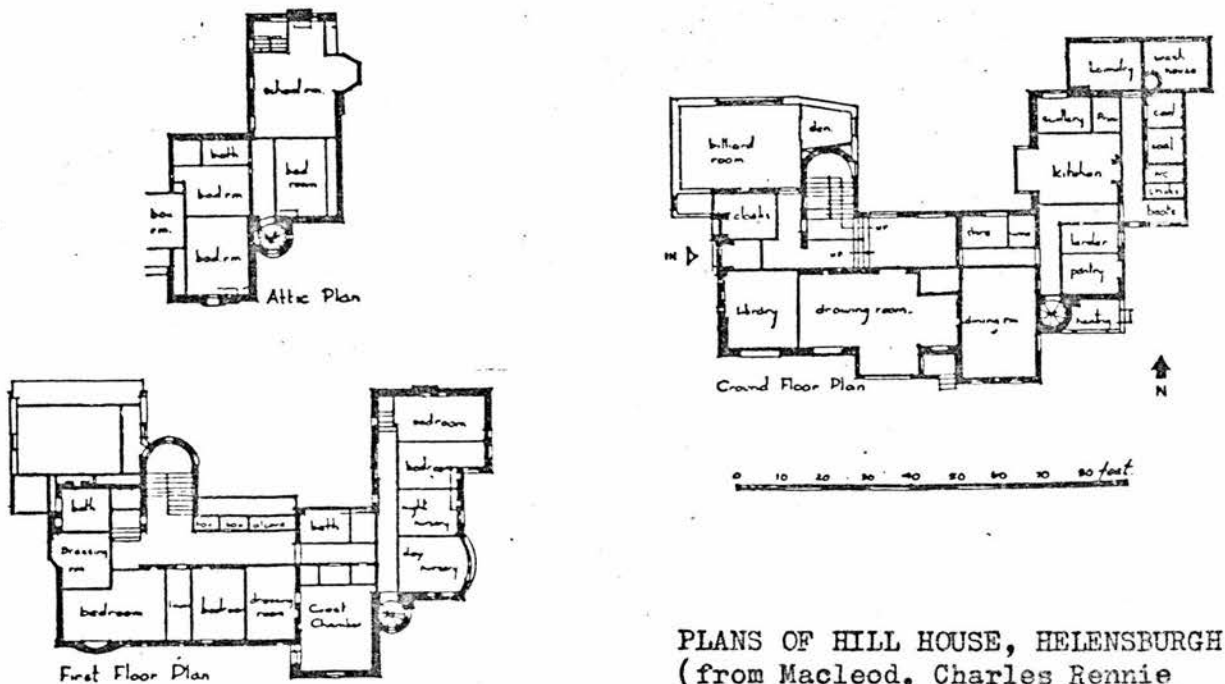
The site of Hill House<sup>27</sup> is on a gentle south-sloping hillside with a good view towards the town of Helensburgh and the Firth of Clyde beyond. Mackintosh paid particular attention to siting, orientation and layout. The garden was laid out according to his instructions in order to enhance the outlines of the principal facade on the south side. The house is built on a terrace of earth supported by stone retaining walls running west to east, and on the east becoming the wall of a conically-roofed tools shed. Further south there are a terraced lawn and a tennis court. (Fig.5.7)

Externally, the house while being undoubtedly modern has a certain affinity with the Scottish baronial idiom.<sup>28</sup> Mackintosh made special efforts to plan the house carefully to meet the requirements



HILL HOUSE, HELENSBURGH by C.R. MACKINTOSH  
 PERSPECTIVE FROM SOUTH WEST  
 (from Scottish Arts Council Exhibition, 1968)

FIG. 5.7



PLANS OF HILL HOUSE, HELENSBURGH  
 (from Macleod, Charles Rennie Mackintosh)

FIG. 5.8

of the particular family, and in fact insisted on spending some time with them before beginning the design. Mr Blackie, the client of Hill House, a publisher, made useful notes of his impressions of the architect and the progress of the commission, and at one point writes "with him (Mackintosh), the practical purpose came first. The pleasing design followed of itself as it were."<sup>29</sup>

The house consists of a principal block running east/west with the service block running north/south and the internal angle thus formed encloses a small courtyard (Fig.5.8). The entrance is to the west at the gable end, and the first space as one enters inside is the hall, of which the staircase forms an integral part. The library, on the south side of the entrance, was to be used by Mr. Blackie as an office whenever business visitors came to see him at home. There is a conscious attempt by the architect to mark clearly the more intimate private domains of the hall using elements like steps, screens, furniture, etc. (Fig.5.10). The drawing room was designed to meet the varying needs of the members of the family and contains two large alcoves. One of these is a bay projecting on the south facade, from which there is a good view of the Clyde estuary (Fig.5.11); it has window seating, bookcases, and two doors leading into the garden. The second alcove is spacious and is designed to accommodate a piano. The remainder of the room may be seen as a winter end, served by a small window and a fireplace well screened from the door, and is in contrast to the sun room or alcove facing south (Fig.5.12). The library interior in contrast to the brilliant sparkle of the drawing room and the hall is a small warm room facing south, lined with book shelves and cupboards in dark oak (Fig.5.13). The main bedroom on the first floor derives its form also from the pattern of use. The bed is placed in a large



FIG. 5.9 ENTRANCE

HILL HOUSE HELENSBURGH  
(source: Edinburgh Architectural Association)



FIG. 5.10 ENTRANCE HALL





FIG.5.11 DRAWING ROOM BAY WINDOW



FIG.5.12a DRAWING ROOM

HILL HOUSE, HELENSBURGH

(source: Edinburgh Architectural Association)



FIG.5.12b DRAWING ROOM



FIG.5.13 LIBRARY

HILL HOUSE, HELENSBURGH  
(source: Edinburgh Architectural Association)

alcove, and a barrel vaulted ceiling clearly marks this space off from the rest of the room (Fig.5.14). Once again the functional effectiveness of the bed alcove is greatly increased by the small window - it gives the impression that the area is well protected, and it is possible to gain an outside view from the bed and yet avoid being seen from outside. The wardrobes are built in, they do not dominate the room and yet are located in a well-lit area (Fig.5.15). Along the internal wall is the fireplace, with a warm protected seating area next to it. Both externally and internally Mackintosh used a number of novel features, and this is more or less self-evident in the figures included.

The qualitative features of this scheme may be effectively highlighted by listing them and by indicating to what class they belong in our function/feature model. Where necessary we also add some comment and explanation:

1. In Fig.5.9 we notice that the private area of the entrance hall is clearly marked through the use of steps, i.e. by raising this zone from the more public part adjacent to the library.

Qualitative feature: marker of private zone (A).

2. Although the raising of this private area is achieved through physical means, it does induce certain psychological effects; a visitor knows straight away that the steps connote a certain barrier between private and public zone and thus will be reluctant to trespass this implicit line.

Qualitative feature: connotative meaning (B and D).

3. From Fig.5.10 and Fig.5.8 it is clear that there is a gradient from the relatively public area of the entrance to the private zone of the entrance hall with its adjacent drawing room and dining room,



FIG. 5.14 BEDROOM



FIG. 5.15 BEDROOM

HILL HOUSE, HELENSBURGH  
(source: Edinburgh Architectural Association)

to the even more private zone of service areas.

Qualitative feature: effective sequence of elements (E).

4. The staircase, because of the way it is lit and because of its location, adds dignity to the entrance hall.

Qualitative feature: dignity (D).

5. The staircase is partially concealed and therefore without it being monumental its location is made obvious.

Qualitative features: subduing the impact of a particular element in order to create certain effects (B); clarity of location (A).

6. The manner in which the staircase is located and screened off from the more public area of the entrance hall also makes it clear that it is part of the private zone.

Qualitative features: marker of private zone (A); connotative meaning (D).

7. The form of the drawing room follows the pattern of use.

Qualitative feature: activity marker (G).

8. The area near the fireplace - because of its location in relation to the door, the large window and the exterior - effectively becomes the winter zone.

Qualitative features: effective relations (E)

9. At the same time, the small window in this area, the arrangement of furniture around the fireplace, etc. indicate that it is a winter zone.

Qualitative feature: meaning of relations (F).

10. The interior of the library is in contrast to the entrance hall and drawing room.

Qualitative feature: contrast in effects created by different elements (F).

11. The form of the main bedroom also follows the pattern of use.

Qualitative feature: activity marker (G).

12. Wardrobes are designed such a way that they do not dominate the appearance of the room.

Qualitative feature: subduing the impact of a particular element (B).

This by no means covers the entire range of the qualitative features of Hill House. We could discuss the scheme much more extensively to obtain many more features, but what has been noted so far provides a list of some rather effective illustrations of significant components of our function/feature model as encountered in this scheme. In the next section we indicate in a general way (rather than with reference to particular buildings) what kind of architectural features exemplify our seven basic classes.

#### Towards a Detailed Specification of Feature/Function Classes

The feature/function model shown in Fig.5.1 is intended to be applicable to any example of architecture. Although a detailed specification of all the qualitative features encountered in architecture as classes of this model is impossible, we must at least make an attempt to enumerate those that are illustrative of the major types.

A. Elemental features designed to increase the effectiveness of functional/practical. Important features of this category are:

I. Markers of different types of zones such as public, semi-public and private; we have seen this being applied to the entrance hall of Hill House (items 1 and 6 above). Another example is the

provision of lay-by spaces between corridors and seminar rooms in educational buildings. At a much broader level, Oscar Newman's ideas on defensible space<sup>30</sup> are concerned with marking of zones of a different kind. Alexander et al. have also pointed out the practice of providing a semi-public zone between the private world of the house and the public world of the main road in a number of Peruvian settlements.<sup>31</sup>

II. Clarity in the location of elements, as exemplified in item 5 above.

III. Familiar elements. Traditional architectural solutions tend to be more easily accepted and put to proper use by the inhabitants of a building than unfamiliar solutions such as, for example, open plan classrooms, landscaped offices and open plan houses.

IV. Present day rather than archaic or obsolescent elements.

V. Appropriateness of elements to the types of users for whom the building is designed.

B. Elemental features designed to enhance users' interest in the environment, increase its impact and create effects. Typical features of this class include:

I. Subduing the impact of certain elements of a space so that its overall appeal may be preserved. We mentioned how this category can be applied in our discussions concerning the foyer of a concert hall and Hill House.

II. Little known architectural solutions. Unfamiliar solutions can carry special impact and help to create atmosphere.

III. Dated elements. The use of obsolescent elements can add 'colour' and 'setting' to a design.

IV. Puns. Architects sometimes use intriguing elements to create interest in the environment. Some examples from Lutyens, Venturi and Stirling reveal this aspect.<sup>32</sup>

V. Referential Meaning.

VI. Connotative Meaning.

C. Abstracts which increase the effectiveness of the functional/practical. Included in this class are items like privacy, defensibility, safety, tidiness, compactness, spaciousness, quietness.

D. Abstracts which enhance users' interest in the environment, increase impact and create effects. Items like dignity, impressiveness, uniqueness, come into this category. Also features like privacy, spaciousness, quietness, etc. mentioned under C can be effects created as opposed to tangible, physical measures, and therefore may be included in this category. Similarly, referential meaning and connotations need not relate to elements of architecture but can be abstract characteristics of a particular environment. We have already mentioned that in most cases abstracts are connected with elements and relations; but from the practical point of view of reminding the architect about the existence of these qualities it seems desirable to list them separately.

E. Relational features which are designed to increase effectiveness of the functional/practical. Features illustrative of this class are:

I. Effective sequence of elements. We saw this exemplified in Hill House (item 3).

II. Effective relation between elements, as illustrated in the design of the living room in Hill House (item 8).

III. Simple relation between elements,<sup>33</sup> can help such tasks as



direction finding, identification of entrances, exists, and so on.

IV. Building type, room type, space type indicators; that is to say index signs.

V. Compact arrangement.

VI. Familiar combination of elements. Well known combinations are more easily accepted and utilised by the inhabitants of a building. For instance, a two-storey dwelling having living areas on the ground floor and sleeping areas on the higher level will be more readily accepted than the reverse.

VII. Marking boundaries between elements. This is very much a theatrical technique and very often finds its way in architecture in the form of changes in floor levels or changes in finishes which define certain uses for specific areas.

VIII. Possibility of surveillance of indoor as well as outdoor spaces<sup>34</sup>.

F. Relational features devised to enhance interest, increase impact and create effects. Typical features belonging to this class are:

I. Meaning of relations.

II. Avoidance of monotonous arrangements.

III. Introduction of novel arrangements. New and striking combinations of elements make a design fresh and unexpected, and indeed give the impression that ideas are also new and important (e.g. in Aalto's Sayanatsalo community centre the largest room - the assembly room - is on the top floor).

IV. Contrast created by different elements (e.g. between the living room and the library in Hill House).

V. Complex relations between elements. This is the opposite of

simple relations discussed under E above. While simple relations can help such functional/practical aspects like direction finding, identification of exists, entrances, etc., complex relations can be employed to make the environment richer, so that it allows complex layers of actions and events to take place. While simple relations are usually to do with either/or questions (e.g. inward looking arrangement or outward looking arrangement), complex relations are to do with a way of achieving both. For example, Denys Lasdun's plan for the University of East Anglia attempts to combine the benefits of an inward-looking arrangement with those of an outward looking view offered by the site.

VI. Lack of transition markers between spaces. Leading users abruptly from one kind of space to another without the introduction of any transition space can be useful in creating impact. This happens, for instance, at Piazza San Marco in Venice. After walking through many narrow streets, pedestrians are suddenly faced with a large piazza with important monuments, landmarks, and the Grand Canal at one end.

VII. Diffuse arrangement of elements. Boundaries between elements may be deliberately blurred to allow a free and smooth flow of space. An example of this would be allowing a garden to flow into a living area without any abrupt barrier.

VIII. Complexity in appearance (many of the Renaissance palaces do this by the use of such features as rustications, pilasters, and so on).

IX. Destruction of formality (for example, asymmetry).

G. Features closely connected with actions and events that take place in a space. It is very difficult to specify these features as universally applicable categories, and yet as pointed out earlier in connection with the example of the foyer for an auditorium, it is important to bear in mind actions and events while designing a particular space.

These then are some of the qualitative features, illustrative of the major types, and we may incorporate them in an expanded version of the feature/function model as shown in Fig.5.16. It is of course one thing to be able to recognise qualitative features and analyse their function, and quite a different one to work out the means by which they can be applied in the process of briefing and design. We conclude this chapter by looking at the possibility of using the feature/function model as a tool in this process.

#### Qualitative Features and the Process of Brief-Making and Design

Answering the requirements of a brief can be thought of as consisting of the following: 1. analysis of information related to design in terms of the requirements of the users and of the client; 2. transfer, in which the analysed material from the brief is transferred to the language of design and represented (that is to say a decision is made on the kind of resource required - e.g. space, equipment, furnishing, and their interrelations); 3. restructuring, in which the transferred material is restructured in order to make the final solution acceptable from the technical

FEATURES

ACTIONS AND  
EVENTS

ELEMENTS	ABSTRACTS	RELATIONS	ACTIONS AND EVENTS
<p>A.</p> <p>I. Markers of zones</p> <p>II. Clarity in location</p> <p>III. Familiar elements</p> <p>IV. Present-day rather than archaic or obsolescent element</p> <p>V. Appropriateness of elements to the particular section of users for whom the building is designed</p> <p>INCREASE EFFECTIVENESS OF FUNCTIONAL/PRACTICAL</p>	<p>C.</p> <p>I. Privacy</p> <p>II. Defensibility</p> <p>III. Safety</p> <p>IV. Tidiness</p> <p>V. Compactness</p> <p>VI. Spaciousness</p> <p>VII. Quietness</p>	<p>E.</p> <p>I. Effective sequence of elements</p> <p>II. Effective relation between elements</p> <p>III. Simple relations</p> <p>IV. Building type, room type, space type indicator (index sign)</p> <p>V. Compact arrangement of elements</p> <p>VI. Familiar combinations of elements</p> <p>VII. Markers of element boundaries</p> <p>VIII. Possibilities for surveillance</p>	<p>G.</p> <p>1. Features created with actions and events in mind</p>
<p>B.</p> <p>I. Subduing impact of particular elements</p> <p>II. Little-known elements</p> <p>III. Dated elements</p> <p>IV. Puns</p> <p>V. Referential meaning</p> <p>VI. Connotative meaning</p> <p>ENHANCE INTEREST INCREASE IMPACT CREATE EFFECTS</p>	<p>D.</p> <p>I. Dignity</p> <p>II. Impressiveness</p> <p>III. Uniqueness</p> <p>IV. Privacy</p> <p>V. Spaciousness</p> <p>VI. Quietness</p> <p>VII. Referential meaning</p> <p>VIII. Connotative meaning</p>	<p>F.</p> <p>I. Meaning</p> <p>II. Avoidance of monotony</p> <p>III. Novelty</p> <p>IV. Contrast in effects created by different elements</p> <p>V. Complex relations between elements</p> <p>VI. Lack of transition markers</p> <p>VII. Diffuse arrangement of elements</p> <p>VIII. Complexity in appearance</p> <p>IX. Destruction of formality</p>	

point of view and from the point of view of the users of the building. This process may be represented in a diagram, as shown in Fig.5.17.

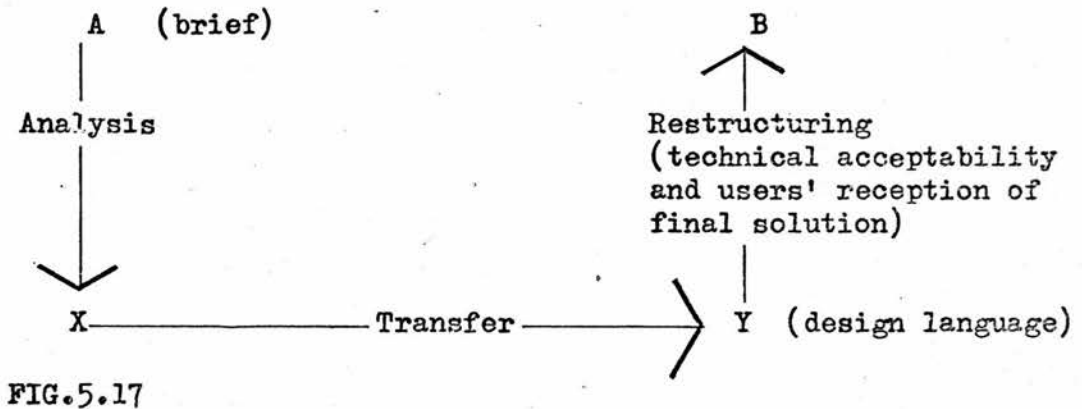
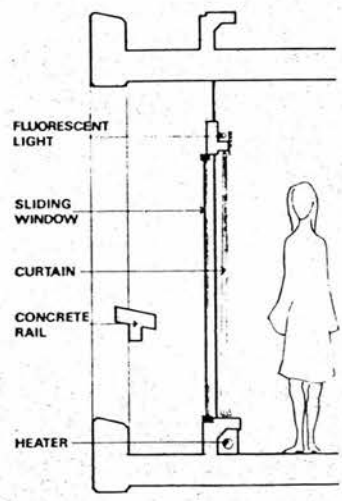


FIG.5.17

The distinction between analysis, transformation and restructuring is hard to maintain in any absolute sense, but consideration of these as though they were separate processes can promote understanding. The most natural place where thinking on qualitative features takes place is at the stage of analysis and transfer. To demonstrate how this can happen we will consider the example of the design of study bedrooms. In the U.K., the University Grants Committee's space standards usually form the basis of an architect's brief, and these standards are shown in Appendix 6. Although these space standards are based on certain analyses of already completed student residences, the project architect of a new commission will take a close look at the requirements given in the brief and determine the qualitative features of the building. It is here that the function/feature model can help him to be systematic.

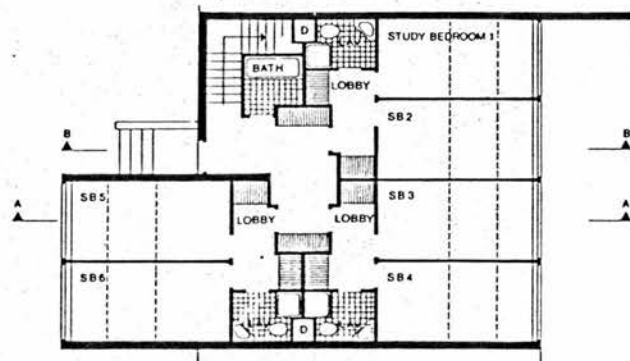
ELEMENTS	CLASS A	CLASS B
	Functional effectiveness	Enhancement of interest, etc.
1 windows	a) viewing possibility from both sitting and standing position b) enable reading in bed	must help in achieving a subtle balance between privacy and openness. One way of doing this is to have large windows set sufficiently back from the outside face of the building as shown in Fig.5.18 below. <sup>35</sup>



SECTION THROUGH STUDY BEDROOM WINDOW, SOMERVILLE COLLEGE, OXFORD  
(source : Dowson, 1969)

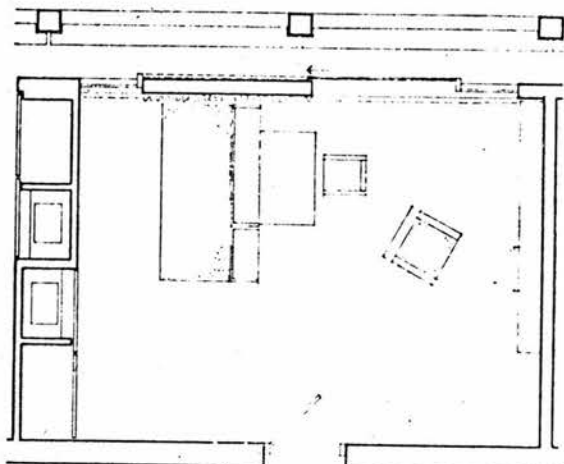
- 2 wardrobe to be located in a well lit area
- 3 washhand basin

2 and 3 should not be allowed to dominate the appearance of a room. One possible solution is to provide them in a lobby between the room and the access corridor as shown in Fig.5.19 below.<sup>36</sup>



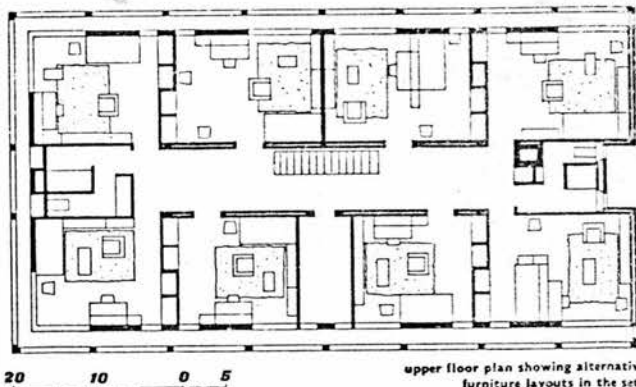
STUDENT HOUSING, GUILFORD  
(source : Maguire, 1971)

- 4 desks must be large enough for spreading two or three books, plus writing paper and possibly a typewriter
- 5 desk chair must enable tilting, free shifting, leg stretching, etc.
- 6 bed that the bed is a popular study location must be borne in mind while choosing the type of bed and in the design layout
- 7 bookshelves students may want to pin-up board re-arrange these etc according to varying personal requirements
- 8 walls opportunities for imprinting the student's personality on the character of the room by facilitating easy pinning up etc. without danger of permanent damage to decoration
- 9 study-bedroom as a whole
- a) activity markers<sup>37</sup> as shown in Fig.5.20 overleaf
- b) if double rooms are provided, introduce opportunities for creating personal space
- c) choice from a variety of room types - not so much different in shape but with different possibilities for furniture arrangement, as shown in Fig.5.21 overleaf
- certain connotations may be desirable (eg that of a group of houses), others may not (eg that of monastic or prison cells)



STUDY BEDROOM  
SOMERVILLE COLLEGE, OXFORD  
(source : Dowson, 1968)

FIG.5.20



SOMERVILLE COLLEGE, OXFORD  
(source : Architectural  
Review, February 1965)

FIG.5.21

#### ABSTRACTS

##### CLASS C

Related to functional effectiveness

- a) acoustic privacy may be provided by some buffer zone between study bedroom and access corridor (see Fig.5.18)
- b) tidy appearance can be provided by avoiding awkward shapes, restricting the number of materials and careful choice of furniture and fittings

#### RELATIONS

##### CLASS E

Related to the functional/practical

- a) alternative furniture arrangements must respect functional relationships between different items of furniture (eg light source on the left or in front for study)
- b) relation between study bed and other areas - eg one bathroom to serve two or three bedrooms, the relationship being marked clearly (see Fig.5.18)

**ACTIONS AND EVENTS** : the design of study bedrooms is a problem of opposites - i.e. a place where one works and sleeps, a place of retreat and also one to entertain friends, a place of privacy yet part of a larger unit. The design should reconcile these polar opposites without denying their existence.

##### CLASS D

Related to creation of effects, etc.

- a) subtle balance between openness and privacy

##### CLASS F

Related to the creation of effects, etc.

- a) avoid institutionalism by grouping six to eight bedrooms and by avoiding long corridors
- b) dissimilar effects in different rooms (study bed, communal rooms, corridors, etc.) by the use of varied fenestration, lighting, materials, textures, and so on.



This hypothetical example of design of study bedrooms is intended to illustrate how the function/feature model can be used as a stimulus for considering a number of issues which often get left out or left to the discretion and talent of individual architects. Function/feature classes help us to name qualitative features, and therefore enable the thinking involved in conceiving them to be made explicit. As Ivor Smith pointed out, although the physical environment acts as a background to life, different environments function at different intensities.<sup>38</sup> The function/feature model helps us to specify with some precision what these intensities should be for a proposed building. The seven classes of this model act as a kind of scaffold using which we may systematically construct formulations about architectural quality; once these formulations are completed the scaffold can be removed. In other words, in the final description of information on qualitative aspects of design reference to elements, abstracts, relations, actions and events is not necessary.

Returning to the process of design outlined in Fig.5.17 in practice one would not simply settle down to the idea prompted by the classes given by our model. One would evaluate each solution to see whether it is acceptable from the economic and technical point of view and from the point of view of the users of the building. If it is not acceptable, then the solution may have to be restructured; quite often it may be necessary to go back to the brief and carry out the operation again, beginning with analysis. This remark simply illustrates the familiar methodological suggestion that no sequence of design operations should be considered linear. Very often words like 'loops' and 'cycles' are used, but the best

explanation is through the analogy of crossing a broad, deep, swift river. If one does not know how to swim, and does not have a boat, it is necessary to go up and down the bank of the river until a place is found which is shallow enough to serve as a ford. The time and effort spent walking along the side of the river are not only not wasted; they are absolutely essential to the crossing.

## Chapter V : Notes

1. In fact the structural view of architectural quality was originally developed from an examination of past architectural theories. For the sake of clear and direct presentation a detailed account of qualitative aspects of architecture in past theories is not given in the main text but in Appendix 5.
2. The distinction between what is a functional aspect and what is not is very hard to maintain in any absolute sense. For instance one can argue that even architectural mouldings like architraves and freezes are functional devices. For our purposes the need to make a precise distinction between functional aspects and those aspects which create effects is less important than accommodating both in our view of architectural quality.
3. There is a kind of 'fit' between the classes elements, events or actions, abstracts and relations and the grammatical classes of ordinary language. Elements are most typically expressed by nouns or pronouns, abstracts by adjectives and adverbs, and events or actions by verbs. But most ordinary languages also provide ways of shifting the class membership of terms - for instance by expressing events or actions by nouns - thus making it impossible to place an = sign between the two sets of terms. It is this fact that led the author to adopt these new terms.
4. Queen Elizabeth Hall: An Appraisal, RIBA Journal, June 1968, pp.258-59.
5. We have already pointed out in Chapter IV that terms like 'inviting place' should be expanded with the aid of multi-dimensional classes, so that they may be more precise. Expansion will probably lead to something like 'to make the foyer an inviting place the design should make an attempt to subdue the impact of such things as ticket counter, signs indicating various spaces, displays of information about future programmes, etc. and yet these must be obvious to the users. Seating spaces should be located such a way that there is awareness of the movement of people but no interference caused by it. Lighting should indicate that it is a public space, but be neither too harsh nor too gloomy;'and so on. But the phrase 'inviting place' has to be used in the text above all as a form of shorthand.
6. Appendix 5 deals with the difficulty of analysing aesthetic problems in greater detail.
7. Norberg-Schultz, Christian, Intentions in Architecture, Oslo, 1962, pp.122-27.
8. (a) Wittkower, Rudolf, Architectural Principles in the Age of Humanism, London, 1949.  
(b) Panofsky, E., Meaning in the Visual Arts, New York, 1955.
9. Op.cit.

10. Fingesten, Peter, The Eclipse of Symbolism, South Carolina, 1970.
11. The references for the points on symbols made here are:  
 (a) Pierce, Charles, Sanders, Collected Papers, Cambridge, Mass., 1931.  
 (b) Morris, Charles, W., Foundations of the Theory of Signs, Chicago, 1938, pp.63-75.  
 (c) Reichenbach, Hans, Symbolic Logic, New York, 1947.  
 (d) Landar, Herbert, Language and Culture, New York, 1965.  
 (e) Nida, Eugene, A., Toward a Science of Translating, Leiden, 1964, pp.30-37.  
 (f) Spradley, James, P., (ed.) Culture and Cognition, San Francisco, 1972, pp.3-35.
12. Ibid.
13. (a) Nida, Eugene, ibid.  
 (b) Spradley, James, P., ibid.
14. See, for instance, Jenks, Charles, Baird, George, (eds) Meaning in Architecture, London, 1969.
15. Nida, Eugene, A., op.cit., pp.30-37.
16. Jenks, Charles, "Andrew Melville Hall, Charles Jenks offers a semiotic analysis" in Architectural Forum, September 1970, pp.55-57.
17. The example has been taken from Huff, William, S., "An Argument for Basic Design" in Architectural Design, May 1966, pp.252-56.
18. Hertzberger, Herman, Architectural Record, July 1968, p.119.
19. The psychologist Moore found that in perception meaning came before the name of an object. Moore, T. V., "The Temporal Relations of Meaning and Imagery" in Psychological Review, No.22, 1915, pp.177-215. In psychology generally the trend is towards the analysis of the same objects into separate attributes or dimensions like 'functions, uses, response properties or meanings' depending on whether one wishes to emphasise what the subject does with the object or how he perceives it. See Johnson, Donald, M., Systematic Introduction to the Psychology of Thinking, New York, 1972, p.185.
20. As a result of this confusion in architectural writings concerned with meaning, it is often difficult to know whether the analysis is concerned with architecture or linguistics. See Jenks, Charles, A., Meaning in Architecture, op.cit. It should be added that this confusion persists in other fields as well. The psychologist Floyd Allport points out its existence in his field in Theories of Perception and the Concept of Structure, New York, 1955, p.573.
21. Barbara Cook has analysed the significance old people attach to these types of elements. See "A Residential Complex whose Form Followed Findings about Users' Wants and Needs" in American Institute of Architects Journal, June 1974, pp.28-32.
22. Hertzberger, Herman, op.cit.

23. Nida, Eugene, op.cit., pp.113-19.
24. Department of Architecture, University of Edinburgh "Environmental Analysis, a Ten-Day Stint" unpublished paper produced by a group of architecture students under the author's direction.
25. Osgood, C.E., Suci, G.J., Tannenbaum, P.H., The Measurement of Meaning, Urbana, 1957.
26. (a) Hesselgren, Sven, The Language of Architecture, Kristianstad, 1967, pp.359-60.  
 (b) Canter, D.V. and Wools, R., "A Technique for the Subjective Appraisal of Buildings" in Building Science, 5 (3 and 4), 1970, pp.187-94.
27. Macleod, Robert, Charles Rennie Mackintosh, Feltham, 1968, pp.80-96.
28. Howarth, Thomas, Charles Rennie Mackintosh and the Modern Movement, London, 1952, pp.98-107.
29. Ibid., p.97.
30. Newman, Oscar, Defensible Space, New York, 1973.
31. Alexander, Christopher, et al., Houses Generated by Patterns, Berkeley, 1969.
32. See, for example a) Hussey, Christopher, 'The Personality of Sir Edwin Lutyens', RIBA Journal, April 1969; b) Venturi's house for his mother illustrated in Architectural Review, February 1966, p.89; c) James Stirling's entry for the Competition for the Redevelopment of the Market Place in Derby (particularly the stage for the open air theatre) in RIBA Journal, February 1971, pp.51-54.
33. Simple relations, effective sequence of elements and effective relations may appear superficially to be similar. This however is not the case; simple relation between different spaces of a building helps the user to anticipate where each element will be located. Effective sequence is a more complex step: it affects mainly users' behaviour (eg discouraging them from trespassing a private zone); effective relation is even more complex: as well as promoting understanding of how different parts are ordered, it also helps users to appreciate directly the effectiveness of that order.
34. Oscar Newman's ideas on defensibility are based on the principle that users wish to take possession of spaces as their own personal space can be promoted by a certain arrangement of these spaces. Newman, Oscar, op.cit.
35. Dowson, Philip, 'A Room of One's Own', Architectural Design, April 1968, pp.164-72.
36. Maguire, Robert, 'Approach to Architecture', RIBA Journal, April 1971, pp.140-48.
37. Dowson, Philip, op.cit.
38. Smith, Ivor, 'Approach to Architecture', RIBA Journal, July 1967, pp.271-80.

**VI. VERBAL DESCRIPTIONS AND  
PHYSICAL DESIGN—A STUDY  
OF FACTORS AFFECTING  
THE TRANSFORMATION**

VI VERBAL DESCRIPTIONS AND PHYSICAL DESIGN -  
A STUDY OF FACTORS AFFECTING THE TRANSFORMATION

So far we have attempted to capture the essential structure of designing as a human activity and have considered how this structure affects the process of data-gathering in general and on qualitative aspects of architecture in particular. However it is not true that by providing the architect with all the necessary information one automatically gets a good design. A great deal depends on the architect's ability in transforming the verbally formulated requirements into physical design. In order that the study of information and design in their full dynamic relation may be carried to its logical conclusion, this chapter is devoted to the analysis of factors affecting this transformation. Whilst it cannot be denied that there are many architects who possess the skill of translating written requirements into design to the full satisfaction of clients and users, a theoretical account of the principles underlying this transfer is almost non-existent in architectural literature. That is to say the practice of design has far out-distanced theoretical explanations.<sup>1</sup> The main reason for this is that practitioners still believe that designing is an art and its skills can only be acquired by a sensitive person through repeated practice. Such a view has stood in the way of probing beneath the surface of the obvious principles and procedures that govern the functioning of the transfer. It is true that

sensitivity is an indispensable ingredient of good design, but this should not obscure the fact that the transformation processes involved in designing are amenable to rigorous analysis and description. Continuous communication between all the participants is essential for the emergence of good design. But even in situations highly conducive to uninhibited exchange of views there is a 'focus' and a 'direction' which underlie all human communication, and this almost inevitably produces certain conflicts. After analysing this focus and its associated conflicts this chapter introduces a theoretical model of communication between clients, users and architects, and uses it to illuminate matters concerning briefs, translating these into buildings, and the bases on which one may assess the success of a design.

#### Focus and Conflicts of the Design Process

The focus of everyone concerned with the building activity has for a long time been (and to some extent still is) the designer himself in that he has traditionally taken particular delight in giving his clients and users buildings with a certain individuality. This tendency for architecture to be more a representation of the designer's 'genius' than anything else can be traced back to Renaissance times.<sup>2</sup> In the Middle Ages the names of architects did not matter very much; as Pevsner put it<sup>3</sup> "they were content to be workmen working for a cause greater than their own fame". But during the Renaissance with the appearance of perspective and the associated individual monocentrism things changed. Renaissance



architecture was created for the merchants of Florence and the bankers of kings, and artists and architects were chosen for reasons of pride and prestige. This had the effect of increasing the social status of architects. We see this trend being strengthened with the appearance of the Romantic conception of art which included architecture towards the end of the 18th century. Although the modern movement wanted to abandon the 'prima donna' role of the architect and wanted to initiate a scientific approach to the study of users' requirements and design, it did not entirely succeed. Such things as personal expression, making bold statements through architectural design, and introduction of visual novelty have impeded a real change of focus.

Nevertheless more recent developments in the field of architecture and urban design suggest that a radical change is in the process of taking place. There is certainly more widespread research interest in establishing users' requirements, often involving collaboration with social scientists. The pressure on those who initiate building projects to introduce user participation in decision-making is increasing, and indeed there are a number of recent projects where participation has been put into effect with some success (e.g. housing scheme at Byker, Newcastle by Ralph Erskine; housing for steelworkers at Terni, Italy by Giancarlo De Carlo). Lastly and perhaps most importantly a certain radical realism has been emerging in some of the recent literature on architecture and urban design. For instance, Kevin Lynch's work<sup>4</sup> treats the most subjective aspect of urban design, the environmental image, from the standpoint of users of the city, and explores methods of identifying substantial group images. There are many other works<sup>5</sup>

which suggest that the introspective and rather idiosyncratic nature of traditional architectural theory is being replaced with another theory whose central concern is with making architecture less and less a representation of its designer and more and more a representation of its users.

In this sense the focus is gradually shifting away from the architect towards the users. In spite of this, the communication pattern in architectural situations is highly varied. Broadly speaking, there are two basic directions in which communication between the participants of the design process proceeds: 1) horizontal - where there is an uninhibited exchange of views; 2) vertical - which could be a) descending - with the extreme example of someone in power giving instructions to his subordinates; or b) ascending - when those affected by the decisions made attempt to communicate with those who have the power to take such decisions. A descending system of communication normally seems to be well organised, as it follows readily from the structure of authority. The user feedback or ascending communication tends to be only partially developed<sup>6</sup> even in situations highly conducive to democratic practice. The consequence of the existence of a 'focus' and a 'direction' in interpersonal communication between architects, users, clients, consultants, and so on is that it introduces certain conflicts, and we may explore these in terms of three sets of opposing 'poles': (a) emphasis on new forms vs respect for emergent exemplars;<sup>7</sup> (b) general emphasis on form vs concentration on process as explained in Chapter III (this naturally follows from (a) );<sup>8</sup> (c) literal interpretation of clients requirements usually expressed in terms of solution images (e.g. study bedroom, classroom, tutorial rooms, etc.)

in a schedule of accommodation, as distinct from free exploration of what physical resources are needed for the actions of users and the events in which they take part. These three sets of differences are closely related but not identical. Generally speaking, in practical situations the issues raised by these differences are never well-defined. For the most part, such expressions as "my client insisted on having a certain type of room", "my architect was guided by some formal ideas" are essentially battle cries of those who wish to defend themselves or criticise the work of others. It is rare for these conflicts to be analysed in detail or for their implications to be worked out carefully. The difference in attitude expressed by emphasis on new forms on the one hand, and respect for emergent models on the other, is concerned with the extent to which an emergent exemplar can be expected to meet changing requirements of users. We deal with this in the next sub-section. The social aspects of the process and a free exploration of the resources required by users are related to ways in which architecture can be made more a representation of users than of architects, and this has to be discussed in the context of interpersonal communication between all the participants of the process of design.

### Emergent Models and the Process of Design

Chapter II pointed out the importance of personal models, Chapter III and IV the importance of emergent models.<sup>9</sup> If model solutions of one kind or another have a central place in the design process, it follows that designing involves choice, articulation and

refinement of models with a view to producing a physical equivalent of the written requirements contained in the brief. The majority of models involved in ordinary architectural practice tend to be those that have been recognised as accomplishments of the profession.

One of the difficulties in translating requirements into design can be traced to the fact that the designer can often have a wrong view of the emergent model he is employing. It is essential to recognise that each emergent model has its own 'genius'; that is to say each model possesses certain characteristics such as, for instance, a capacity for generating anagrams or a capacity for combining its basic elements at a variety of levels. This can be illustrated further by a consideration of emergent models in the field of housing. The three models high rise/high density, low rise/high density and low rise/low density each have their own limited possibilities for significant variations. That is to say there are only limited alternatives for the constructional, the spatial or the services system for each model. Rather than bemoaning the lack of some features in a certain model, the designer must respect those features of the model that produce a high degree of user-satisfaction and yet be prepared to alter those which inconvenience the user. Unfortunately, designers' attitudes towards emergent models have tended to follow fashion; architects' reactions to tall blocks illustrate this quite clearly. The reasons for the general change of view on tall blocks are many.<sup>10,11</sup> Firstly their original aim - to clear the ground - became obscure: they became a symbol of prestige. Secondly, tall blocks became an easy solution for clients without professional advice to adopt a package deal. Also the cost and local shortages of housing meant that wrong kinds of families came

to be housed in tall blocks. Criticism however has been directed at tall blocks as such, and not towards their misuse as models. Models emerge as a result of complex design, planning, economic and social circumstances. Tall buildings, for instance - at least as far as London is concerned - emerged as a result of the work of Whitfield Lewis at the Housing Division in 1950 who took an overall look at housing which led to the idea of 'mixed development'. The aim was obviously to attempt a match between dwelling type and type of household. No doubt the prevailing architectural ideologies of the time had a part to play in the emergence of tall blocks as models.

Despite this it would be simply untrue to say that tall blocks cannot meet certain basic human needs, as it is possible to provide compensations for many of their deficiencies, e.g. adequate traffic-free play-spaces; private allotments in place of gardens; well-designed waiting areas near lifts; reliable lifts; adequate, well-lit and well-defined (in terms of whom the space belongs to) lobby spaces in front of flats as compensation for the lack of a door-step; and so on.<sup>12</sup>

Also, in adopting a model or in rejecting an emergent model as inadequate, architects and clients have repeatedly shown a remarkable lack of understanding of the adaptability of users. In certain cases this has been assumed to be much greater than it is, while in other cases it has been assumed to be non-existent. The case of tall blocks of flats illustrates both these assumptions. The tendency in mass housing has been to freeze all provisions which aid the process of adaptation. As we said before high-rise blocks came about largely as a result of prestige (politicians felt that their

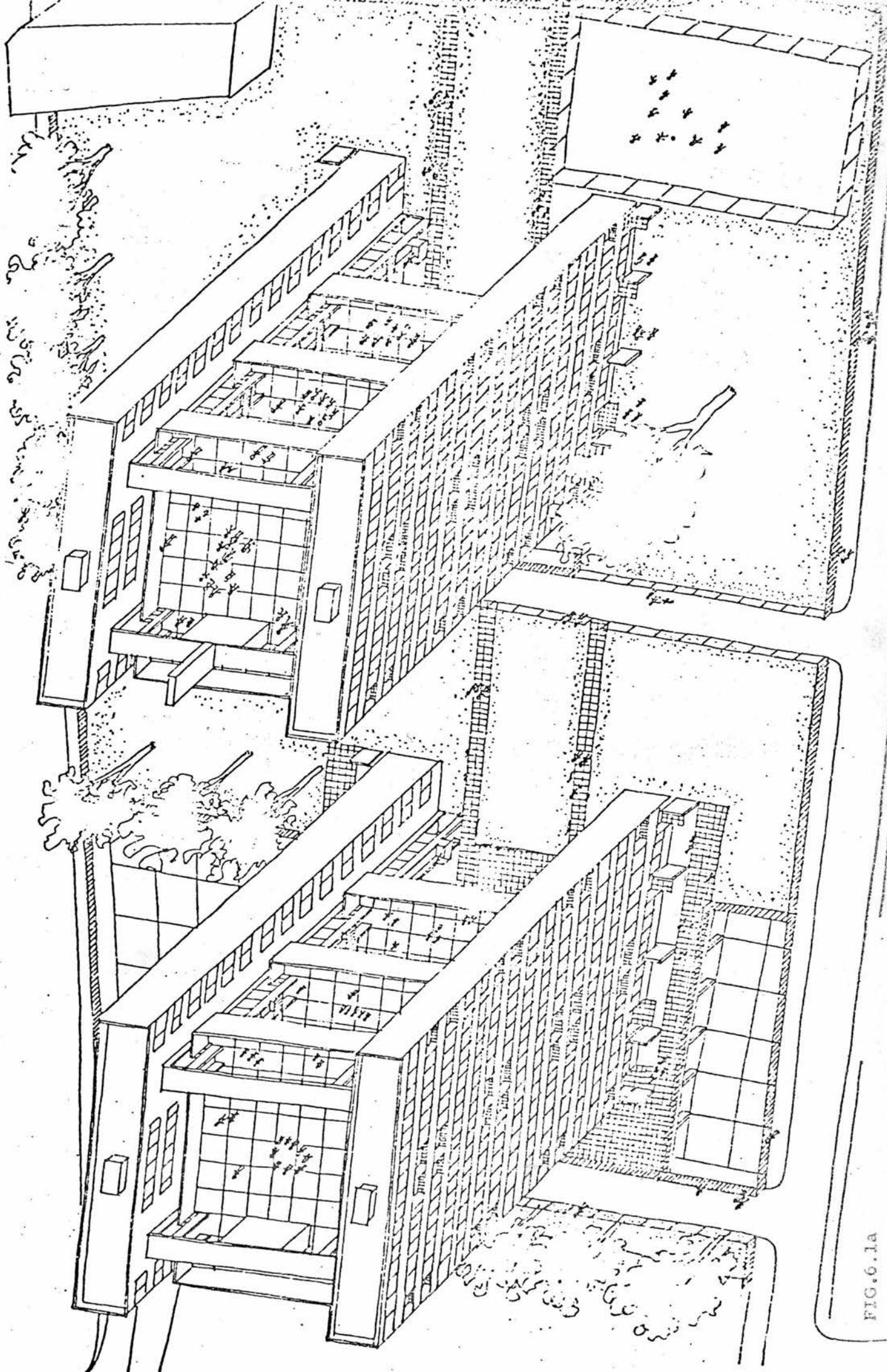
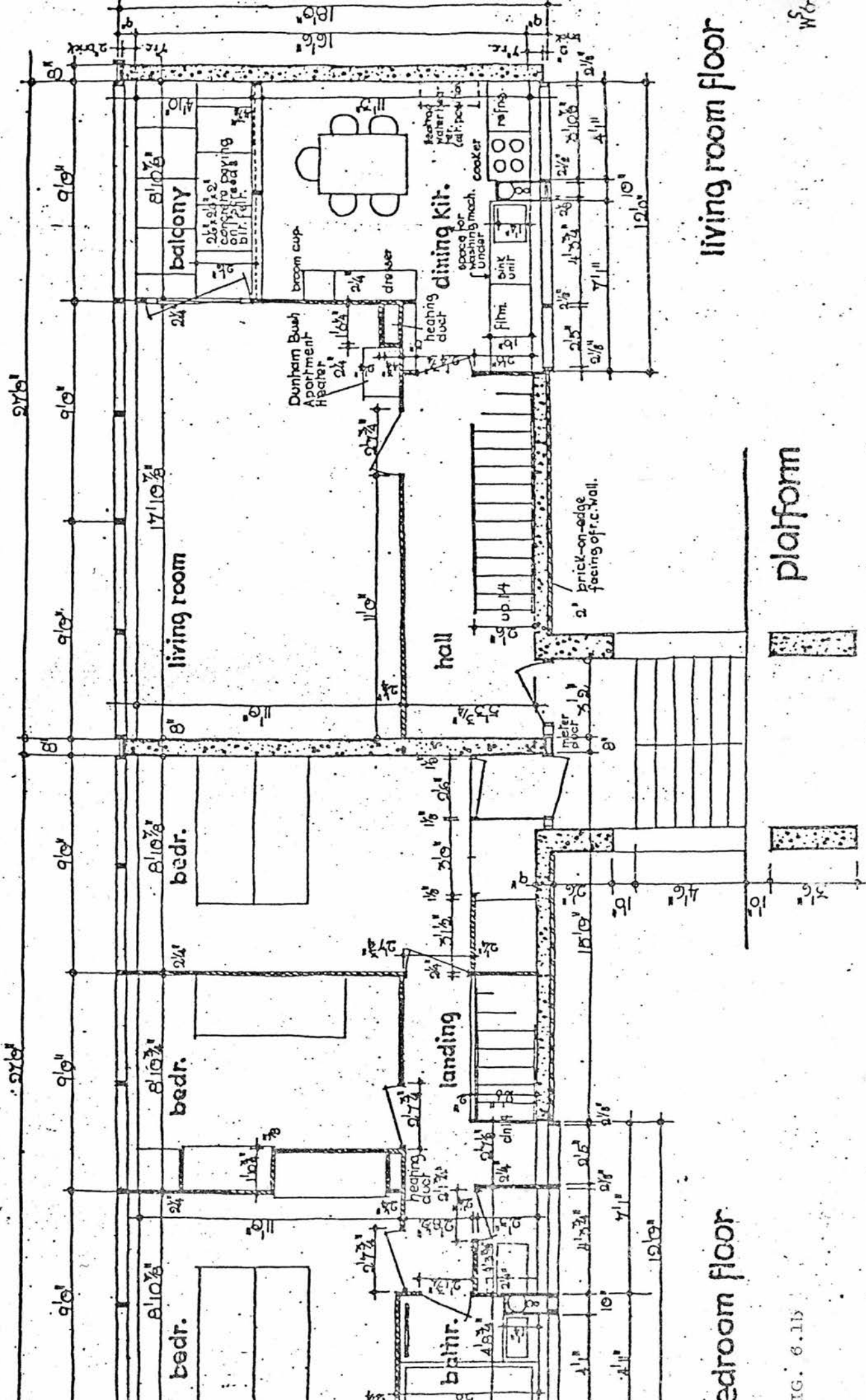


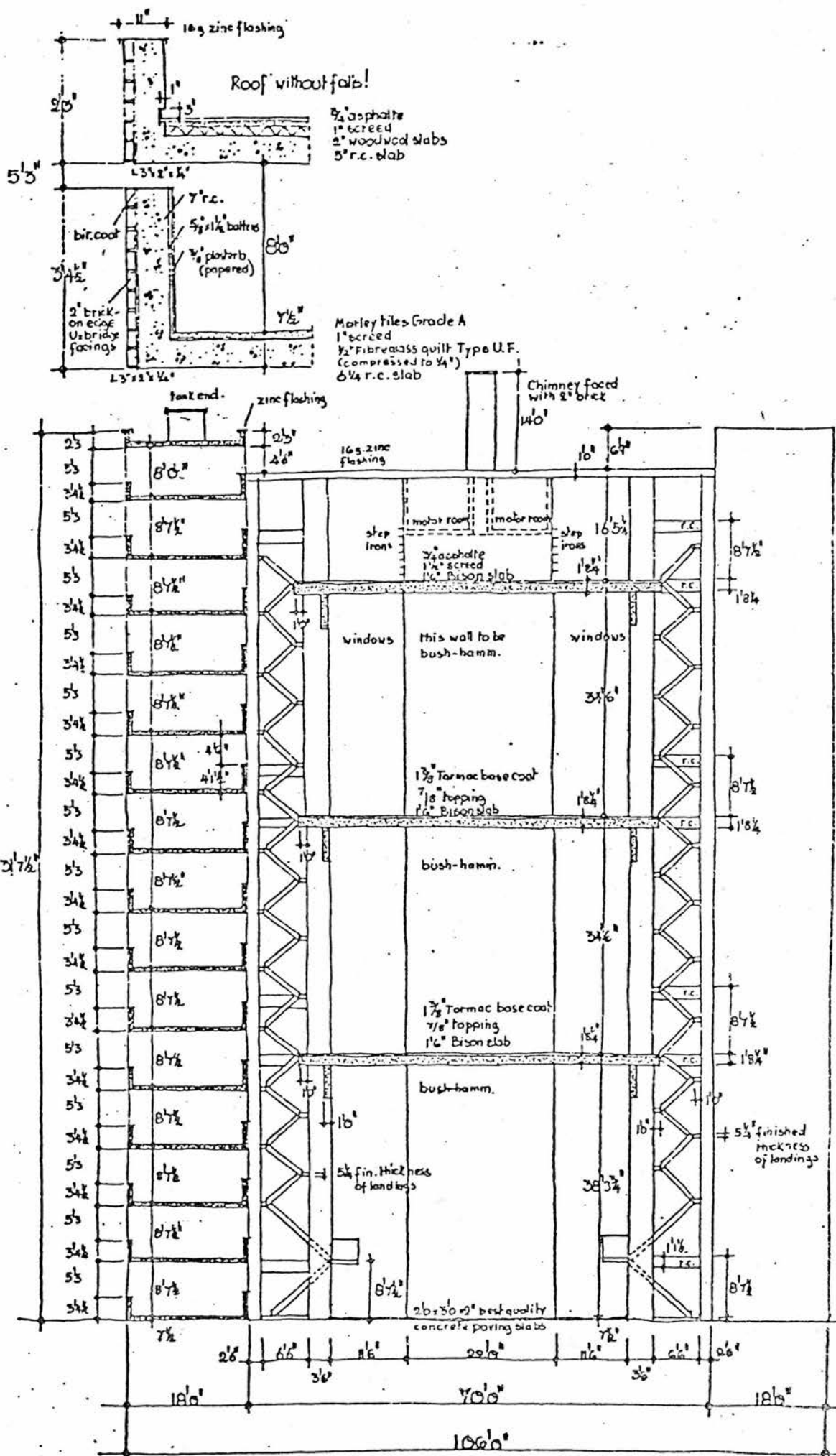
FIG. 6.1a



living room floor

bedroom floor

platform



ground floor: where suspended: as above  
 where in situ : 5" concrete  
 Trebil membrane  
 2" screed



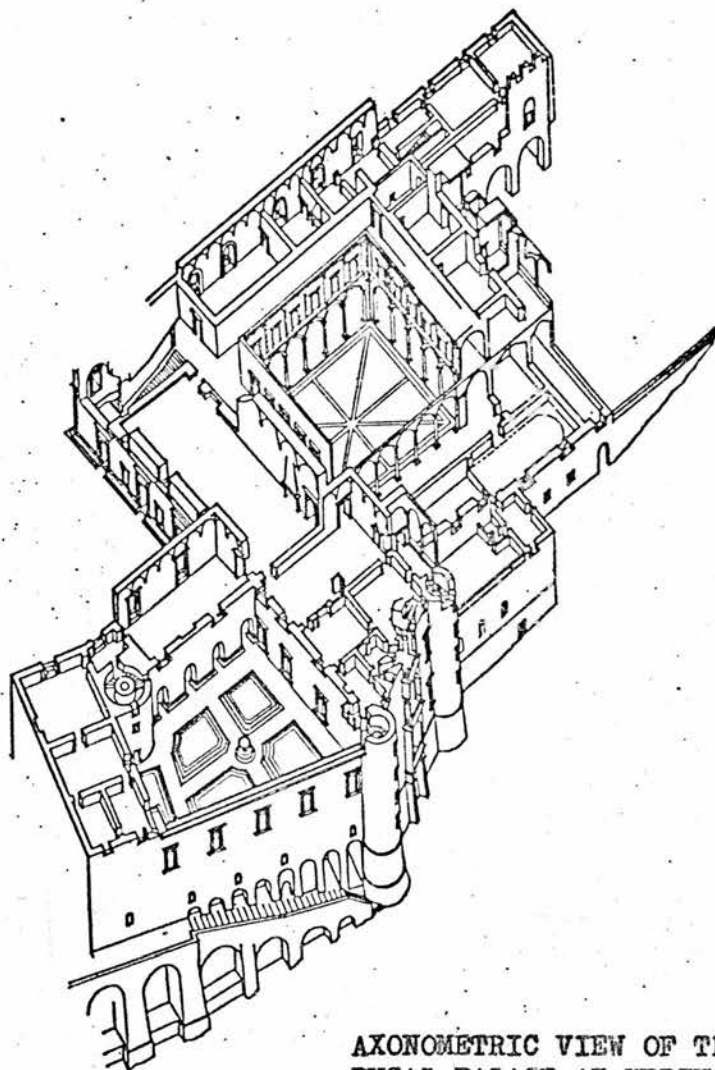
borough should have them), architectural ideology and ill-considered ideas on high density. In some cases architects and clients never considered the adaptability of users, while in other cases it was implicitly assumed that users would adapt to this new form of housing. In accommodating large families in this type of housing their potential difficulties were totally ignored. Recent studies show that families in the higher socio/economic bracket do adapt to them very well<sup>13</sup> and in rejecting the model outright the architectural profession is now ignoring the adaptability of this type of family. The aim here is not to advocate the building of more tower blocks, but to suggest that in certain specific contexts such blocks can be legitimate. Total rejection of them as type solutions or models following fashions is unproductive, as there is the problem of using the existing stock. Furthermore, where buildable land is in short supply it may well be necessary to build high. In both these instances it is necessary to bear in mind that certain types of users are more adaptable than others, and that in any case some form of compensation, as mentioned above, is necessary. The latter consideration involves considerable relaxation of the formal ideals of the architectural community. Once compensations are provided (e.g. play areas, communal facilities) tall buildings will certainly not be elegant blocks set on a sea of uncluttered green space as the profession wanted in the early days. Of course the necessary compensations could be built into the building leaving the green spaces free. Fig. 6.1 is an example of a rare design by Walter Segal which shows some understanding of the notion of compensation.<sup>14</sup> The building was not built for various reasons, but it does illustrate the importance of the architect's willingness to relax formal ideals. The spaces provided for play activities

would inevitably prevent the building from becoming a tall, slender block, but the abandoning of formal requirements is definitely necessary. The space provided may not be sunny and protected from the wind, but this will be the case in many play areas provided at ground level. It is however a matter of proper design. In the case of the high-level play area, although it is difficult to make it as sunny as one in the open, it can be protected from undesirable winds and, if necessary, it is possible to produce a controlled environment in the play area. Questions of economy are of course important; but this is a different matter altogether.

Broadly speaking, all emergent models - because they undergo trials, followed by revisions and refinements - must theoretically meet all human requirements.<sup>15</sup> If certain established models do not appear to be meeting certain needs it is because often the designer does not want to relax his formal and aesthetic ideals, thereby reducing the full potential of a model. For instance, such features as landscaped offices, inward looking layouts, open plan layouts and so on have so much visual and aesthetic appeal for designers that they overlook the fact that certain modifications to the basic idea may be necessary in order to meet the requirements of the particular situation (e.g. acoustic privacy in the case of landscaped offices and open plan layouts, the requirement for outside view in inward looking buildings). Good architects have always shown a willingness to make adjustments to emergent models and therefore a readiness to give up some of the formal ideals of their time. The history of architecture abounds in examples that bring strength to this point. Two quite different examples from Renaissance architecture (which was dominated by a certain formal ideology) illustrate it well. In

Urbino during the Renaissance architects like Laurana, Francesco di Giorgio and Bramante worked on a variety of projects, and in fact it is believed many of these architects worked as a team. All of them were aware of and indeed contributed through their writings to the then emerging principles of classical architecture (centrally planned buildings, proportional systems, use of circles and squares as symbolic representation and so on), yet the Ducal Palace at Urbino, illustrated in Fig.6.2 is not 'classical' in the sense exemplified by the 'ideal city' shown in Fig.6.3 The architects were quite prepared to relax some of their formal classical ideals in order that the building might respond to the topography and the existing medieval parts of the palace, and indeed to medieval Urbino.

The second example comes from Palladio's work. Palladio's work and 'Palladianism' as practised in England exemplify the model-based thinking of architects very well. It is well known that Palladio modelled his own buildings on the great buildings of ancient Rome and the 'Palladians' in turn modelled their works on the buildings he executed. But what was less well known to the 'Palladians' was the fact that Palladio, on many occasions, used elements of his models of antiquity with considerable flexibility. For example in his design for the Palazzo Iseppo Porto at Vicenza (unfinished) he took great portions of the entablature between the columns of the internal court to light the upper galleries (Fig.6.4). Current Italian thought on Palladio is quite contrary to the 'idyllic' English interpretation of his work, and attempts to set him in the context of contemporary Mannerists. Nevertheless the example cited above should not be regarded as a Mannerist device solely aimed at visual impact. It must be seen rather as an instance where a good

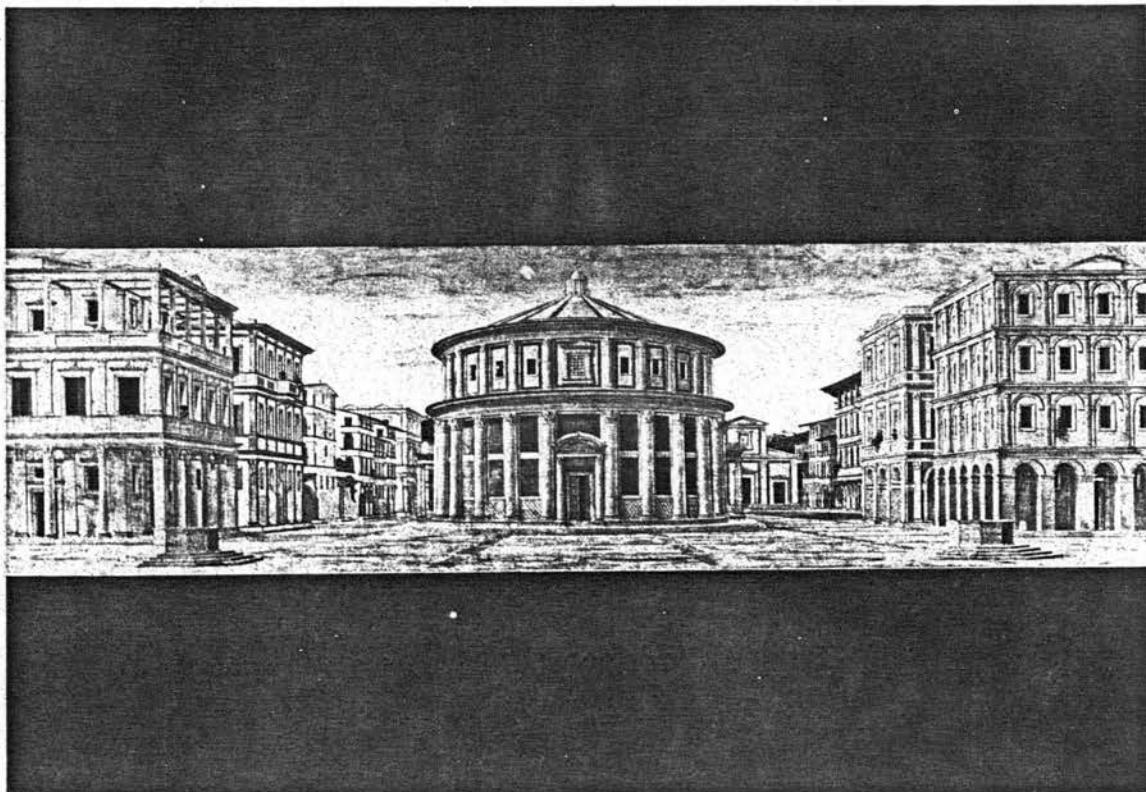


AXONOMETRIC VIEW OF THE  
DUCAL PALACE AT URBINO  
(source: Tafuri, *L'Architettura  
dell'Umanismo*, 1970).

FIG.6.2

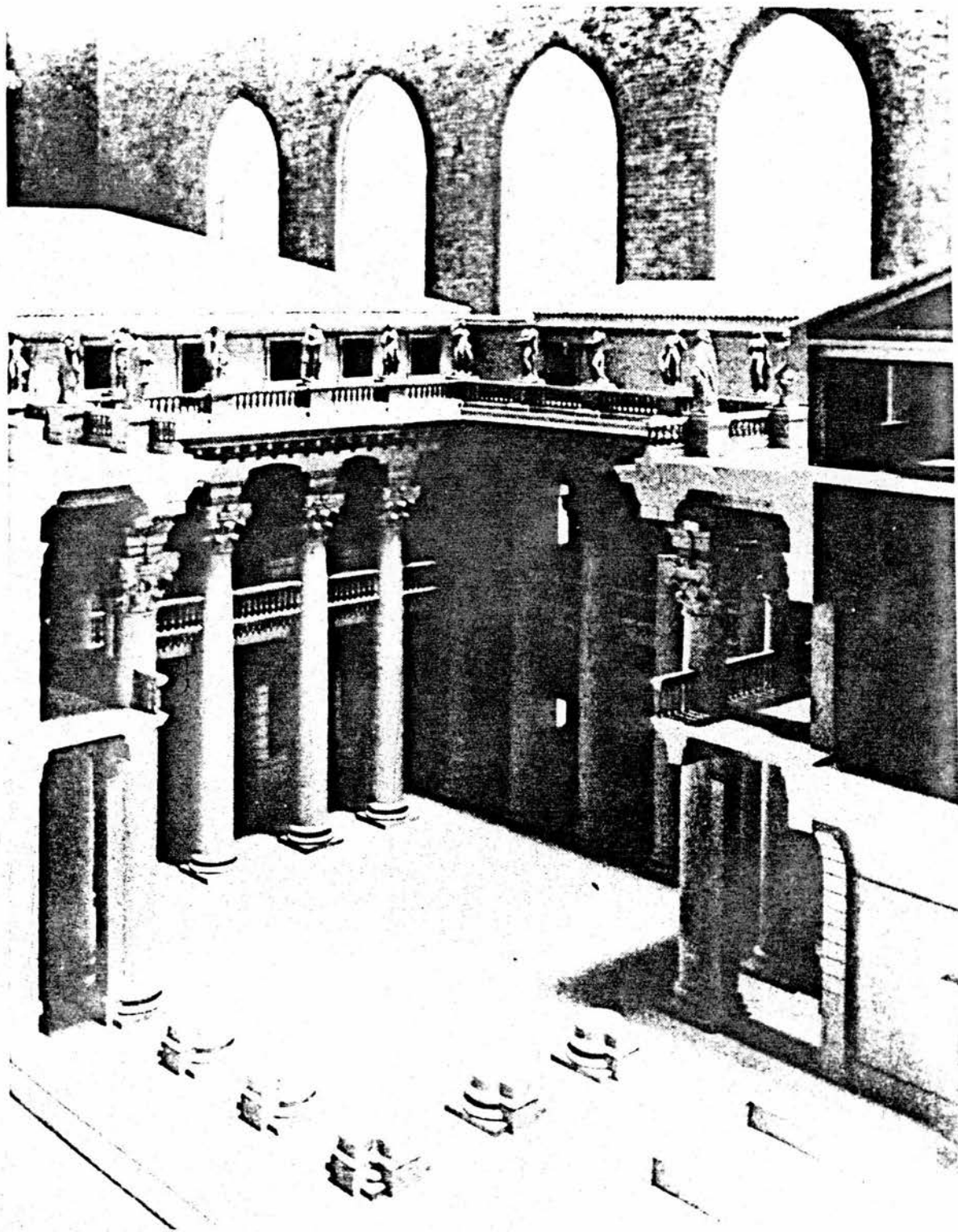
architect makes certain adjustments to the established elements of an emergent model (classical architecture) in order to achieve certain functional results.

It is true that to an architect engaged in the active practice of design the relaxation of formal ideals may seem like a compromise which dilutes his best ideas. But history reveals that nearly all good architects were prepared to use the formal principles of their time in a flexible way, and in fact every time they did so this



15TH CENTURY PAINTING 'CITTÀ IDEALE'  
(source: Palazzo Ducale, Urbino, Italy)

FIG.6.3



PALAZZO ISEPPO PORTO, VICENZA. MODEL.  
(source: Exhibition of Palladio's works at Vicenza, 1974)

FIG.6.4

proved to be a strength and not a weakness. Formal ideals are a result of the architectural community's belief system; they can and should be revised or even abandoned if they are in conflict with the requirements, interests and experience of users. How groups of users express their requirements, interests, aspirations and so on depends on the 'focus' of all the participants in the process of design. When the focus is on architects, as was the case in our examples of Renaissance architecture, rather than users and clients, one rarely gets a response from the users, and in this case the onus is on the architect to ensure that the model solution he employs meets all the needs of users and, if necessary, to make the required revisions to his model in order to satisfy the basic requirements of users. But when the focus is on the users, one can expect considerable healthy criticism from them, and in this case it is a question of the architect approaching the problem with a free and open mind;<sup>16</sup> occasionally, users' criticisms of the model solution may be unfair, in which case it is the designer's task to explain its suitability; in other instances he may well have settled for a particular model on the basis of its 'formal' or 'aesthetic' appeal, in which case he should make use of the users' criticisms in introducing revisions to the established model. Only in this way can architecture be made richer, reflecting the diversity of users' requirements.

Of course design is not determined simply by what is acceptable to the users. The interpersonal communication which informs design decisions is much more intricate than our discussion on the 'focus' and 'direction' of communication has implied so far, and calls for a more detailed exploration. A communication is not intellegible if it is considered as an event separated from the social context

of which it is a part, and in fact it can only be understood in terms of its total setting, including the relationships of the participants to the code or language that is employed, their relationships to one another as members of a group attempting to communicate and the manner in which whatever is being communicated (information, message, etc.) acts as a link between the source and the receiver. In order to define the total architectural setting in which communication takes place we must be clear about who the sources and the receivers of that setting are. The situation is obviously complex, for even in the straightforward case where an architect explains his scheme to the users and is prepared to make certain changes in the light of their criticisms, the architect acts both as source - because he generates inventive information - and as receiver - because he accepts information from client and users through their criticisms. Similarly users receive the design and through their criticisms generate new information; thus they are both receivers and sources.<sup>17</sup> Our task here is to analyse the interpersonal communication between participants in the building process without losing sight of its dynamic dimension. In the next section we develop a model of this communication using a system of notations to describe the participants and their roles, and show how this model can be used to relate communication, transformation and assessment of design.



Interpersonal Communication and the Role of Participants in the Design and Building Process

The term 'source' implies source of design information or message, but when we talk about reception we use it to describe not only the reception of information by the brief writer, the architect and the critic, but also the reception of the design itself by the users. Thus 'Receivers' and 'Sources' cannot be neat categories if we wish to analyse interpersonal communication in all its dynamic dimensions. We may list the roles of participants in different circumstances as follows:

Client : Source of information on the type of building required; cost limitations; social and technical aspects of building process; management policy; nature, number, type of occupancy; sex, age distribution etc. of users; feelings on flexibility, interrelationship between spaces, future requirements etc.; sociological data on users; internal environment and so on. Receiver of design and information on users.

Users : Source of information on requirements and undesirable features which are to be avoided in the proposed building. Receivers of design.

Brief writer : Source of information to the architect. Receiver of information (of the type described under the heading "Client") from clients and users.

Architect : Source of inventive information and design. Receiver of information from clients, users and brief writer.

Critics : Source of inventive communal information. Receivers of design.

Society at large:<sup>18</sup> Source of inventive information in the form of prevalent ideology. Receiver of design.

This description is only a rough one and is advanced here as a suggestive rather than definitive way of describing the roles of participants in the design and building process. In real situations the roles can of course vary - for instance in some cases the architect may also be the brief writer and clients and users may be the same body; it is however possible to adapt this description to suit any particular situation. A study of the roles of the different participants in interpersonal communication given above reveals that two quite distinct entities are involved - one is 'Information' and the other 'Design'. Both these entities lend themselves to an analysis in terms of source and reception.

Although the progress from information to its transformation into design is a continuous and cohesive process, it seems to have distinct aspects and occurs in two quite different settings. Fig.6.5 is a way of showing the communication that takes place using rectangles for the information aspect and circles for the design aspect. The first box represents client and users who communicate information on various requirements to the brief writer. The actual users may not be known at the early stages of design, but users of a building similar to the one proposed can advise clients on the desirable features of the proposed building. Just as the inhabitants of a city build up substantial group images<sup>19</sup> of their city, we may expect users of similar buildings to develop group feelings about

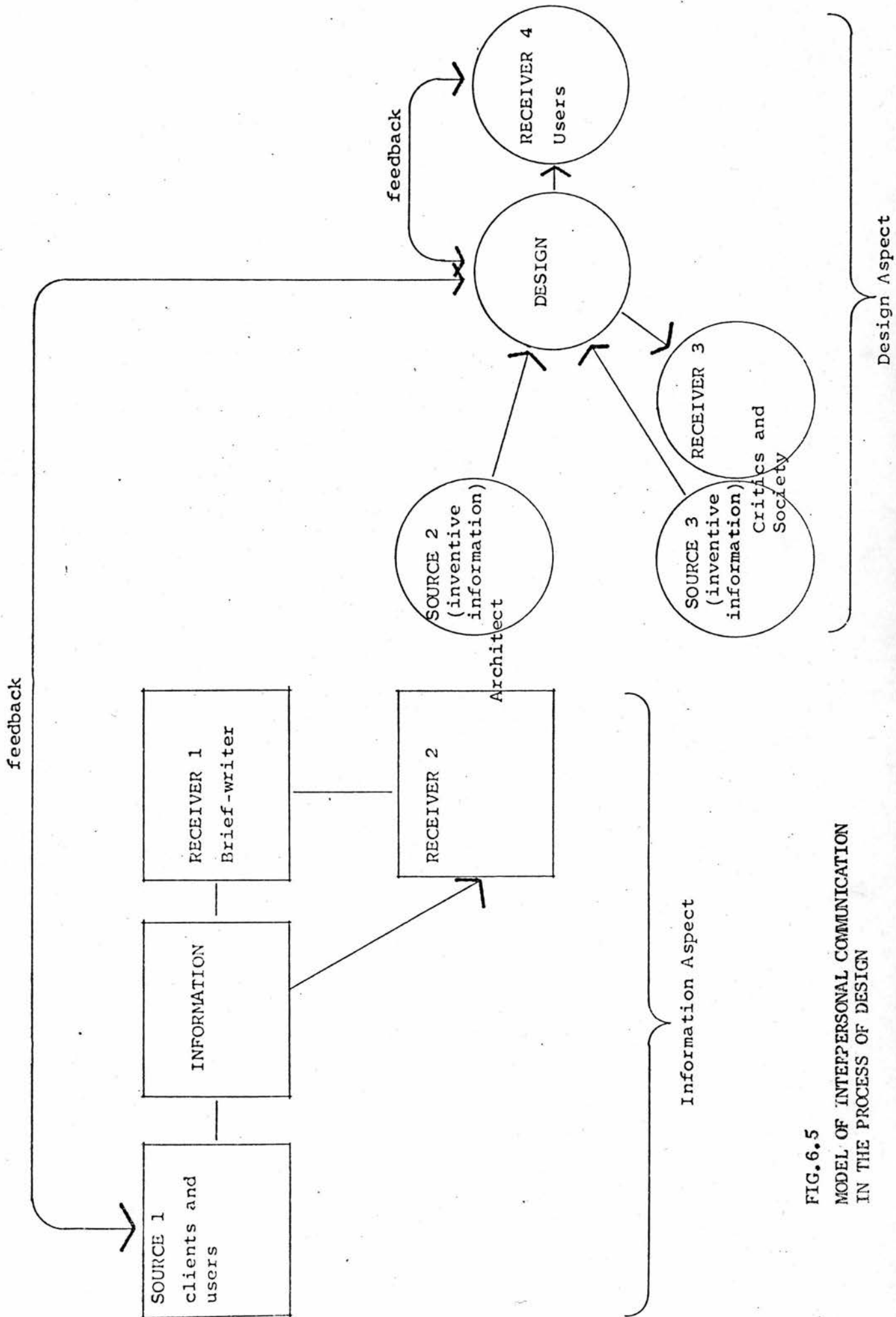
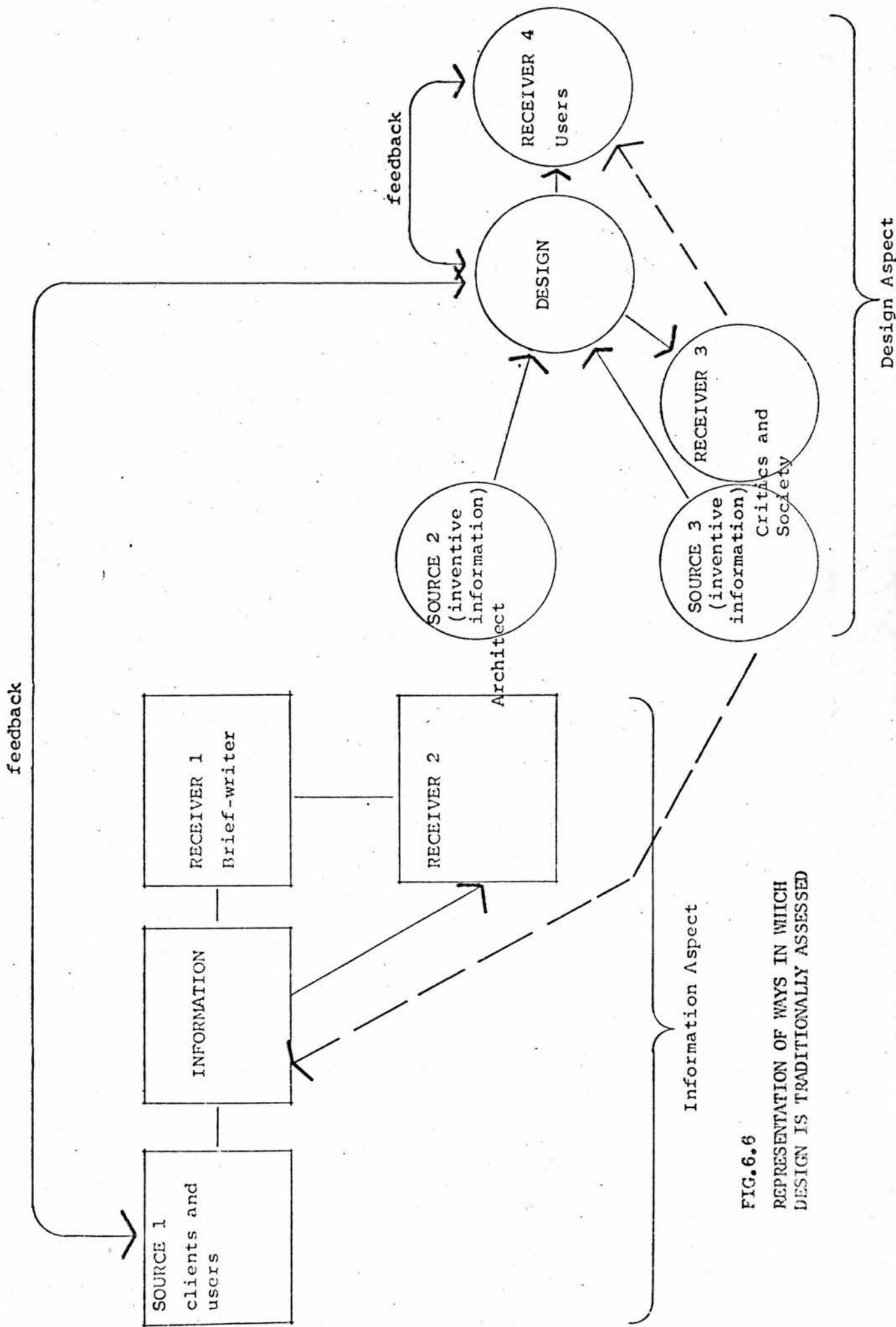


FIG. 6.5  
 MODEL OF INTERPERSONAL COMMUNICATION  
 IN THE PROCESS OF DESIGN

the desirable features of that type of building, and these group feelings may be elicited through the use of methods of environmental evaluation explained in Appendix 3. Thus information is communicated by the client and users to the brief writer. The architect is both a source and a receiver, since he receives information on clients' and users' requirements and generates inventive information and therefore design. Inventive communal information is also generated by critics and theorists and is usually expressed in the design process as a form of the prevalent ideology of the profession; society at large also provides certain forms of ideology as we saw in the case of tower blocks. At the same time, an architect knows that his design is not only to be received by his particular client and users but also by architectural critics and society at large. Thus critics and society are both receivers and sources. Therefore, any design responds to a variety of information from a number of sources; users are the most involved receivers of the design; and, as pointed out earlier, an architect must try to accommodate any criticism of his proposals by users and clients, and this is represented by the feedback shown between Design and Source 1 and Receiver 4. In diagram 6.5 the vertical dimension also represents temporal differences between different procedures.

Thus we have a description of the interpersonal communication between participants in the design and building process as a procedure by which source and receptors are related through the instrument of information and design. Fig.6.5 relates these four basic components: source, receiver, information and design in rather complex ways, reflecting the dynamic nature of the communication involved in any design situation.

Besides describing the interpersonal communication between participants, diagram 6.5 can also be used to show how a design is judged traditionally and to pinpoint the shortcomings of this procedure. Following this we may also suggest how it may be improved. At the present time a critic or a jury giving certain awards (e.g. Civic Trust awards) simply compares the information provided in the brief with the design, talks to the architect who provides some of the inventive information and using these elements, together with the prevalent ideology of the profession (in which the critics or the jury's own ideology has a place) as a basis, the design is judged. This process is diagrammed in Fig.6.6 where the dotted lines show the assessment process. This is one way of evaluating the quality of a design, but it has one built-in problem, for the critic or the jury is often too familiar with the kind of information encountered in typical design situations and when that information is coloured by communal inventive information almost instinctively anticipates only certain types of solution - all others are ruled out as inferior or unworthy of commendation. This is why many award-winning schemes and competition-winning schemes turn out to be failures in many fundamental ways.<sup>20</sup> If, however, we direct attention not upon the correspondence between information (that contained in the brief and the inventive information provided by the architect and critics) and final design, but upon the manner in which Receiver 1 and Receiver 4 have appreciated a) the nature of the building required in the case of the former and b) the nature of response to the final design in the case of the latter, we oblige the critic or jury to enquire just how users receive the design and how far this has been taken into account in the early briefing stages.



**FIG. 6.6**  
 REPRESENTATION OF WAYS IN WHICH  
 DESIGN IS TRADITIONALLY ASSESSED

Thus the critic must examine thoroughly the degree to which the brief writer has appreciated users' requirements and then test how the design reflects this by considering users' response.

Thus this procedure, which is diagrammed in Fig.6.7 suggests a way in which the critic or jury may avoid a situation in which the judgement of a design is affected by the inventive aspects (both personal and communal) of the profession. This does not mean that inventive aspects are unimportant or unnecessary - indeed we pointed out their importance to the design process in Chapters II and III - but it is one thing to be clear about their role in the design process and another to allow them to interfere with the assessment of a design.

#### The Brief and its Transformation into Design

We have already made several references to a few principles governing the transformation of information into design. A clear description of interpersonal communication between the various participants which we have just completed is a necessary first step in formulating such principles. Before summarising these principles we must describe the part played by a written brief in the process of transforming information into design.

Unfortunately, extreme views about the nature of the information which a brief can provide are not uncommon. The brief has been regarded alternatively as a volume of totally useless data, or as the finest instrument ever devised by the profession.<sup>21</sup> On the contrary, the brief must be regarded simply as a conveyor of information through the use of ordinary language, and as such possessing the qualities and liabilities of any communication involving ordinary language. To recognise the true worth and significance of a brief

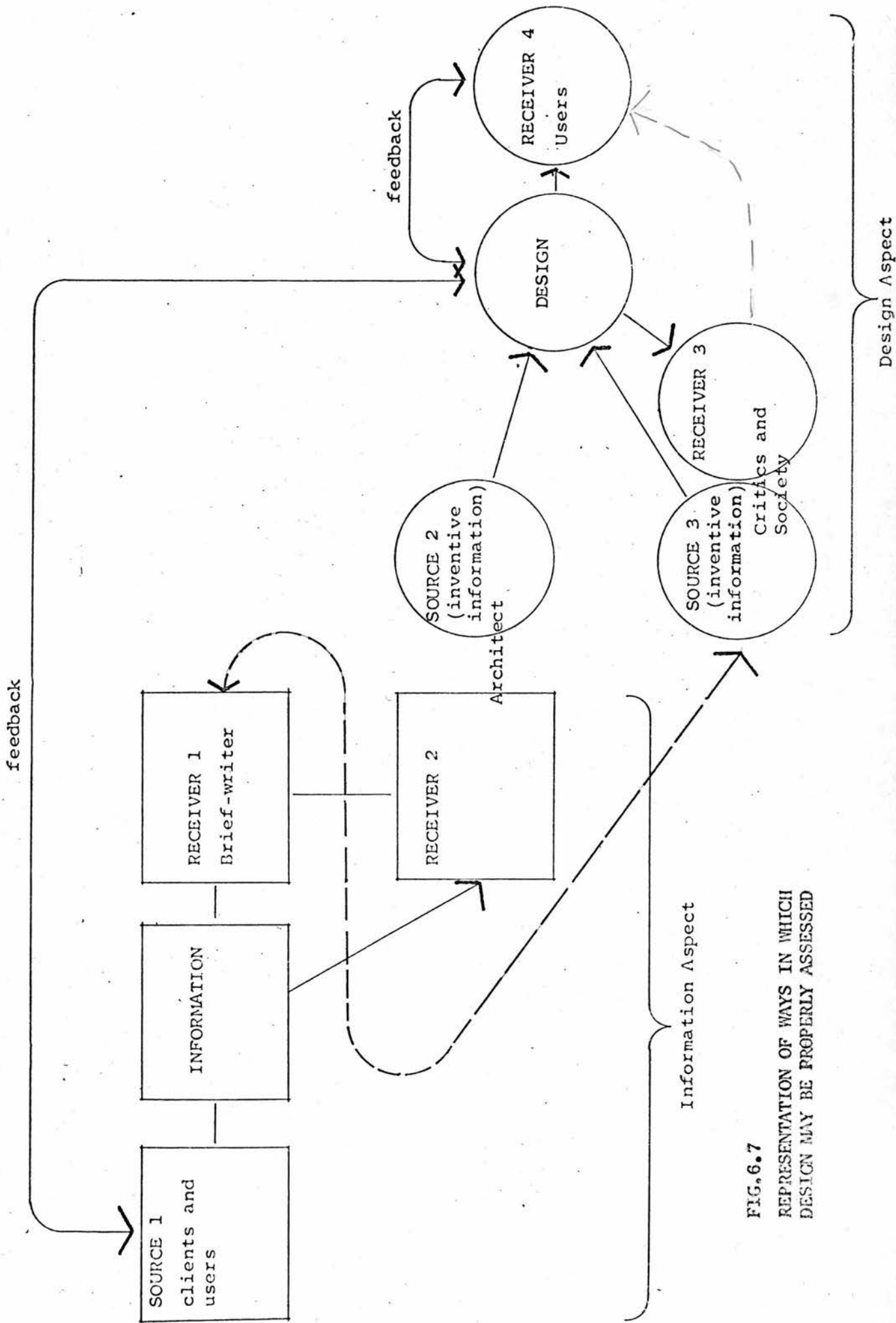


FIG. 6.7  
 REPRESENTATION OF WAYS IN WHICH  
 DESIGN MAY BE PROPERLY ASSESSED



one must understand three essential and architecturally relevant implications of using the brief as a vehicle of communication:

1) the brief is subject to the limitations of ordinary language.

All languages possess numerous grammatical and lexical ambiguities, and these are usually resolved by the linguistic context. But what is really important is that the words used in the brief are rooted in the finite experience of those who write it, and to a large extent they have meaning only in terms of their social, economic, administrative and cultural context. Therefore all the information presented must be understood in terms of this type of background.

2) brief writers expect to be understood.<sup>22</sup> Writing to be understood might seem to be a truism, but it is quite surprising how many designers have dismissed a brief as being too complicated and difficult to understand.<sup>23</sup> Brief writers concern themselves with concrete situations involving the need to provide certain resources for a group of users to perform certain activities; thus they are trying to represent a group of people who often need to satisfy some of their basic requirements (e.g. in mass housing). It may not always be possible for an architect to understand precisely what the brief writer actually means, but he should not assume that the brief writer was intentionally trying to be difficult and obscure.

3) the architect as a translator must attempt to produce physical interpretations of the brief writer's intentions as understood by the user/client body. The principle of attempting to translate a brief writer's intentions may seem so obvious as not to be worth mentioning, but there is more here than one might suspect. Architects' commitment to emergent models can be so strong that a check on whether

that 'model' matches the intentions of the brief writer may not be performed at all. Further, in architecture intentions tend to be expressed in the form of solution-images (e.g. study-bedroom) which are liable to obstruct the exploration of users' requirements at a basic level. Exploration of basic requirements will almost certainly lead to several adjustments by the architect to the brief. An example may illustrate this. If we interpreted the schedule of accommodation for halls of residence developed by the U.G.C. (see Appendix 6) we would simply get a corridor residence as shown in Fig.6.8a. There may not be anything wrong with this, in fact it may well be the most economical solution to the particular problem. But if we wish to allow the original intent in all its dimensions<sup>24</sup> to influence design, we must make certain adjustments based on what different participants understand by the intentions of the brief. The adjustments made by Maguire and Murray to the information contained in the U.G.C. schedule are as follows:<sup>25</sup> the built-in wardrobe and the wash-basin, both impersonal objects, tend to dominate a small room and restrict variations in furniture arrangement; they should go out. This resulted in paired single study-bedrooms off a shared lobby with wardrobes, shower and WC (Fig.6.8b). This also helped in avoiding groups of large numbers of bathrooms, WCs, etc., which would have contributed to the feeling of institutionality. It was also thought that some shared rooms, particularly for younger students, were desirable, and these were incorporated, again opening onto a lobby with toilet and wardrobes (Fig.6.8c). Simple cooking and coffee-making was the next informal centre around which new groups could form. From a socialisation point of view, a unit of ten seemed to the architects appropriate (Fig.6.8d). From there they progressed to a larger group which to them seemed perceivable as a 'place' and

THE EVOLUTION OF STUDENT HOUSING  
AT GUILFORD  
(from RIBA Journal, April 1971)

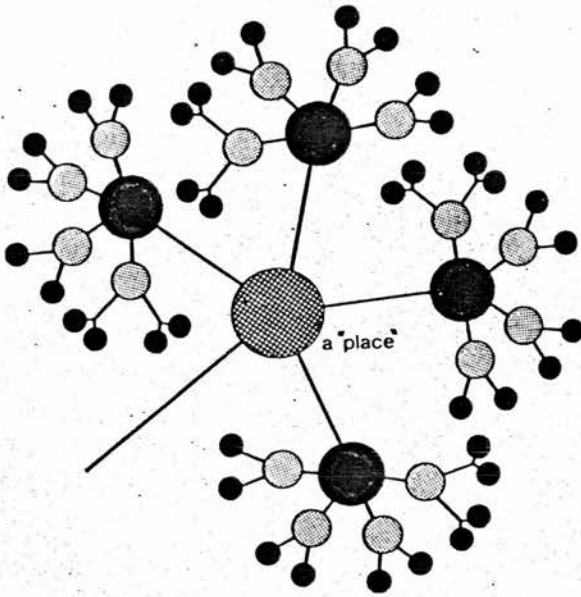


FIG. 6.8e

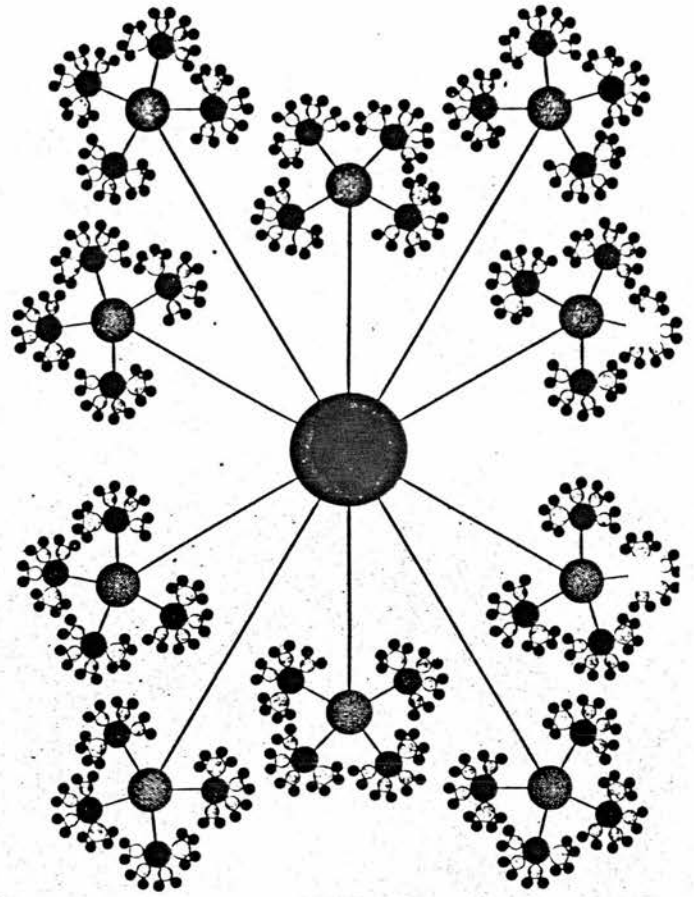
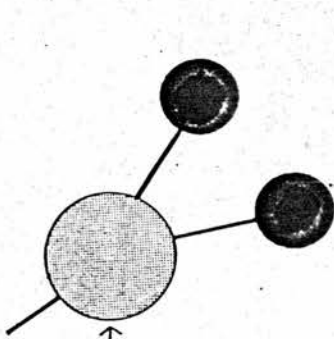
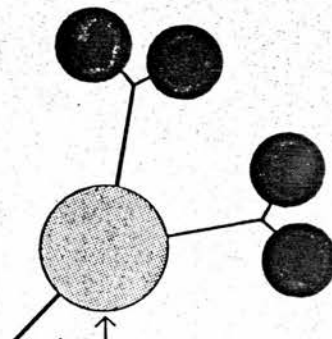


FIG. 6.8f



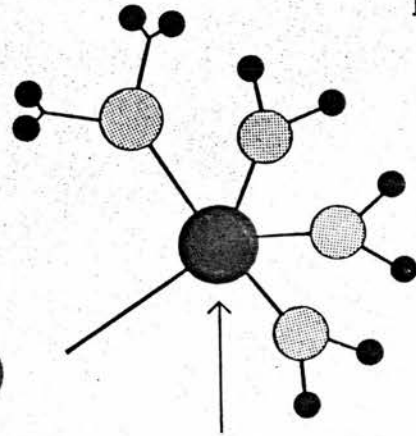
↑ lobby  
wardrobe  
toilet accommodation

FIG. 6.8b



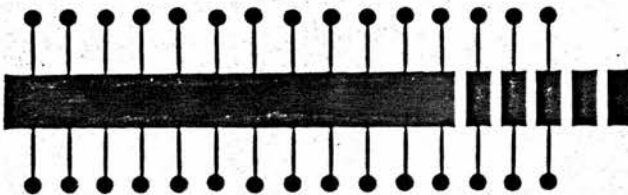
↑ lobby  
wardrobe  
toilet accommodation

FIG. 6.8c



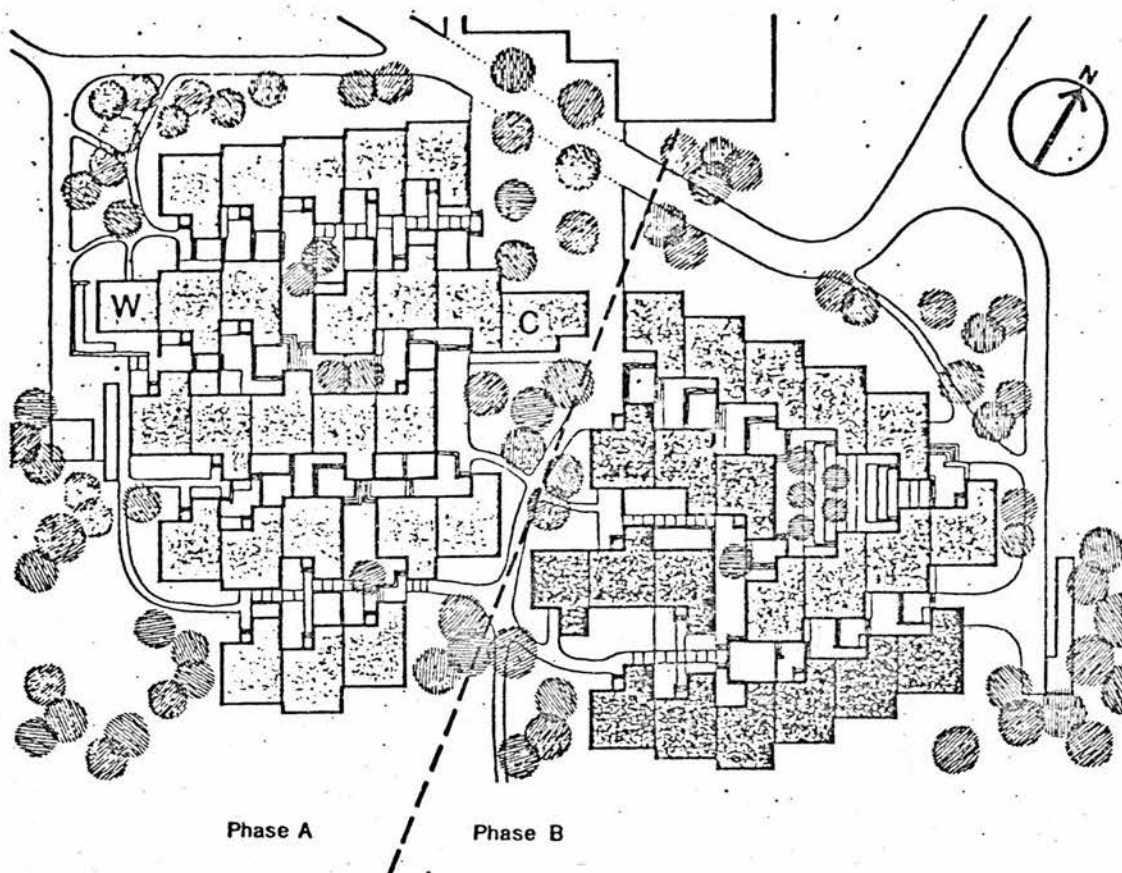
↑ cooking  
eating  
common sitting space

FIG. 6.8d



THE TRADITIONAL  
CORRIDOR RESIDENCE

FIG. 6.8a

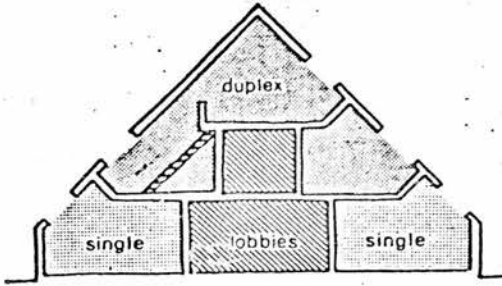
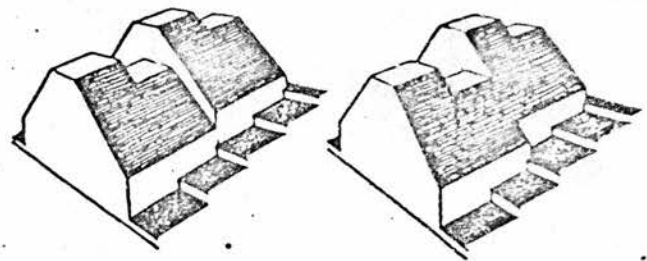
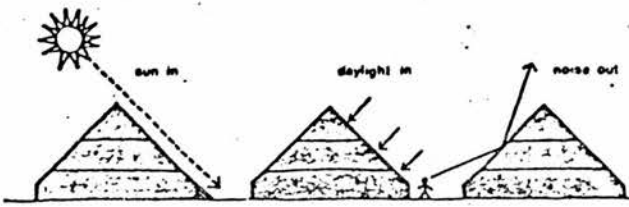


STUDENT HOUSING AT GUILFORD : SITE PLAN  
 (source: RIBA Journal, April 1971)

FIG.6.9

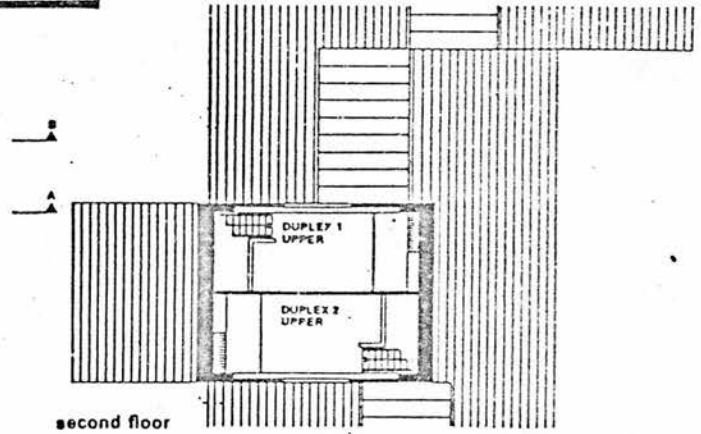
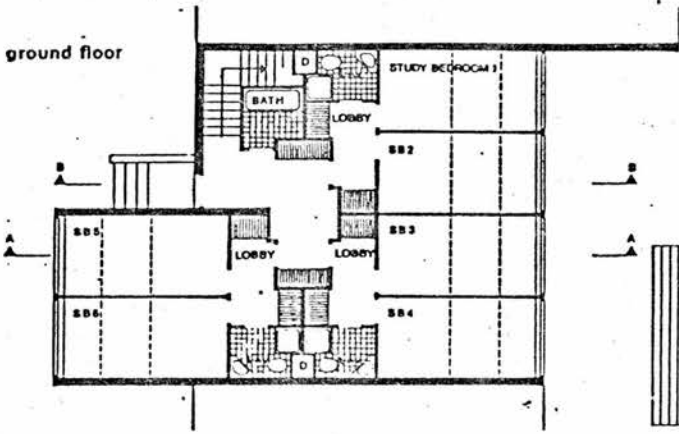
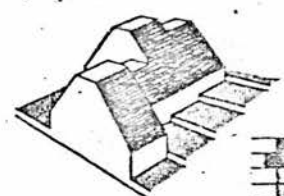
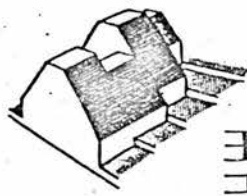
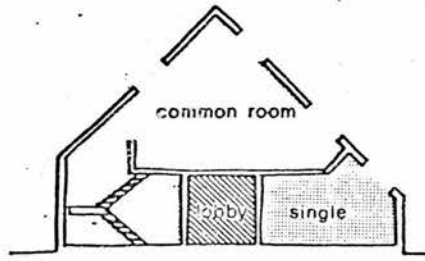
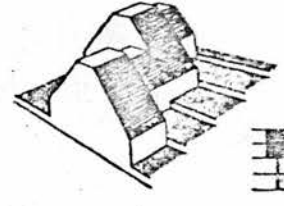
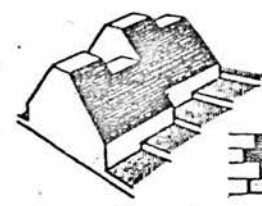
this unit, unlike the other units at lower levels, had no specific activity associated with it, except that of access. The next level group was formed around a central communal place, possibly a site for a small-scale social building with a laundry. Figs.6.9 and 6.10 illustrate the physical translation of these basic adjustments made to the information regarding the design problem. It will be noticed that abstract requirements live 'avoiding impersonal objects inside the study bedroom', 'avoiding institutionality', 'making a group of buildings perceivable as a place' and so on provide criteria on which adjustments to the brief were based.

Thus the designer must strive for a kind of equivalence rather than literally giving the client what he wants. In a sense, this is

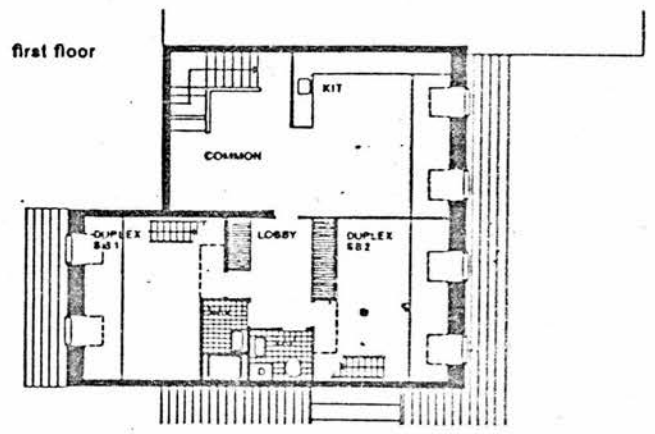


roof over through

roof over through



second floor



first floor

STUDENT HOUSING AT GUILFORD  
 (from RIBA Journal, April 1971)  
 FIG.6.10

just another way of emphasising the idea of basic requirements rather than solution-images, but it reinforces the need for radical alteration to a statement such as '120 study bedrooms are required'. Such a statement, as Maguire<sup>26</sup> puts it, "obstructs discussion of needs: e.g. the need to sleep without disturbance, to undress and dress in privacy, to get away on one's own for a while, to have a personal 'place' which responds to oneself". The notion of 'equivalence' is therefore crucial and needs to be developed further.

No good design can look like a direct physical interpretation of what the brief asks for. A brief cannot avoid 'solution-images': after all, from the point of view of written language it is more economical to say a study bedroom rather than a space where a student can work and sleep without hindrance, dress and undress in privacy, and which is a personal place that can respond to oneself. Words used to designate any one thing cover areas of meaning and not mere points of meaning. Further, since the significance of abstracts like 'privacy' and many of the actions and events that may take place in any space can vary not only for different groups but also at different times, any absolute, once-and-for-all formulation on what a study bedroom should be is not possible. This does not mean that all the study bedrooms that have been built in the past will have faults, but rather that if one wants to re-employ the same pattern of arrangement one must be prepared to make certain adjustments to this pattern so that it may fit the particular context. The precise nature of the adjustments will depend on an exploration of basic requirements. once these adjustments are made the new solution will not be a close correspondent of a solution-image stipulated in the brief but an equivalent; and the word 'equivalent' is used to denote a model

solution which has undergone certain revisions and developments in order that it may satisfy the requirements of a specific context. So, an equivalent may be said to be any design solution (a collection of elements and their relations) containing physical features which in specific ways meet carefully elaborated requirements. Achieving equivalents (as opposed to the physical interpretation of a brief) does depend on the competence of the designer, but a clear explanation of the restrictions which confront an architect who strives for equivalence may be of general use. The main restrictions stem from the type of design problem that is being handled and the attitudes of the designer about being 'faithful' to the brief. No-one who tackles problems from an established field of design is completely free to do what he likes, for the historical background always tends to dictate the extent to which the users and clients of a building will accept a particular design as a 'faithful', 'accurate' or 'effective' transformation of the requirements formulated in the brief. Moreover, attitudes towards what is an acceptable solution vary at different periods in the history of a particular design field, and this must be considered if the architect is to produce an acceptable transformation. The pressure from tradition becomes even greater when the architect has to produce designs for a client who has commissioned many similar programmes before; the architect is then confronted not only with a general pressure to conform to certain acceptable standards, but also with the immediate necessity of making any change to those solutions already executed acceptable to those who are acquainted with them. The so-called faithfulness to the written stipulations of a brief is always a problem, since written language must use abbreviations and certain simplifications of real

requirements. A transformation which is an exceedingly literal interpretation of a brief can therefore lead to simplistic design solutions. At the other end, when an architect is concentrating on equivalence there is a danger of total disrespect for the intentions behind the brief. . Literal interpretations of a brief which fall below an acceptable standard seem to be more common than correspondingly inadequate attempts to achieve equivalence, for the gross simplifications of the former arise primarily out of ignorance, oversight, unwillingness to employ critical thinking and failure to comprehend the true nature of design.

Because many average architects have naively assumed that architecture is simply to do with objects and nothing more, the common tacit assumption results that designing involves physical interpretations of verbally described elements. In other words the traditional emphasis is on elements, whatever their scale may be. Enough has been said to indicate that the emphasis should be on the relationships between elements and on the contexts in which objects and human beings interact in distinctive and structured ways. So, mistakes made by architects striving for equivalence are less numerous since they are made with eyes wide open. There is of course a relatively wide range of possible legitimate and acceptable solutions beginning with somewhat literal interpretations of the brief to rather highly 'equivalent' interpretations. There seem to be points at both ends of this scale where design solutions fall off rapidly in meeting users' requirements effectively and in being qualitatively successful.



## A Summary of the Principles and Procedures of Transformation

So far in this chapter we have set the transformation process in the general context of interpersonal communication between participants in the design and building process; we have tried to examine the implications of our earlier suggestion that design is essentially model-based; and we have spelt out how changing the focus of all participants could affect transformation processes. All that remains to be done now is to isolate the principles and procedures of transformation and describe them in a way that makes them assimilable in the process of briefing and design.

Architects seem to be constantly facing a series of polar distinctions which force them to consider: a) basic requirements of the user as opposed to solution images; b) striving for equivalence as opposed to literal reproduction of what the brief asks for; c) the genius of an emergent model as opposed to its formal integrity; d) respect for an emergent model as opposed to emphasis on inventing new forms; e) general emphasis on process as opposed to form. Good design results when an architect exploits the potential of continuous communication between all the participants. In order to make the most of this communication an architect must understand where the focus of all the participants lies and the directions in which communication is proceeding. In practice he may encounter a variety of situations, but they will all fall into one of the following combinations:

<u>focus</u>	<u>direction of communication</u>
a) on users	descending
b) on users	ascending
c) on users	horizontal
d) on architect	descending
e) on architect	ascending
f) on architect	horizontal

Situation a) suggests a patronising attitude on the part of those in authority, and must be avoided as far as possible. In situation d) uninhibited criticism from users may not be available, so the onus is on the architect to establish priorities based on his knowledge of successful buildings similar to the one being conceived. The model of communication shown in Fig.6.7 will be of help in assessing the effectiveness of his proposals. In situations b), c), e) and f) the architect must approach the problem with a free and open mind, explain his model-based thought process to clients and users, and in response to their views be prepared to make certain adjustments to the brief and the final design. Revisions to the brief are to be based on an expansion of the intentions of the brief which also includes the brief's formulations on users' requirements. Intent (when expressed in terms of all its significant levels) produces the necessity to strive for equivalence, as opposed to literal interpretation of the brief which is often written in terms of solution-images. When the final solution is restructured to accommodate users' criticisms, functional/practical aspects must have priority over qualitative aspects in general and visual aspects in particular. Forms acceptable to users must have priority over architecturally prestigious forms; that is to say the architect must be prepared to give up a model's formal integrity if it interferes in any way with users' expectations and feelings. Expressing the nature of the building needed in terms of elements, relations, abstracts and actions or events can help in determining the kind of adjustments needed in the brief and in the final design. It can also help in giving parts and wholes simultaneous consideration. Good design involves transforming verbal descriptions of parts - that is to say elements - into design with the structure of wholes (relations, abstracts, actions and events) in mind, so that they all fit together as a unit.

## Chapter VI : Notes

1. One exception to this is the work of design methodologists. They are certainly interested in making the thought process public; but as far as the author knows no methodologist has attempted to provide an explanation of the factors which govern the transformation of verbally formulated requirements.
2. De Carlo, Giancarlo, 'Architecture in the Seventies', an Architecture of Participation, The Melbourne Architectural Paper No.3, 1971.
3. Pevsner, Nikolaus, An Outline of European Architecture, Harmondsworth, 1943, p.93 in 1961 edition.
4. Lynch, Kevin, The Image of the City, Cambridge, Mass., 1960.
5. The written and executed works of Bonsiepe, De Carlo, Erskine, Goodman and Hertzberger are in this vein.
6. For instance in educational building projects one would expect a free exchange of views between the building development officer, the head and members of staff of the department concerned, the architect, and so on. The author's observations in two different situations suggest that there is a certain design hierarchy which inevitably makes the communication not only 'vertical' but also in the main 'descending'.
7. Historically, the Renaissance period seems to be the time when a preference for new forms derived from Roman ruins began. The authority which exemplars exerted on Gothic builders is well known and it can be noticed in any study of Gothic cathedrals.
8. Once again Gothic builders were exclusively concerned with the technical aspects of the building process (particularly with structural aspects) rather than with formal aspects. To them the form was supplied by the exemplars. In contrast Renaissance architects show a high level of interest in formal aspects of building. There were of course technical innovations, but often they were of incidental importance, serving rather to give expression to their formal aims.
9. Appendix 4, which explores the skilled performance of an architect, also suggests that pre-existing patterns of response - that is to say detailed level models - regulate various design skills.
10. Campbell, Kenneth, 'The Rise and Fall of the Tower Block', Chadwick Trust Lecture, reported in Architects' Journal, 23rd July 1969, pp.151-52.
11. Jephcott, Pearl, 'Homes in High Flats - Some of the Social Issues', in Architecture and Social Sciences, P.G. Raman (ed.), Edinburgh, 1973, pp.77-95.
12. Ibid.
13. Ibid.

14. Segal, Walter, 'Low-cost Housing and User Participation' in Architecture and Social Sciences, Raman, P.G. (ed.), op.cit.

15. In Chapter III we argued that, in spite of advances in ergonomics, the prototypical forms of chairs remain limited, since the arrangement of components such as seat, back-rest, arm-rest, etc. are conditioned by human seating requirements which have remained largely unchanged. Each prototypical form becomes accepted by those who design largely because it has undergone real world trials and subsequent revisions. It is not difficult to demonstrate that each prototypical form of chair can in its own way meet the seating, resting and leaning requirements of human beings. Those new ideas which do not undergo real world trials and those that do not meet basic seating needs of human beings never gain lasting popularity among users and designers. For this reason disrespect for emergent exemplars very often amounts to desertion of the practice of designing. For instance, a sack filled with polystyrene nodules has been put forward as an alternative to the conventional armchair, in the last ten years or so. Although it has enjoyed some popularity with young people it has not been universally accepted as an alternative to the armchair.

16. Users, architects, clients, brief writers differ from each other in the type of information they wish to convey and receive, in the medium they use to convey a message, and so on. Although this makes perfect communication between them impossible, a relatively high degree of intelligibility can be promoted if individuals participate in the affairs of the group in question. Further, linguists suggest that even people of widely different cultural backgrounds tend to make generalisations which appear to be very similar (see Osgood, C.E., 'The Cross-cultural Generality of Visual Synesthetic Tendencies' in Behavioural Sciences 5, 1960, pp.146-69). So in the interest of increased intelligibility an architect must, wherever necessary, explain the thought process that led to the choice of a particular emergent model. Such an uninhibited explanation is more likely to help than hinder interpersonal communication. Models after all are generalised solutions, and since certain similarities do seem to exist in the generalising tendencies of different people, the explanation of a proposed solution as model-based is likely to promote understanding.

17. An analysis of the roles of participants as receivers and originators is in fact a simplification, since some of the participants can also act as purveyors and censors of information. But it is necessary for the following reason: we can, by introducing the factor of 'noise' and the notions of 'encoding' and 'decoding' take account of the purveying and censoring roles of the participants, but the resulting description of communication would be far too detailed for our purpose. The bases of such a description (although they may be interesting from a theoretical point of view) are not easily manipulated to fit varying situations encountered in architecture.

18. Communication between society at large and the architect cannot of course be called interpersonal communication. But at least part of it takes place in the form of a discussion of the current ideology of the profession, exchange of opinions about particular buildings, and so on. In these activities leaders of opinion play an important

part and we may include some of their views in our analysis.

19. Lynch, Kevin, op.cit.

20. The well-known Pruitt-Igo housing is an extreme example of this kind, but there are many more less well-known examples.

21. Forum on 'Briefing the Architect' organised by the Building Centre on 28th April, 1966 in which architects, clients and builders took part, showed clearly the prevalence of both points of view. See 'Proceedings', published by the Building Centre, London, 1966.

22. There are many reasons why architects do not always understand the brief writers' intentions, but the most important one is the fact that design thought is model-based. Models incorporate generalised information and hence make it difficult for the architect to be concerned with particulars a brief may be mentioning.

23. See Building Centre 'Forum on 'Briefing the Architect', op.cit.

24. The intentions of a brief are normally derived from a complex exchange of views between various participants and as such they can be seen as representing different levels, e.g.: what the source wants the receiver to understand by a message or a piece of information; what the receiver does understand; what the particular message or information means to the majority of people; what experts in the communicating group say the source must have meant; and so on. Once we lay bare these different levels they can guide us in making the necessary adjustments to the requirements given in the brief.

25. Maguire, Robert, 'Approach to Architecture', RIBA Journal, April 1971.

## **VII. A SUMMARY OF CONCLUSIONS**

## VII A SUMMARY OF CONCLUSIONS

The task we set ourselves was to explore certain theoretical aspects of information and its transformation into design. At the beginning we pointed out the importance of viewing all human phenomena as indivisible and this led us to consider information and design not in isolation from each other, but together in all their dynamic dimensions. As a first step in this direction we attempted to identify all the factors that determine the nature of design. They were :

(a) factors in the spirit of architectural vocation which individuate designers; (b) factors belonging to the collective consciousness of architects as professionals; (c) information on functional/practical aspects; and (d) information on qualitative aspects of buildings.

As conventional studies of determinants of design are exclusively concerned with the functional/practical aspects we decided to concentrate on the other three aspects and their interrelations. Most of our conclusions are theoretical in nature; they aim to bring together accepted knowledge, facts, and research findings on the nature of design. In order that we may test the degree to which the theoretical conclusions of this thesis are successful we must begin by summarising the significant generalisations.

## 1. Design Process as a Model Based Activity

Architects do not derive designs directly from problem requirements; they are developed by imposing pre-determined model solutions of different kinds on the range of problem requirements. This does not mean that the nature of architectural tasks has no bearing on design, but rather that an architect can never know the nature of his task except as it has filtered through his perceptions; therefore his understanding of problems and his feelings about what might be suitable solutions are largely a function of his past experience, his assumptions and his purpose. No matter how often we are told we are wrong, we alter our perceptions only under certain circumstances. This is not something that is peculiar to the architectural profession; it reflects generally the nature of human mind. Factors such as architects' past experience, assumptions and purposes are vague and rather general. Nevertheless, examination of what architects say their inspirations are reveals that these factors manifest themselves in (a) models of visual characteristics; (b) models used as psychological aids to the discovery of form; (c) personal prototypes; (d) the emergent communally respected models; and (e) the architectural profession's network of habits, attitudes and ways of seeing. Of all these we said least about models of visual characteristics as we felt that they were the least important; the observations we made on the other models and the network of habits, etc. may be summarised as follows:

### A. Models Used as Aids to the Discovery of Form

Our treatment of this type of model was limited because of our concern with the explanation of how the majority of practising architects conduct their affairs. Nevertheless, we discussed all that is essential



about the circumstances in which individual architects develop new architectural ideas. Problems requiring the invention of new forms only emerge under special circumstances, usually when the profession feels that the potential of conventional solutions in solving central problems has been exhausted; and in this sense the emergence of new ideas has to be prepared by the progress of ordinary practice. Occasionally, awareness of new and unconventional problem requirements also helps in stimulating new ideas. When architects disregard this fact about the circumstances in which novelty emerges, and persist in producing new ideas, their works remain unrecognised academic exercises.

Assuming that the professional practice of design is at a stage where there is a readiness to recognise new ideas, the process involved in developing them calls for significant alterations to the ways in which an architect habitually perceives the nature of design problems, and to his views on what might be suitable solutions. If we see an architect's past experience, his assumptions and purposes as 'schemata' then we may say that inventiveness involves making new use of acquired schemata. It is a remarkable fact that the same form or pattern of relationships can be embodied in a variety of entities, and inventiveness involves exploiting this fact. It consists of making a concrete picture of something 'A' and then using it to evolve a concrete something else 'B'. This is the essence of models used as psychological aids to the discovery of form, and the process is subtle; it takes training and more often than not it requires that the entity used as a model for advancing a new idea has some intrinsic relevance to the architect.

#### B. Personal Prototypes

An examination of invariant characteristics in different types of

projects executed by particular architects suggests that in the majority of cases there is a consistent employment of pre-existing solutions in new situations. These may be schemes previously designed by the architect himself or features of schemes by others which the architect attempts to emulate in his design. These prototypes are not simply transferred to new situations: they are systems in the process of growth and as such undergo development and re-interpretation through application. We say that models of this type are personal because the choice of one model rather than any other in practice remains subjective. Nevertheless these models are much more tangible and concrete than those which are used as aids to the discovery of form; hence communication about the host of relationships which personal prototypes embrace is that much easier. It is of course possible that some of the models which evolved as heuristic devices in the first place can become concrete and may be used as prototypes by architects. Also, at a certain stage of repeated application and development, personal prototypes become recognised as successes by the profession (owing to the fact that their features can be communicated in intelligible ways) and these are the origins of the emergent communally respected models to be discussed next.

### C. Emergent Communally Respected Models

Following Michael Polanyi<sup>1</sup> and Thomas Kuhn<sup>2</sup> we may distinguish between implicit knowledge and explicit knowledge. In solving problems such as those of architectural design implicit knowledge plays a most important role, and this knowledge is acquired by the act of practising design rather than acquiring rules for its practice. Implicit knowledge does not consist of unanalysable intuitions of architects, but rather it is embedded in the shared exemplars of professional achievements.

Creative architects develop an awareness of the existence of these models and their response to problems therefore does not consist of bizarre and remote solutions, but of ordinary solutions in large numbers. New models gain acceptance as established accomplishments because older ones reach a saturation point as a result of repeated application and the new models appear to be more successful in solving certain problems which architects come to recognise as crucial. The major part of an architect's day-to-day practice of design involves the realisation of the initial promise of success shown by emerging models. What constitutes significant design data is not always determined by the architect or anybody else. These tend to be that class of facts and theories which from time to time emergent solutions show to be particularly revealing of the nature of design. Design consists of devising practical uses for these facts and theories, and in this process emergent models and their elements get articulated and developed. Although design tasks are complex, emergent models have the effect of simplifying them. Models as collections of readily available solutions are easily manipulated as units, and those models that are not acceptable to the community of architects are automatically ruled out. This limits the range of available solutions and therefore the choice is made simpler.

As with personal prototypes, communally respected models are not simply transferred to new situations. In fact their application to different situations involves re-arranging their elements to suit particular contexts in such a way that the new solutions are intelligible as off-springs of the established accomplishments. We may say that a solution has model characteristics when its relational characteristics persist even though the elements themselves and/or

their locations change.

Thus a model is a systematic repertoire of concepts and as it gets applied it suggests further issues taking the architect beyond the particular problem requirements which he aims to meet. It is this suggestiveness and deployability that make emergent models useful speculative tools. We can use this fact and enrich the conventional notion of information for design by including in it concepts of sufficient implicative power derived from a study of emergent models. We shall summarise how this can be done in the sub-heading after the next.

#### D. A Detailed Specification of the Components of Tacit Knowing

Emergent models are highly influential in shaping the architectural community's tacit knowing and can be expressed as consisting of a collection of the community's habits, attitudes and ways of seeing. They include: (a) a set of received beliefs; (b) mythical beliefs; (c) limited ways of viewing codes of practice, standards and regulations; (d) special ways of seeing problems and their solutions; (e) principles of organising space which govern the perception of architects; (f) symbolic generalisations of the profession; (g) the profession's system of values; (h) representational aids; (i) the profession's inclination to concentrate on certain technical aspects at certain periods in history. These factors together with emergent models help the architect to be always ahead of data. They are certainly implicit or submerged but we can observe evidence for their existence in architects' explanations of their work, in critics' reviews, and so on. They are a system of codes with the characteristics of language and it is only a slight exaggeration to say that that an architect 'sees' with this system of codes.

Sharing this network together with commitment to emergent models makes architects believe that they and they alone are uniquely qualified to practice the design of buildings. Implicit social organisation promotes faith in models acceptable to the architectural community and it develops through many different kinds of social links, for example students receiving direction from their tutors, informal communication between architects, formal collaboration, communication through learned journals. Mythical beliefs largely consist of binary discriminations between, for example, honest/dishonest, moral/immoral, good/bad, pure/impure. They must not be regarded as defects as they are a system of communication amongst architects and as such play an important role in informing them of the many features of emergent models. Standards and regulations when they are interpreted in limited ways also promote full communication and a relatively unanimous judgement within the architectural profession. Architectural history shows that views such as , for example "antiquity is the only source of the rational" "Gothic is the model of rationality" "20th century structures like aircrafts and ships are of rational construction" "landscapes are good sources of built form" significantly affect the nature of architecture of different periods, and no ordinary sense of the word "interpretation" fits these intuitions through which architectural ideas are often born. Therefore they have been labelled as ways of seeing. Symbolic generalisations consist of habit-forming verbal expressions like "form follows function", "the structure must be honestly expressed", "the building should reveal the social organisation inside it". General acceptance of rhetorics like these at different periods in history is what leads architects to think that the architecture of their time is unique and different from other

periods. Although analysis of design as it is done suggests that ordinary architectural practice can proceed with few such symbolic generalisations, the distinctiveness of the architecture of a particular period seems quite generally to increase with the number of generalisations its practitioners have at their disposal. By the time generalisations like 'form follows function' or 'a building must reveal the social organisation inside it' are accepted, practitioners have already developed an implicit understanding of what terms such as 'form', 'function', 'social organisations' etc. are supposed to mean. All new ideas in architecture involve, among other things, the abandonment of accepted symbolic generalisations.

Values are more widely shared than symbolic generalisations among architects, and give them a sense of group or community. Although not all architects apply these values in the same way they are important determinants of group behaviour. As Thomas Kuhn put it "men did not all paint alike during the periods when representation was a primary value, but the developmental pattern in plastic arts changed drastically when that value was abandoned."<sup>3</sup> Finally, the network of shared habits includes constructs such as particular ways of depicting architectural ideas (e.g. using perspectives, axonometric projection or models) and exclusive attention to particular technical problems at particular periods (e.g. daylight, structure, proportions, services). These are more concrete than the other components and significantly determine the nature of architecture.

Emergent models are an integral part of this network of habits, attitudes, values, and the sense of the model theory may be expressed as follows: buildings are modelled more on each other or on objects or systems of architectural interest than in conformity with any

abstract criteria of styles or in direct response to problem requirements. The disciplinary networks of beliefs, values, etc. are modes of communication through which the properties of emergent models are transmitted to the profession.

## 2. Consequences of the Model Theory

Design related information may be defined as that which determines form (the orderly arrangement of parts) in space and time. A piece of information can determine form in two ways: (a) by a process of working from first principles; (b) by a process of selection from readily available solutions.

The amount of information required by different designers varies. In fact informational sufficiency depends upon the strategy for information utilization a particular architect adopts and the manner and rate at which he will use the information. Broadly speaking, model theory suggests that an acquired ability to see resemblances between apparently disparate architectural situations plays in the design process a significant part of the role traditionally attributed to proper analyses of the problem. Once a new situation is seen to be analogous to a design instance previously encountered, one simply uses attachments that have proved effective before. That ability to see group-approved resemblances is the main thing students acquire while tackling studio projects. If our model theory has portrayed the essential characteristics of the design process, then it follows that informational requirements of designers depend upon the concepts embodied by the models which an architect

considers as suitable solutions to the problem in hand. A brief writer can therefore significantly affect the thought process of a designer by extending the notion of information to include desirable features of emergent models. Also, disjunctive and relational class concepts can help him to be precise about certain requirements. By providing complex but precisely formulated concepts in the brief we go beyond the traditional idea of a 'fit' between activity and space to a more dynamic but realistic situation of producing a fit between the major attributes of an emergent model and its field of application.

### 3. The Application of Theoretical Models in Architecture<sup>4</sup>

The two theoretical models used in our study of architectural quality and interpersonal communication constitute a way of talking about important issues of architectural design. Both involve new terminologies and help us in linking highly disparate issues such as the functions of a building and their architectural effects; or information and design; or clients' interests, users' interests, society's interests in a building and architects' and architectural critics' predilections. They help us to identify new relations, notice hitherto overlooked facts and pay simultaneous and adequate attention to 'wholes' and 'parts'.

#### A. The Function/Feature Model of Architectural Quality

The qualitative functions of architectural features may be described as increasing the effectiveness of functional/practical aspects and creating special effects, enhancing users' interest in the building and producing certain impacts. The features of any environment can



be classified as elements, relations, abstracts and actions or events that take place in the environment. By combining these we obtain a function/feature model of architectural quality, which enables us to consider architectural quality as a kind of frame of reference imprinted in the mind of users of a building. The seven classes of this model can be seen to embrace features of qualitatively successful environments in a universal way and therefore can be used as a tool for evaluating whether or not an environment is successful from the users' point of view as well as a design tool. Although there are difficulties in including topics such as aesthetics as parts of our function/feature model, topics such as symbolic aspects of architecture and the associated meanings of features of an environment do form an integral part of this model.

#### B. Design and Interpersonal Communication between Participants in the Building Process

In all human communication there is a focus and a direction. In the case of architectural design the focus has traditionally been on the architect, but there are signs that it is shifting away from him towards the users. Human communication tends to proceed in two directions : (1) horizontal - when all participants deal with each other on equal terms; (2) vertical - from those in power to take decisions to those affected by those decisions, and vice versa.

The existence of focus and direction in communication, forces architects to choose between a series of polar distinctions: (a) basic requirements of the user as opposed to solution images; (b) striving for equivalence as opposed to literal reproduction of what the brief asks for; (c) the genius of an emergent model as opposed to its formal integrity; (d) respect for an emergent model as opposed to

inventing new forms; (e) general emphasis on process as opposed to form. The choice in each case must be related to users' requirements, interests and aspirations. These factors are intellegible only when they are considered in the context of interpersonal communication between all the participants of the design process. Client, users, society at large, the architect, all have a role to play in that communication. By regarding each of these participants either as receivers or as sources of design or design related data we are able to produce a model of interpersonal communication. This helps us in formalising what actually happens in architectural practices at the present time, notice the deficiencies in that system and construct a new model which can overcome them.

These then are the major conclusions of this thesis. The model theory unifies factors of the architectural vocation which individualise designers, and factors belonging to the collective consciousness of the profession. Thus it provides an account of the inventive aspects of architectural design. The function/feature classes provide a way of describing architectural quality. Our explanation of the attributes of emergent models and of the role of interpersonal communication in the process of design attempts to establish the relationship between different aspects of information and their role in design.

No theoretical work of this kind can be complete without an appraisal of its significance to the field of architecture and some suggestions for future research ensuing from it. This will be the concern of the final chapter.

## Chapter VII : Notes

1. Polanyi, Michael, Personal Knowledge, Chicago, 1958.
2. Kuhn, Thomas, The Structure of Scientific Revolutions, Chicago, 1962.
3. Kuhn, Thomas, 'Reflections on my Critics' in Criticism and Growth of Knowledge, ed. Lakatos, I. and Musgrave, A., Cambridge, UK, 1970, pp.261-62.
4. For a detailed explanation of what is meant by theoretical models see Appendix 2.

**VIII. SELF-CRITICISM AND  
SUGGESTIONS FOR  
FUTURE RESEARCH**

## VIII SELF-CRITICISM AND SUGGESTIONS FOR FUTURE RESEARCH

In Chapter I it was pointed out that successful theoretical works can change the traditional outlook upon a range of familiar issues, introduce new methodologies and procedures, and stimulate further research. Some of the simple examples included in Chapter VI and Appendix 7 attempt to illustrate the value of the methodologies and procedures evolved in this thesis, but no worked example so elementary as ours can represent all that has emerged in the course of this study. We have already mentioned in Chapter I that the significance of theoretical formulations has to be tested according to the criteria of agreement with facts, generality, parsimony, consistency and explanatory value. We begin by specifying these criteria in greater detail.<sup>1</sup>

### Criteria for the Appraisal of our Theoretical Formulations

1. Agreement with the Facts : Do the facts from the field of architectural design that are called upon to support a particular conclusion really support it? The conclusion should also be consistent, or at least not inconsistent, with other known facts.
2. Generality : How many instances from the field of architectural design does the theoretical formulation 'accommodate' in the sense of being not merely consistent with them but of positively providing for

them a place within its framework? If the formulation is true, i.e. in agreement with facts, how widely is its truth exemplified?

3. Parsimony : Generality should not be achieved through an ad-hoc multiplication of postulates to meet the demand of special cases. The fewer the postulates the better suited a particular theoretical formulation is for illuminating aspects of the design process.
4. Logical Consistency : There should be no internal contradictions in a good theory.
5. Explanatory Value : The theory should increase our understanding of the phenomenon under consideration. It should supply more in the nature of an argument than just an analogy. Once the theory's postulates are accepted and its rationale understood it should produce a sense of inevitability and the explanations should possess clarity and conviction.

It is necessary to develop further the significance of the last criterion. The word 'explanation' is used here to denote a description that is more general than those available at the beginning of any theoretical research. For example if one wants to describe the way in which tenants use the space immediately outside their dwellings, an explanation would consist of some general principles embodying conditions under which human beings take possession of space and the relationship this space has with other spaces (e.g. public walkways) as in the concept of territoriality. This concept is at the same time more general and more precise than a description of how outdoor spaces are used in a particular scheme; however it is still a description. It is given in terms of what universally occurs or something that

happens relatively frequently and will always be found to happen. Although explanation and description are one and the same in the broader sense, we can say that a phenomenon has been explained only when the relation between a generalisation and concrete cases is made explicit. That is to say, it is important to know how the general principle applies to the specific fact. To say that the concept of territoriality explains why outdoor spaces are used in certain ways we must also show that users do not tolerate encroachment on what is necessarily their personal space. From all this follows the way in which we shall use the word 'understanding'. Understanding is achieved as a result of adequate explanation. Understanding any phenomenon involves the apprehension of a generalised description of it followed by an assessment of how the generalisation is intelligible in terms of the specific structure of the phenomenon. In applying the fifth criterion we will have to make efforts to follow these meanings of the words 'explanation' and 'understanding' as closely as possible.

With reference to the list of five criteria, they are not totally discrete; for example, explanatory value and generality are highly interconnected. Nevertheless the criteria are sufficiently distinct to be used as separate tests of nearly all the conclusions of this thesis. Finally, in employing these criteria our main aim is to advance self-criticism. But these criteria also show a way of imposing rigorous and explicit requirements on the so-called theoretical studies of architecture. Consistent employment of them should identify omissions, difficulties and successes of each theoretical formulation and point out directions for future research.

A Critique of the General Model Theory of Design

In essence our model theory shows that buildings are modelled more from each other and from objects of architectural interest than from problem requirements stated in a neutral language, or from abstract canons of style. It has a certain coherence and it unifies a wide variety of instances into a single theory, and as a result possesses satisfactory parsimony and logic. It may be thought that the architectural profession's network of habits, attitudes and beliefs, which is an essential part of our model theory, is just another name for canons of different styles. This however is not the case, since canons of style are mainly historians' tools for classification of works of architecture. Although theoreticians and practising architects have often spoken about the styles of architecture, while designing buildings these have always been given new interpretation corresponding to the spirit of specific periods of history. In this process of interpretation the network of values, attitudes, and so forth has an important place. The model theory is supported by facts from pragmatic studies of examples of architectural design, from psychology of perception, psychological research on creativity and from theories of knowledge. The model theory is certainly a description of how design is done and models of visual characteristics, personal prototypes, the emergent communally respected models and the disciplinary network of values, attitudes and beliefs are component parts of this theory. Our analysis of these components is concerned with showing how the general model theory applies to specific facts and hence the explanatory power of the theory as a whole depends upon the extent to which the components of the theory are successful.



Difficulties in our Explanation of Models Used as Psychological Aids to the Discovery of Form

That new ideas emerge only under certain circumstances and that this emergence calls for significant alterations to the ways in which an architect perceives the nature of problems and to his views on what might be suitable solutions is common sense. More complex and problematic from the point of view of evaluation is our explanation of the process by which architects deliberately make new use of acquired schemata. This explanation is in accord with certain facts found in the field of psychology and in the nature of the design process itself. But investigation of the way in which architects develop new ideas is by no means extensive, and therefore it is difficult to say how widely exemplified is the truth of the theory that new ideas involve deliberate re-interpretation of available or already constructed patterns and that these patterns must have certain intrinsic relevance for the person using them. The formulation as it stands is fairly parsimonious and free of any internal contradiction, but it must be admitted that any further development and research on how new ideas are developed may show it to be lacking. The explanatory value of this formulation is perhaps the most problematic point. Our recourse to explanation in terms of the hobby horse and Picasso's sculptures provide only certain analogies and nothing more in the nature of argument. It must, however, be noted that it is this particular conclusion that most architects find attractive and meaningful to them<sup>2</sup> and it also offers a number of problems for further investigation.

### An Evaluation of our Observations on Personal Prototypes

The conclusions on personal prototypes are quite extensively supported by our pragmatic analysis of a number of architects' works and they are not inconsistent with the schemata thesis which was invoked as a support to our model theory in general. There is also a high degree of generality, since we were able to see the employment of personal prototypes in a wide variety of instances (for example in housing, in present day practice, in examples of historical architecture, in university buildings and in industrial buildings). The contents of our formulation on personal prototypes were not multiplied in any way to meet the particular demands of these varying examples, and hence the formulation is parsimonious. Extensive discussion about what really happens when architects attempt to use the same pattern of relationship in diverse design situations - for instance with reference to Epstein's linear plan - shows that there are no internal contradictions about our thesis concerning personal prototypes and its explanatory value is not by any means lacking.

### The Value of our Observations on Emergent Models

As with prototypes, our conclusions on emergent models embrace facts from a wide variety of design situations such as university planning, medieval buildings, early timber frame constructions, Renaissance architecture and public buildings of the modern movement. Other than supporting the model theory our conclusions are also consistent with some well known psychological findings on creativity,

on anagrams and emerging ideas of the sociology of knowledge. The view that design mostly involves selection of an emergent model followed by re-arrangement of its elements to suit particular situations is a simple and coherent view and has no internal contradictions. Our explanation of the role played by emergent models in design throws light on why creative architects when asked for ideas produce relatively ordinary ideas in large numbers. That design competence involves acquiring professionally respected exemplars and that they are to be acquired by the practice of doing design as opposed to acquiring them through rules for practising design enables us to understand a great deal about the design process. This is a way of going beyond just a conceptual study of the design process and allow for what is practical in its description.

#### Components of Architects' Tacit Knowing - A Critique of their Elucidation

The fact that the network of habits, attitudes and ways of seeing developed by the architectural profession determines the nature of design does possess explanatory value. It enables us to understand how architects construe design and designing. In the absence of reliable data on every aspect of what a building should do, architects have to continue designing and this involves certain communal commitments to their own ways of looking at the world. So far as it goes it is a coherent point of view and indeed agrees with a number of findings from the social sciences. But the notion of tacit knowing has not demonstrated its generality by any means, although the examples cited to illustrate the components of tacit knowing indicate sufficiently

that historical studies can confirm their generality across different periods and across different branches of architectural design. In describing the process adopted by ordinary architects we made several critical remarks about the failure of previous attempts to comprehend design as it is done by the overwhelming majority of architects; and we attempted to bring out many common features of design thought which make it possible to speak of architectural tradition in reasonably precise ways. But our approach is open to the criticism that it gets carried away by the notion of tacit knowing and while emphasising the continuity between traditions in architecture it glosses over the important differences between them. This is true, but the reason for not studying the difference between the network of beliefs, values, etc. across different periods is that although there are differences, they do not amount to a difference in the thought process adopted by architects. In other words, design thought is always model-based and difference in tacit knowledge of different periods gives rise to commitments towards different models. It is hoped that this clarification ensures that the explanation of architects' tacit knowing is free from any contradictions. Finally, our description of communal inventive aspects is advanced as a suggestive rather than a definitive piece of work and as such provides many avenues for further research. They are listed at the end of this chapter.

#### A Critical Look at the Consequences of the Model Theory and Tacit Knowing

Proper assessment of the relative merits of our conclusions demands their subdivision. (a) Information is that which determines form in

space and time either by a process of selection from known solutions or from first principles. (b) Information requirements of architects depend upon the models at their disposal. (c) A brief can influence the thought processes of designers by providing (in addition to information on users' requirements) clearly formulated concepts extracted from emergent models. All three conclusions are by-products of our model theory. Item (c) is a suggestion for a new procedure and Chapter VI and Appendix 7 attempt to indicate its value. The other two conclusions are theoretical formulations aimed at increasing our understanding of design, and therefore have to be assessed according to our criteria of agreement with facts, generality, parsimony, logical consistency and explanatory value.

Design information - as that which determines ways of ordering elements of a building - is of course common sense and it is artificial to speak of agreement with facts in this connection. But generality and explanatory value are a different matter. The explanatory value of our definition lies in the fact that it puts into proper perspective a number of activities related to the process of design. For example, choosing a solution from a design guide is only one way of determining the building form or part of it, and the tendency to regard design guides and bulletins as the ultimate tools must be resisted. Further, this definition of information is consistent with the view that information and design should be analysed together in all their dynamic dimensions, and is in fact a basis<sup>3</sup> for our general taxonomy which consists of inventive aspects, qualitative aspects and the functional/practical aspects. The series of major themes that run through our analysis of inventive aspects and qualitative aspects gives our general definition of information sufficient particularity.

The informational requirements of a designer depend upon the model solutions he brings into operation - this is a logical and unified point of view based on a wide variety of facts. A pragmatic look at the early stages of a design field suggests that data gathering is random at first, but as emergent models get established it becomes more purposeful. The study of information processing involved in anagram solution also shows how it is influenced by pre-formed patterns. Other psychological researches on concept formation and acquisition of skills (see Appendix 4) also lend support to this view. Although we made no attempt to investigate its generality in the field of design, our examination of the emergent models in different areas implicitly showed that it accommodates a wide variety of instances. An explanation of how good design comes to be conceived is provided in terms of the importance of multi-dimensional class concepts (particularly by disjunctive and relational concepts) embodied by emergent models and of how they provide a basis upon which sensitive designers work out the revisions needed to the emergent models at their disposal. It is this explanation which leads us to suggest that a brief must attempt to extend the traditional notion of information to include the desirable features of emergent models and describe them in clear and unambiguous ways. This is the rationale of our procedure suggested in item (c) above.

#### The Value of our Observations on Theoretical Models

The conclusion that the employment of theoretical models can bring together highly disparate entities, helps us to notice hitherto

ignored facts, and unify parts and wholes may seem rather grandiose. Nevertheless in our two limited applications a number of elements of that conclusion have been demonstrated and much evidence for this point of view can be found in Appendix 2 and the references sited there. Recent developments in architecture and urban design have been characterised by simplifications of varying kinds which have led practitioners to a number of either/or situations like, for example, traditional methods of construction or industrialised methods; intuitive design or rationalised procedures; landscape design or building design; conservation or redevelopment; users' requirements or clients' requirements; functional aspects or aesthetic considerations; individual buildings or townscape; and so forth. In the majority of these cases the answer should have been 'both'. Ways and means must therefore be found for avoiding simplifications that result from polarised situations like these, and the use of theoretical models as a way of thinking about issues takes us in this direction. What has so far been said by no means demonstrates either the agreement with facts or the generality of our conclusions. They are nevertheless highly plausible conclusions and the two examples of function/feature classes of architectural quality and the model of interpersonal communication show the logic of their use. Instances where theoretical models may be employed do require a detailed and careful examination. The two instances included in this thesis which we evaluate in the next two subheadings certainly indicate that they are valuable analytical tools.

Omissions, Difficulties and Successes of the Feature/Function Model of Architectural Quality

Description of environments in terms of component features such as elements, relations, actions and abstracts and in terms of their two functions, namely that of increasing the effectiveness of the functional/practical and enhancing interest of users, is an integrated approach. It goes sufficiently far to recognise the indivisibility of the notion of quality of an environment. Appendix 5 demonstrates that our views on architectural quality agree with past works which have dealt with this subject, and Chapter V shows it is in accord with our observation on three widely varying environments (the foyer of a concert hall, Hill House and study bedrooms). It cannot however be denied that these observations called upon to support the theory of architectural quality are somewhat conjectural. In fact further research is necessary to demonstrate how function/feature components are imprinted in the mind of users. With reference to completeness of coverage there have been some notable omissions - for example the topic of aesthetics. The conclusions handle the question of symbolic aspects and the associated meanings of features of an environment reasonably well, and on both topics there is an attempt to provide a new explanation. The explanatory value of the model is further indicated by the fact that it can be used both as an aid for describing environments and as a design tool.



The Value of our Observations on Design and Interpersonal  
Communication between Participants in the Building Process

Our conclusions have fallen into two distinct parts: (a) those that explain the focus and direction that exist in human communication and the consequences of their existence; these are factual observations<sup>4</sup> and there is no need to assess them in terms of our five criteria; (b) the use of information and design as two distinct areas and the consideration of participants as either sources or receivers to develop a model constitute a theory which must be assessed in terms of our criteria.

The merit of this theoretical model is that it broadens our understanding of how determinants of design are generated and attempts to introduce new life into the old problem of communication between architects, clients, users, critics, and society at large. The theoretical model is logical and parsimonious. So far as it goes it is in good accord with facts concerning the process of design and human communication in general. As to its generality, although the model does have potential for embracing a wide variety of design instances we have not shown its application in any one particular instance. This is largely due to the practical difficulties of observing interpersonal communication in architectural practices and due to the lack of resources for conducting such observations. Attempts to analyse communication as it is in a particular design instance and to put forward suggestions as to how it should be, would certainly have been desirable, but it is not easy to get practising architects to agree to such an exercise and convince them of its value to their work. Further monitoring of interpersonal communication between architects, clients, users, consultants and others having an interest in the

building is beyond the capacity of an individual researcher. Nevertheless, it offers a future possibility for an inter-disciplinary study, and until work of this kind can be undertaken the completeness of the theoretical model must be in doubt. The notion of focus, direction and communication, the manner in which information and design are analysed together, the exposition of design as being directed by choice between a series of polar distinctions such as between basic requirements and solution images, equivalence and literal interpretation, process and form, genius of a model and its formal integrity, conventional solutions and new solutions give it a high degree of explanatory value.

#### Problems for Future Investigation

First we have to understand the conclusions of this thesis only as a fragment of much larger work on the theory of architectural design.<sup>5</sup> It is therefore legitimate to ask what problems remain to be solved before we may develop firm bases for constructing an adequate theory of architectural design. Generalisations on inventive personal aspects, tacit knowledge of the architectural profession, and laws governing the qualitative aspects of design as determinants of design are useful. We also tried to discover some clues to the relationships among these generalisations by analysing the place of models in brief-making and the interpersonal communication between participants of design. Although these generalisations and their interrelations are suggestive, the task of developing them into a consistent theory requires deeper study and the raising of more

questions about them. We now attempt to assemble these queries and outline a broad programme of further research. Some of our questions arise out of the deficiencies of our conclusions, others are new directions to be followed, but all of them call for new, pertinent facts as well as a different ordering of the knowledge we have already gained.

1. The Function of Models as Aids to the Discovery of Form: We have examined these models as a kind of experimental work undertaken by architects who attempt to evolve new ideas. Our examination was done through an extended study of Aalto's and Pietila's methods. In connection with the process by which novelty emerges we noted that experimental work of analogous kind (such as Joseph Paxton's studies of plants) plays a role in the general development of architectural ideas. We also suggested that other than comparing and contrasting works by different architects, there are no other methods to test the process by which new use is made of the acquired schemata. Therefore, for a more detailed study of models used as heuristic devices we will have to turn to history. What can we say about historically significant experimental work of this kind conducted by architects such as the process by which Villard de Honnecourt derived patterns for use in the design of Gothic buildings or the relationship between Vitruvian man drawn by different Renaissance architects and the buildings they designed? How do they differ from the experimental work analysed in this thesis? Since the subjects used as models are not entirely arbitrary, what are the factors which determine their choice? Do these experimental works arise entirely from the mental equipment of the particular architect or have they any links with the culture in which novelty emerges?<sup>6</sup> If we can call the use of landscape abstractions

by Aalto and Pietila, Paxton's studies of plants, and Renaissance architects' use of Vitruvian man experiments in design thought, what are the conditions which lead to thought experimental situations of this kind? Any attempt to produce answers to these questions will have to be a historical study, but it will have to be a historical study of a particular kind.<sup>7</sup>

2. Further Investigation of the Components of Architects' Tacit Knowing: The portrayal of architectural development as a series of tradition - bound periods governed by the professional network of habits, attitudes and ways of seeing, and as something punctuated by sudden breaks in compulsion towards particular establishments has been borrowed from highly researched materials both in architecture and outside it. Nevertheless their incorporation into a viable theory or architectural design calls for more extensive study. In this connection Thomas Kuhn has identified one problem:<sup>8</sup> "asked why his work is like that of, say, Einstein and Schrodinger rather than Galileo and Newton, the scientist replies that Galileo and Newton, whatever their genius, were wrong, made a mistake. My problem, then, is to know what takes the place of 'right' and 'wrong', 'correct' and 'incorrect', in an ideology which declares a tradition dead, but its products living." A set of answers to this question has to some extent been given by Summerson's analysis of Viollet-le-Duc's view of design.<sup>9</sup> Viollet strongly believed that "Architecture has to do mainly with the faculty of reasoning. Taste, properly understood, is simply unconscious reasoning. For the artist, however, unconscious reasoning is not enough. He must analyse what pleases him; he must be conscious of the logical process which lies behind the successful result. The architect's education must, therefore, proceed in two

stages. First, he must learn to analyse the masterpieces of the past; then he must learn to make his own synthesis, serving the conditions and using the materials dictated by his age." This is a penetrating answer to Kuhn's question and indeed we ourselves used it to support our model theory. Our model theory looks backward while moving forwards, whereas revivalism - a related idea which is more familiar to historians - also looks backwards but stands its ground. Although there exist historical studies of individual architects' thought processes as being model based (such as the works of Viollet-le-Duc, the Ottoman architect Sinan, Palladianism and the relationship between Mies Van der Rohe's works and Shinkel's neo-classical buildings) it is reasonable to say that no attempts have so far been made to build from them a coherent theory of architectural design. Chapter III attempted to fill this gap but the scope of this thesis and limitations of space forced it to remain schematic. The question that needs further investigation is: what are the interconnections between received beliefs, mythical beliefs, ways of seeing, organising principles, symbolic generalisations, technical constructs and the emergent model? This question points to many areas requiring further study. For example, with respect to values and received beliefs arising from the existence of social organisation, how can we discover the social influences that produce conformity?<sup>10</sup> If binary distinctions and recurrence of same episodes are common to diverse kinds of mythical beliefs, it should be possible to superimpose historically significant belief systems of the architectural profession which have mythical components. This should lead to clearer understanding of myth as a mode of communication among architects and tell us something about the thought process of architects.<sup>11</sup> In this

connection, architects interested in developing theoretical formulations face a dilemma. The more one reflects on matters such as belief systems of architects, the more one gets involved with questions of wide generality; that is to say at a certain stage the study of architects becomes a study of man. Approaches of this kind have not so far received whole-hearted approval within the discipline of architectural research, but undoubtedly the willingness to accept such a broad view is increasing all the time. However trespassing into domains other than architecture in order to produce fresh approaches to the problems of design can only succeed when facts on how design is practised are kept in the foreground. Finally, in what ways does affinity between certain types of models and technical constructs develop, such as that which occurs between interest in antiquity and proportional systems and perspectives, between modern housing schemes and interest in daylight or between university planning in the sixties and walking distance between buildings?

3. Further Studies of Qualitative Aspects of Architecture: The most important direction for future study is indicated by the necessity to understand architectural quality as a total field composed of elements, their interrelations, abstract qualities and the events taking place in the environment. Cognitive representations of how quality of an environment is imprinted in the mind of users may be obtained by asking users to describe environments, draw maps of them, describe their feelings about these environments or their features. These may be analysed with the aid of our function/feature model. Comparative studies of widely varying environments created for the same function will give clues as to the most valued features of an environment; this

procedure can become an integral part of environmental analysis, which may precede a briefing exercise. Some of the limitations of the conventional methods of obtaining data which were mentioned in Chapter IV and Appendix 3 can only be overcome by seriously taking into account the commentaries of users.<sup>12</sup> Human beings do not just respond to stimuli, they think about their response, modify, postpone and even act counter to received expectation. As a result, in the analyses of any human interaction the commentaries of the actors themselves must have a place and the function/feature model should be used to incorporate these commentaries in the process of making decisions.

4. Analysis of Practical Instances of Interpersonal Communication in Architecture: Our critique of the model of interpersonal communication points to the unresolved problem of using the analytical technique in examples of architectural practice. An attempt to apply this technique should try to study at one and the same time each participant, the relation between participants, and the group itself as a system.

In conclusion, the most significant topics for future study appear to be: historical investigations of models used as heuristic devices; development of the model theory into a coherent theory of architectural design; deeper studies of components of tacit knowing; analysis of architectural quality as a total field imprinted in the mind of users and its design potential and application of the technique of modelling interpersonal communication in instances of architectural practice.

All the above are suggestions for more extensive studies of topics covered in this thesis, and from these it might be inferred that the study has raised more questions than it has answered. This is perhaps as it should be, considering the breadth of view we deliberately chose at the beginning. Our aim was to carry out a reconnaissance of a new territory to open the way for more detailed studies.



## Chapter VIII : Notes

1. Explanations of these criteria have been adapted from Allport, Floyd H., Theories of Perception and the Concept of Structures, New York and London, 1955, pp.5-13.
2. The statement is based on the response the author got for his seminars on this topic at (a) Department of Architecture, University of Edinburgh; (b) Architectural Research Unit, University of Edinburgh; (c) Environmental Design Research Conference held at Blacksburg, Virginia in 1973; (d) Conference on Design Methods held in London in 1974; and (e) School of Architecture, Trabzon, Turkey.
3. This fact may have been obscured by the order in which the arguments of this study are presented. We began by speaking about different types of information and only in Chapter IV gave a definition. The reason for this approach was that we wanted to begin with a pragmatic look at design and proceed towards theoretical formulations.
4. Much evidence on these points is to be found in Nida, Eugene A., Toward a Science of Translating, Leiden, 1964.
5. The phrase 'theory of architectural design' is used to mean our interest is in the process of design as opposed to its products. The latter is the concern of theories of architecture.
6. James Ackerman has advanced the view that assessment of innovation calls for an analysis not only of itself but of its function in the culture in which it occurs. See "The Demise of the Avant-Garde: Notes on the Sociology of Recent American Art" in Comparative Studies in Society and History XI, 1969, pp.371-384. The essay includes a number of architectural examples. See also Thomas Kuhn's comments on this essay in p.403.
7. J.A. Passmore distinguishes between four different types of historical investigations: (1) daxographical - which tries to tell where and how an architect lived and what contributions he made; (2) retrospective history begins from important achievements and sets out to show how previous developments led up to it; (3) problematrical history looks at architects as thinking, living human beings confronting various architectural tasks with certain expectancies about the form of solutions and the methods of deriving them; (4) cultural history is interested in architecture as a human endeavour and tries to show the place of it in the state of society at a point in time. It is the methods of problematrical history that should be systematically followed in our investigation. See commentaries (on Problems in Historiography) in Scientific Change, A.C. Crombie (ed), London, 1973, pp.857-61.
8. Kuhn, Thomas, comment on Ackerman's paper, op.cit., p.408.
9. Summerson, Sir John, Viollet-le-Duc and the Rational Point of View in Heavenly Mansions, New York, 1948, pp.140-41 in 1963 edition.

10. A number of precedents for an analysis of this kind exist in the field of sociological analysis of science and the procedures they use can certainly be adapted to the study of social organisation in architectural practice. See, for example (a) Hagstrom, Warren O., The Scientific Community, New York and London, 1965; (b) Crane, Diana, "Social Structure in a Group of Scientists: A Test of the Invisible College Hypothesis" in American Sociological Review XXXIV, 1969, pp.335-352.

11. There is an established procedure of analysing mythical belief systems in the field of anthropology which was originally derived from the technique of structural linguistics. The technique is associated with the names of Roman Jakobson and Claude Lévi-Strauss. It can be easily used in our analysis of belief systems of architects.

12. There are many works which have proceeded along this path in analysing human interaction. For example, works by P.F. Strawson (Individuals, An Essay in Descriptive Metaphysics, London, 1959), Stuart Hampshire (Thought and Action, London, 1959), R.D. Laing and A. Easterson (Sanity Madness and the Family, London, 1964) and Eric Berne (The Games People Play, The Psychology of Human Relationships, London, 1966). The analytical techniques employed in these works offer a point of departure for a study of interaction between people, environment and objects.

# APPENDICES

## APPENDIX 1.

## DEFINITION AND EXPLICATION OF SOME OF THE TERMS AS USED IN THIS THESIS

The terms contained in this glossary have either been borrowed from fields outside architecture or have been used in this thesis in a sense different from their everyday meaning. Words which are not defined are to be understood in their ordinary meaning in the various contexts encountered in this thesis.

## ABSTRACTION

The consideration of form or structure which several analogous things may share, without any reference to contents.

## ABSTRACT

A member of a category of terms that refer to qualities which are properties of objects or physical environment, but which can be conceptually separated from the elements whose properties they are. Typical examples are: privacy, institutionality, compactness, cosiness.

## ACTIVITY MARKER

A device, e.g. an element or an arrangement of elements, which goes a long way towards fixing the function or activity taking place in an environment or in a part of it. A typical example is the use of furniture as room dividers to mark different functions of a single area.

## ATTRIBUTE

Any property of a phenomenon, thing, event, assumed by the observer to be significant.

## CLASS

Category or discrete structures that differ from one another.

## COMMUNICATION

The act of transmitting a message to a receiver. The closer the resemblance between the intention of the source and the understanding of the receiver, the more effective the communication.

## COGNITION

A general term embracing all the various modes of knowing: perceiving, remembering, imagining, judging, reasoning and conceiving.

## CONCEPT

Abstractable, public, essential form of a thing.

## CONCEPTION

Personal mental image of something.

**CONJUNCTIVE CLASS**

A class made up of the conjunction of two attributes.

**CONNOTATION, CONNOTATIVE MEANING**

That aspect of meaning of objects, environments or situations which concerns the emotional attitude of users of a building.

**DISCRETE**

Separate, unconnected or discontinuous.

**DISJUNCTIVE CLASS**

Class defined by either of two or more attributes.

**DISPARATE**

General sense 'dissimilar' used in this thesis to refer to entities belonging to different areas of concern - e.g. design and information; architects, users, clients and society; functions and effects of environment.

**EFFECTIVENESS OF FUNCTIONAL/PRACTICAL**

Maximum satisfaction of functional/practical requirements of the user at the cost of least effort.

**EMERGENT MODELS**

Established accomplishments of the architectural profession which have been tested by real world application and as such strongly influence further practice of design.

**EQUIVALENT**

Model solution which has undergone certain revisions so that it may satisfy requirements in specific contexts as opposed to a close correspondent of a solution-image given in the brief.

**EVENT (ACTION)**

A category of processes in which users, objects and environment take part.

**FOCUS OF COMMUNICATION**

The centre of attention in any human interaction or part of it producing communication.

**FORM**

Orderly arrangement of components.

**FORMAL CORRESPONDENT**

A type of architectural design in which the solution-images given in the brief are mechanically reproduced. Opposed to equivalence.

**FRAME OF REFERENCE**

A characteristic of all experience which involves judging or evaluating according to a structure of standards developed as a result of the individual's experience.

**FUNCTIONAL/PRACTICAL ASPECT**

The name given to information on the physical resources required to perform various activities, the relationship of activities to one

another, limitations imposed on finance, the climate and topography of the site, the standards of thermal, visual and acoustic comfort to be achieved in a project; the number of car parks required, capacity of lifts, sizes of rooms, the network of constraints, and so on.

#### GENIUS OF A MODEL

The unique qualities at all levels of an emergent model which distinguish it from other emergent models.

#### HYPOTHESIS

A provisional theory to explain available facts.

#### ICON

A type of sign which bears some resemblance to its referent.

#### INDEX

A sign indicative of some phenomenal change. Unlike icon, which has formal associations with its referent, index has a natural relationship with its referent - e.g. smoke is the sign (index) of fire.

#### INFORMATION

Knowledge of facts about things.

#### INVENTIVE ASPECTS

Refers to personal, unshared aspects of information which play an important part in creative acts at all levels.

#### MEANING

Implicit rules for attaching a symbol to its referent.

#### MYTHICAL BELIEF

A narrative or tradition without a scientific basis, embodying popular ideas regarding natural phenomena.

#### PERCEPTION

The process of recognising or identifying something.

#### PROCESS

A continuous series of successive but interdependent changes or events.

#### PROJECTIVE TECHNIQUE

A psychological technique of making users of a building express their feelings, needs, etc. in an indirect way.

#### QUALITATIVE ASPECTS OF ARCHITECTURE

The patterning of choices made in a particular design which gives the work its uniqueness.

#### RECEIVER

A person concerned with or using a building, or a person receiving information related to its design.

#### REFERENT

That which a sign refers to, calls attention to or causes an organism to take account of.

**RELATIONS**

Those that specify meaningful connections between elements, actions and abstracts.

**RESPONSE**

The sum of the reactions of a receiver of a message or a design in terms of understanding or lack of it, satisfaction or lack of it, and emotional attitude.

**RESTRUCTURE**

To change the form of a design or parts of it without overlooking any of the problem requirements.

**SCHEMA**

A mental framework or outline. It is difficult to pinpoint it accurately. It is something like a set of attitudes but less definite, and it functions as a kind of vague standard arising from past experience.

**SEMANTICS**

That part of the structure of a language which deals with the meanings of words and expressions and also with meaningful structure of discourse.

**SIGN**

A transmission or a construct by which an organism affect the actions of another.

**SKILL**

Ease, rapidity and precision of actions.

**SOLUTION-IMAGE**

Pre-formed solutions to design problems - e.g. study bedroom as a solution for student living.

**SOURCE**

That part of communication network where information or messages of different kinds are assumed to originate.

**SPECIAL EFFECTS**

The impact of those features of architecture which tend to arouse curiosity, heighten emotion, strengthen users' interest, at times even at the cost of some loss of the effectiveness of the functional/practical.

**STRUCTURALISM**

A school of thought in linguistics and anthropology which emphasise a deep permanent structure of which the observed variations of language and cultures are forms.

**STYLE IN ARCHITECTURE**

All the visual and formal manifestations of a particular period in architectural development.

**SYMBOL**

A type of sign which is characterised by an arbitrary relationship between stimulus-object and referent (e.g. the wave of a hand is not

related to the departure of a friend in the same way as a cloud is associated with rain), but the stimulus-object and referent of all symbols are linked by implicit meanings.

#### TACIT KNOWLEDGE

Knowledge that results from doing design rather than acquiring rules for doing it.

#### TAXONOMY

A set of terms so structured that the generic, superordinate terms at the top define a domain which includes increasingly specific items at several levels.

#### TRANSFER

The second stage of transforming verbally formulated requirements into design.



## APPENDIX 2.

## DIFFERENT MEANINGS OF THE WORD 'MODEL'

Chapter II mentioned models of visual characteristics, personal prototypical solutions, heuristic devices; Chapter III the communal models of the architectural profession; Chapter V the function/feature model of architectural quality; and Chapter VI the model of interpersonal communication. In this appendix we consider what is meant by these different senses of the word 'model' and analyse the pre-suppositions and consequences of using models in any intellectual activity.<sup>1</sup>

The least controversial sense in which the word 'model' can be used is the scale model. Architects often use it to show how their buildings will look and it is not necessary to explain its characteristics in any detail.

Less familiar is the model which involves change of medium. Here we are thinking of Pietila's and Aalto's use of abstractions derived from landscape as models of desirable space characteristics. We may label this a model of analogical characteristics.<sup>2</sup> The important difference between this type of model and the scale model is that the latter is based on identity; its aim is to imitate the original, whereas with models of analogical characteristics the aim is more abstract; they are usually conceived to derive or represent a network of relationships; they share with the real situation for which they are models not a set of features or an identical proportionality of magnitude, but the same structure or web of relationships. Identity of structure among an enormous variety of phenomena makes possible endless opportunities for devising models of analogical

characteristics, and this makes them powerful as well as dangerous. The risk of deriving fallacious inferences from a model of this kind can only be reduced by an independent appraisal of solutions derived from it in terms of their suitability to the real world situation. Models of this kind supply only plausible hypotheses and not final proofs.

We now move on to consider what may be called an implicit model. The following description taken from M.H. Abrams' The Mirror and the Lamp explains it:<sup>3</sup>

"Any area for investigation, so long as it lacks prior concepts to give it structure and express terminology with which it can be managed, appears to the inquiring mind inchoate - either a blank, or an elusive and tantalizing confusion. Our usual recourse is, more or less deliberately, to cast about for objects which offer parallels to dimly sensed aspects of the new situation, to use the better known to elucidate the less known, to discuss the intangible in terms of the tangible. This analogical procedure seems characteristic of much intellectual enterprise. There is a deal of wisdom in the popular locution for "what is its nature?" namely: "What's it like?" "

Most of the personal prototypes mentioned in Chapter II and all the communal models analysed in Chapter III belong to this category. They are a systematic repertoire of concepts using which we describe or apprehend by analogical extension some area or field to which these concepts may not directly apply. The use of a dominating system of concepts offered by older existing models would seem to be typical of all creative enterprises and there is nothing unsound or unnatural about it. What is important however is that the distinctive qualities of each model, its strengths and drawbacks must be constantly appraised.

Lastly we turn to the theoretical model. The crucial difference

between this and the other two types we have mentioned so far is that the theoretical model is not literally constructed. It is simply a way of talking about issues. It is a system of description often involving new terminologies.<sup>4</sup> In the case of the other two types of models the thought process can often be hindered by the irrelevant properties of the model object and theoretical models offer total freedom from such distractions. But this freedom of description has its dangers as well. As we pointed out in Chapter VII, if one does not take adequate care the basic demand of any theory to be self-consistent may be violated. Further the reality one attempts to elucidate through the use of theoretical models, whether it is architectural quality, or the nature of interpersonal communication or, for that matter, any other phenomenon, can appear mysterious. Most successful theoretical models are speculative instruments. They can bring about a synthesis of topics that may appear to be disparate; this was shown by our function/feature model of architectural quality and by the model of interpersonal communication. But the outcome of any attempt to combine highly disparate issues tends to be rather unpredictable. The use of a theoretical model can often result in a tortuous and artificial description of something already known and accepted as common sense. Yet a theoretical model helps us to notice what might otherwise be ignored, to give relative emphasis to details and to grasp new relations.

### Notes

1. The classification of different kinds of models and the description of their characteristics have been adapted from Max Black's philosophical treatment. See Models and Metaphors, New York, 1962.
2. Max Black uses the word 'analogue model' and illustrates it with the example of a hydraulic model of economic systems. This model is

obviously that much more concrete and tangible, but many of his arguments are applicable to the models we are trying to explain.

3. In fact Max Black uses this quotation to emphasise the applicability of the notion of implicit model beyond science.

a) ibid., p.240.

b) Abrams, M.H., The Mirror and the Lamp, Oxford, GB, 1953, pp.31-32.

4. Although a theoretical model is only described and not literally constructed, this sense of 'model' is continuous with those pointed out earlier. The relation between the theoretical model and the situation described is rather similar to that between models of analogical characteristics and the situations they attempt to model. The important factor is that the endeavour is directed towards making assertions about an analysed system to yield insights into unknown fields.

## APPENDIX 3.

## TOWARDS A COMPREHENSIVE ANALYSIS OF USERS' SPATIAL REQUIREMENTS

In Chapter IV we suggested that the traditional methods commonly used for data collection could be improved and this appendix discusses the ways in which this can be done.

The criticism of methods like RDS, ADM, etc. is that the genesis of human actions and the place of objects in these actions cannot be easily discerned by a non-participating observer. It is a more complex and multidimensional business than can be expressed by typical statistical averages to which RDS, ADM, etc. tend to reduce it. These methods originate from behavioural research which has been held to model its activity on the positivist conception of science. Positivism reduced theory to a mere ancillary of prediction and denied it any explanatory role. This led to the emphasis on experiments, and the belief that only experiment can lead to specific empirical results became widespread.<sup>1</sup>

Edward Hall's work on 'personal space' is a typical example of behavioural research. For instance in The Hidden Dimension:<sup>2</sup> Hall suggests that perception of space can be reduced to intimate, personal, social and public distances, and tries to determine these distances in feet and inches. At this point it is instructive to look at one of the most severe attacks on Hall's work:

".... it is significant that these fixed distances have been worked out for human beings on a model suggested by H. Hediger's work on the territoriality of animals in his Zurich zoo. It is a noticeable feature of The Hidden Dimension that no significant

distinction is made, either in terms of concepts or of levels, either in terms of method or of approach, between the studies of contact species and non-contact species of the animals in the first three chapters of the book, and the studies of human spatial experience developed in subsequent chapters.

We recall the comment in the Encyclopaedia Britannica article on Behaviourism: "Behaviourism is first and foremost an extension of the methods of animal psychology to the study of man", and in the light of this comment, we seem to have ample grounds for asking ourselves whether, in spite of its newfangled name, proxemics is any advance on early twentieth century behavioural methods. ....

The question as to whether differences of spatial tolerance might not come into operation at variable points in each individual case, and the question as to whether, therefore, cross-cultural comparisons are quantifiable at all, just never arise. Neither does the interesting possibility (fundamental to the theory of indirect communication) that the individual might use space contrapuntally, in such a way as to counter received cultural expectations."<sup>3</sup>

There is similarity between Hall's work and methods like RDS and ADM. Hall makes an 'unanalysed transition' from one sort of documentation (overcrowding of rats) to another (spatial codes of human beings)<sup>4</sup>. In RDS and ADM although the transition is from one set of users to another and both sets are human, it can be argued that the transition is unanalysed, and of course users can act counter to cultural expectations.

Another criticism of methods of this kind has been advanced by Giancarlo De Carlo in connection with the design of a kitchen presented by a group of architects at CIAM's Frankfurt meeting:

"the kitchen was sized perfectly according to the movements of a woman who had to cook an omelette; and, the omelette became the topical problem. There was an incredible reversal of the subject and the omelette and how to cook it with maximum speed became a target. The participants at the conference were working so hard in that direction that they forgot the subject was a woman, a human being. Of course sometimes human beings cook omelettes, perhaps every day they do this, but the cooking of an omelette cannot be the main reason to live in a space or to use a space."<sup>5</sup>

So the three issues which seem to discredit methods of behavioural research generally, and methods like RDS and ADM in particular are: 1) the problem of unanalysed transition from one set of documentation to another; 2) the failure of these methods to make allowances for the fact that users can act counter to cultural expectations; 3) the simplification that can result from the subject/object reversal these methods can cause. These criticisms can be countered in at least three ways. First one can say that they are based on certain intellectual ideas which bear no relation to the down-to-earth problems with which architecture is concerned and therefore can be more or less ignored. Secondly one can abandon methods like RDS and ADM as legitimate methods of collecting data on users' spatial requirements. The third alternative is to look at these criticisms in a constructive way, try to reduce the dangers of simplification that are inherent in these methods and attempt to discern the nature of interaction between users, spaces and objects in all their complexity. It is this last way which we intend to follow. After all, techniques like RDS and ADM have been extremely useful in producing highly relevant information on critical activities that take place in specialised areas such as an operation theatre or a photographer's dark room.<sup>6</sup> It is of course unwise to regard every kind of space as though it is specialised to this degree, but it is hard to deny the fact that a number of methods (for example observation, questionnaires, interviews, projective techniques of a certain kind) borrowed from the social sciences have been found to be quite useful in architecture in establishing users' requirements.

The rest of this appendix is concerned with the rationale of these techniques and has been derived mainly from a pilot study of

a housing scheme conducted by the author with the help of some architecture students from the University of Edinburgh.<sup>7</sup> These methods - when employed in the full knowledge of their limitations and potentials and taking into account our suggestion that a brief must aim to describe design concepts and qualitative aspects of design - can rescue architects' conventional methods of establishing users' requirements from the three dangers we listed earlier.

#### Methods for Evaluating Building Usage

There are several methods which can be employed for analysing how people use buildings and related facilities. Many of these methods have been used to study isolated aspects of building design - e.g. privacy, friendship patterns, appraisal of physical factors such as lighting, thermal comfort, and so on. What we are concerned with is an integrated analysis of particular environments which illuminates areas of conflict between design provisions and users' activity and experience of the environment. In order that certain valid and useful general points be made about a number of available methods of environmental analysis, a seven-day pilot study of a housing estate was undertaken. Since there were few precedents for an integrated approach using all the available techniques of environmental analysis the investigation was experimental. It was concerned with trying various methods to see what happened.

The techniques used in this analysis included a review of the buildings' history, brief, design and policies behind them; observations in the buildings and in the open spaces of the housing scheme, questionnaires, diaries kept by some of the users about how they



made use of the spaces, equipment, etc. in their homes, and some projective tests on adults and children living in the housing scheme. The main objective was to gain an insight into the activity patterns in a reasonably complex environment and to see what relationship exists between activity, experience of the environment and the environment itself. The investigation was more concerned with obtaining a rough idea of what issues would be raised, what positions were taken by the inhabitants about some of the architectural decisions and what conflicts existed between activity and setting than with obtaining hard sociological data.

Often the preliminary reconnaissance provided very useful clues. Experience in this analysis shows that the investigator should, before commencing a work of this sort, ask himself what he hopes to find out; would the knowledge gained be worth the effort he proposed to expend; what degree of accuracy would render the information obtained reliable and usable.

It seems that in most cases the expense involved in carrying out an analysis of this sort forbids any attempt to carry it out at the early stages of design; but it is the users who suffer the consequences of unresolved issues and conflicts arising from an ill-fitting environment rather than the client or the authority. A crash study of a week to ten days could be of great help in avoiding many of the problems and mistakes.

**Observation :** Methods of observation register actions or events as they occur. The success of an observational technique depends primarily upon having a clearly formulated idea of what it is that the observer is seeking. This implies that the investigator must

develop explicit hypotheses about what actions or events take place in the environment under study. It is also essential that these hypotheses have a clear and definite relevance for design. It is never possible to encapsulate intelligible design determinants by making a note of everything that occurs, say, in a courtyard of a housing scheme. If, on the other hand, one can state explicitly what kind of actions or events can take place in courtyards - e.g. children convert the patterns of paving slabs into games of various sorts and this becomes a source of spontaneous actions and events for groups of children - systematic observation can verify or disprove this hypothesis. In other words, decisions on what to observe should be made in advance. The design relevance of such information is usually self-evident, but if there are doubts about the design relevance of a particular hypothesis the question whether the information resulting from the verification of this hypothesis will determine form in space and time either through a process of design or of selection must help to remove this doubt. Observation has enormous potential in establishing relationships between physical characteristics of buildings and a large set of actions which human habitation entails. Once clear design-relevant hypotheses have been formulated the task of observation becomes manageable.

**Interview :** In the first stages of environmental analysis interview seems to be the quickest and probably the most economical source of good information. Early interviews seemed to reveal broad classes of variables and points of conflict between function and built form; but as interviews proceeded the information provided by users became repetitious. At this stage it is necessary to start identifying key

issues: for example in the particular study we undertook these included "too much noise from the courtyards", "we are not friendly with people who do not live off the same staircase", "inadequate play facilities for children". Statements like these were refined into a set of working hypotheses and tested systematically through observation and questionnaires.

For interviewing to be successful it does not seem necessary to hold a formal theory about the phenomenon being investigated. However, the interviewer must still decide upon a set of specific objectives towards which interview questions are directed; these objectives may change and expand as the interview proceeds, but here too as in observation the analyst must be as clear as possible about the kind of information he seeks. The interviewer can use both 'open-ended' and 'closed' questions. In our particular study 'open-ended' questions included:

"We have talked to many people about this housing scheme - could we have your ideas about it?"

"What were your early expectations about the housing?"

"What were your first impressions about the housing?"

When good open-ended questions were asked, the response led to follow-up questions. Consider the following response offered by one of the tenants to the question "What is it like living in this housing scheme?" :

"Well, it is very noisy, especially in summer. Children run riot in the courtyards; of course there is nowhere for them to go. There is an awful lot of graffiti on walls - vandalism is a problem. The refuse chutes are a dead loss. Outside is awful. Everything looks the same. It is grey: the floors, walls, everything is grey. Sometimes it is very depressing."

A number of follow-up options were available, but the one that was chosen was: "You said there is nowhere for children to go - there are plenty of parks in the nearby area. Could you tell us why you don't send your children there?" While still being essentially open-ended, this question came closer to the users's basic problem. Non-directive probes were employed urging the user to elaborate on his answer: "I am not sure I understand when you say it is sometimes depressing. Could you tell me a little more about it?"

Non-directive probes seem a useful tool in eliminating some of the ambiguities which result from the use of ideas like "depression", "institutionality", "unfriendliness", "variety", etc. The fact that the user was 'depressed' was rather insubstantial without further explanation of how this affected his actions or the events around him. Other examples of vague ideas expressed by the users were:

"I feel a lack of privacy."

"There is no community spirit."

"It is like being in a jail."

This kind of vagueness can be resolved by the use of non-directive probes, which can later become more directive. One tenant, explaining his depressing impressions, said:

"I just thought it was depressing. The walls were dull, ugly and drab. Everything was grey. I wanted to move out and wrote to the Corporation. It was like moving into nothing. Everything was the same."

The interviewer continued: "You just mentioned everything was the same. Could you explain a little more?" The user went on to suggest what in his opinion contributed to the monotony of his surroundings. Paraphrasing the ideas expressed by the respondents seems to make the interviewer's preconceptions about the problem explicit.

Two shortcomings of the interviewing techniques must be pointed out. Ordinary language seems inadequate for the description of physical environments. This may be partly attributable to the fact that precedents for this kind of investigation have concentrated on the psychological and sociological aspects of actions and events. As a result, the major part of our language contains 'corresponding' explanations of human actions. The investigator must be wary of this bias in his analysis of information from interviews. The answers given may also be considerably affected by the respondents' image of what an architect's job is. Answers to questions can often be given in terms of what the tenant thinks the interviewer is interested in - for instance the aesthetic or technical considerations.

Questionnaire : On the selection of items for the questionnaire there are difficulties similar to those of specifying objectives for the interview. Since there exists no reliable theory of users' actions and tendencies related to the physical environment, items for the questionnaire cannot be extracted from theory alone. Therefore one has to rely on interview materials and on one's personal experience.

One of the commonest mistakes associated with this technique is 'loaded' questions. This is a common shortcoming of research techniques derived from market research. Such techniques often equate answers to arbitrary questions with "what people want". If questions are not meaningful to the users, then the answers (no matter how statistically accurate they are) are irrelevant. Conclusions can be predetermined by leading questions and limiting alternatives. Architectural research is susceptible to this danger,

as the main drawback of an approach that employs consumer-type questionnaires is that most consumers only picture a modified version of what they have at any one time.

It is here that our notion of emergent models is useful. If our theory about the primacy of 'models' and its relation to sociology of knowledge and psychology of creativity is accepted, then it follows that an intelligent architect should be aware of all the possible prototypical solutions to a particular problem. This means that if an architect is seeking views on users' preferences on matters of design, he can present them with several feasible alternatives. One instance where this was done and the only instance of this sort the author knows of, is when Giancarlo De Carlo was invited to put forward ideas for steel workers housing at Terni. De Carlo began the exercise with a public exhibition showing all prototypical house forms.<sup>8</sup>

**User's Diary :** This is a useful combination of questionnaire and observation techniques. In this case, however, the user is his own observer. The user is asked to describe some of the actions and events related to his life-style, but to do so in an uninterrupted way. This provides the user's diary.

Self-observation as a device has a special virtue. The information it provides gives a useful picture of the dynamics of space use over time. Also, the data obtained from self-observation can be compared with information obtained from other methods: the result is a clearer picture of relations between user's activity and building form.

The user's diary is perhaps the quickest way of obtaining comprehensive and reliable data on the question of who is doing

what, where and when in the building. The form of diary that was developed in our particular study aimed at probing certain characteristics of space use. The main hypothesis was that utilization of space as specified in architects' drawings (e.g. living room, kitchen, bedroom, etc.) would bear little resemblance to actual living patterns of users, some spaces being used little and others used for functions quite different to those originally intended. Users in flats were asked to record what they were doing, where, and what furniture and equipment they were using each hour of the day. Since the number of diaries involved was small, there was no difficulty in analysing them. But if the numbers were large it should be possible to scan them using a computer and produce visual statements (graphs, etc.) of space use over time.

This technique allows the building to be seen as a receptacle housing dynamic human processes. For instance the diaries of users in many flats studied showed that they used the kitchen for most of the activities which we traditionally expect them to perform in the living room (e.g. letter writing, entertaining friends, reading papers, studying, having a drink). Diaries also provide information on group activities - where and when users meet, and what actions or events result; which of these tend to occur simultaneously, and when they potentially conflict; and which events tend to follow one another.

Self-observation seems to have a strong potential for analysing buildings whose users have different life-styles and goals. In the case of housing, two or three such observations may be conducted - for example one immediately after users move in, and one after they have lived in the house for over six months. Analysis might show changes in activity patterns resulting from adaptation to building

form, neighbours, and changing living patterns. The diaries might be produced by users of different housing types. Comparison of activity patterns might indicate tendencies peculiar to certain physical settings.

Techniques derived from Projective Theory : It is well known that there are severe limitations to the conventional techniques of consumer research. These limitations stem from the fact that users themselves do not know what exactly they want and have difficulties in verbalising their needs. The concept of projection relies on the notion that users can be made to express their feelings, needs, etc. (which sometimes are unacceptable or even shameful when verbalised) through the use of some indirect methods. One such technique that we used was to ask users to draw their own living room. Users were observed while they completed their drawings, and the sequence of objects drawn was noted, which seemed to give clues as to how the space was used; for instance, most users drew the sofa or the easy chair as their first object. The most popular object for the second item was one of the off-peak heaters, which was frequently used for seating (this fact was discovered later). However users sometimes follow an arbitrary pattern in the sequence of objects drawn - for instance, just following the edges of a room. In these cases, apart from the importance of the first object drawn, the sequence may not reveal much about users' attitude to different objects. Consistent size distortion in the drawing of objects and relationships seemed to indicate what conditions were valued. Some of them vastly exaggerated the floor space, drawing tiny pieces of furniture and this might indicate that they tended to use the floor space for reading and working.



There was also an attempt to apply Kevin Lynch's approach to environmental analysis. We asked some of the children aged between 5-14 who lived in the housing scheme to draw their homes and their surroundings. The children up to the age of eight were asked to produce a drawing of their journey from home to school and of things they remembered. The older ones were asked to draw the whole housing scheme and the surrounding areas they frequented. Generally, these drawings seemed to suggest that the architectural features of the housing scheme - for instance the covered canopy - were not at all memorable. The height of buildings (e.g. the flats and maisonnettes) did not seem to have an important function in constituting the perceptual image. The old people's home, which is only one storey high but has a pitched roof, and other conventional features of a house were much more prominent in the children's drawings. Unfinished elements were important features in the environment of children - e.g. the sites which were not yet built over and wastegrounds which they used as a playground.

Although there are many parks in the surrounding area, they did not appear in the older children's drawings. It was discovered in the interviews that children did not frequent these areas since gangs of teenagers from other parts attacked the younger children. In some of the drawings by the younger children the world more or less ended above ground floor door or window level, and the dominant elements presented were shop signs, cars, carefully drawn cast iron railings, zebra crossings, trees and people. In contrast to this rich little world stands the new block, with raised ground floor presenting nothing interesting at this level besides the blank walls for scribbling a few graffiti.

The places children used for group activities were drawn in considerable detail. A good example of this is the staircase in one of the blocks. Our evening observations revealed that this staircase is a place of intense children's activity. Also the colourful window curtains and the red brick school building received considerably more detailed attention than the grey brick buildings in the housing scheme.

### Notes

1. For a cogent criticism of positivism see
  - a) Harre, J.R., 'The Ethogenic Way' in New Society, 8th April, 1971.
  - b) Daley, Janet, 'The Myth of Quantifiability' in The Architects' Journal, 21st August, 1968.
2. Hall, Edward, The Hidden Dimension, New York, 1966.
3. Poole, Roger, Deep Subjectivity, London, 1972, pp.59-60.
4. Hall, Edward, op.cit., p.60.
5. De Carlo, Giancarlo, 'Architecture of Participation', talk given at the Department of Architecture, University of Edinburgh, October 1974.
6. Even Edward Hall's work has been of help in developing ideas like 'defensible space'. Oscar Newman's work on defensible space can of course be criticised as being simplistic, but we cannot deny the fact that many designers have found his ideas helpful and indeed many research workers have found them highly suggestive.
7. 'Environmental Appraisal - A Ten-Day Stint', unpublished paper prepared by students of architecture, University of Edinburgh, under the writer's direction. Owing to the limited time that was available for background research the study was modelled very closely on an environmental analysis of a high-rise dormitory conducted by Sim van der Ryn and Murray Silverstein. See 'Dormitories as a Form for Student Living', Architectural Design, Dec. 1966, pp.623-24.
8. De Carlo, Giancarlo, op.cit.

## APPENDIX 4.

THE RELATIONSHIP BETWEEN INFORMATION AND  
THE SKILLED PERFORMANCE OF AN ARCHITECT

In ordinary language the term 'skill' refers to a certain ability to practise a trade or a craft, requiring knowledge, judgement, accuracy and physical dexterity, normally acquired as a result of long and continuous training. When a designer is carrying out his task, by what criteria his performance can be said to be skilled or competent? Simply posing the question in these terms implies that design skill is wider and more general than physical skills. It is of a more psychological nature and covers mental as well as physical operations. Indeed from a psychological point of view the distinction between physical and mental skill is difficult to maintain in any absolute sense. Any skilled performance is mental in the sense that knowledge and judgement are called for, and all skills require some kind of coordinated overt activity by hands or other effectors. In physical skills overt actions clearly are the important factors, and without them the purpose of the skill as a whole would disappear. In mental skills overt actions play a more incidental role, serving rather to give expression to a skill than forming an essential part of it. For instance a designer's drawings and models, except when the graphic activity is being used as a heuristic device (discussed in Chapter II) serve to give expression to his mental design skill. Thus they vary within fairly wide limits without destroying the nature of the underlying design skill.<sup>1</sup>

In most cases skills involve actions which tend to eliminate discrepancy between intention and performance.<sup>2</sup> Thus in trying to

arrange a given number of kitchen units in a kitchen of a given size the designer's 'trial and error' graphic activities involved (i.e. sketching, model making, etc.) are such as will diminish the conflict between pattern of activity, given space, position of windows, position of kitchen fittings, cooker, refrigerator, sink, cupboards, dustbin, and so on. So the intention behind the planning activity is to reduce the conflict between these factors and it is obvious that it has to be expressed in terms of information and concepts as defined in Chapter IV. The designer's intentions and those of the client/user body can of course be totally different, and the aim of our discussion on tacit conventions in Chapter III was indeed to point out where differences can occur. Further, it may be felt that since the skills involved in design are varied in character, not all of them may conform to those types in which discrepancy between intention and performance could be explicit.<sup>3</sup> This to some extent is true. In many cases the immediate intention of an architect can change constantly. On the other hand, there is always an anticipated ultimate intention of satisfying both client and users, and indeed that of giving them something unusual or unique (this belongs to the inventive aspects) and these play an active part in design skills.

It is usual to think of any skilled performance as consisting of three processes:<sup>4</sup> the receptor process, the translation process and the effector process. The receptor process - in which information is interpreted - involves perception both in the sense of arranging information into wholes and fitting it with past experience. The translation process involves conferring significance for action on perception. The effector process models and carries out the action. The language of skills research in psychology is extremely complex

and seems to have grown side by side with experiments and tests of skilled physical performance. As a result it enables us to make only some rather general observations about design skills. Perception consists in the formulation of a running hypothesis constantly predicting slightly ahead of events and this constant prediction enables performance to be related not to the immediate situation but to a situation expected to ensue at a future time. When incoming data are familiar, they are identified and fitted into context easily. When the data are novel or unexpected there is a more active search for fitting categories in past experience, and there may be use of images, search for analogies, and considerable amount of trial and rejection. The past experience is always in a state of flux as any new experience changes it in some way or other. Past experiences are not simply an aggregate of past impressions, but they are organised or schematised. The relationship between perception and action is of course complicated, but many translations seem to be ready to hand or 'built into' the repertoire that human beings bring to bear upon a particular task. In a design task for which no translation has been built up, the designer has to construct one ad hoc, involving considerable trial and error. Finally, the effector process seems to involve progressive differentiation and particularisation. First some general orientation or attitude determines in outline what needs to be done, followed by some general methods of dealing with the situation which in turn are followed by knacks or dexterities which bring to play overt physical actions. Like in the receptor side, the effector side is also characterised by pre-existing patterns of response. The models we discussed in Chapters II and III are also pre-existing patterns. Since human skilled performance is infinitely varied, and

since it can often be unique, the patterns are similar to those of personal models.

### Notes

1. This introduction of the notion of skill has been adapted from Welford, A.T., Ageing and Human Skill, Oxford, GB, 1958, pp.17-27.
2. Oldfield, R.C., "The Analysis of Human Skill" in General Psychology, Halmos, P. and Iliffe, A. (eds), London, 1954, p.41.
3. Ibid., p.43.
4. Welford, A.T., op,cit.

## APPENDIX 5.

## QUALITATIVE ASPECTS OF DESIGN IN PAST THEORIES OF ARCHITECTURE

The idea that the purpose of buildings is more than the mere satisfaction of utilitarian demands is very old. Vitruvius declared 'utilitas', 'firmitas' and 'venustas' as components of good architecture.<sup>1</sup> According to him, beauty consisted in the rational integration of the proportions of all the elements of a building and such proportions must be based on those of the human body. For instance, Doric columns show masculine proportions with a ratio between diameter at the base and height of 1:6; Ionic columns have a feminine ratio of 1:9; and so on. When Renaissance architects rediscovered Vitruvius they incorporated his principles in their approach, giving them a new interpretation corresponding to the spirit of their time. The circle circumscribing the Vitruvian man became a basic shape around which the centrally planned buildings of the Renaissance were evolved. The circle was considered the most perfect shape expressing the divine perfection of God. The square, on the other hand, was a symbol of earthly existence. Thus the Vitruvian man defining the circle and the square represented a symbolic reconciliation of divine perfection and earthly existence.<sup>2</sup> The ideas of Plato, Euclid, Pythagoras and others provided further stimulus for a renewed interest in the science of proportions. During the Baroque period, however, classical theory was criticised. Claude Perrault suggested that proportions are not at all perceptible and that rules of architecture - rather than directing us towards the creation of beauty - are simply the result of habits.<sup>3</sup> As Norberg-Schultz notes,<sup>4</sup> David Hume advanced the same view from a philosophical standpoint and stated that "Beauty is no

quality in things themselves, it exists in the mind which contemplates them and each mind perceives a different beauty".<sup>5</sup> Abbe Laugier took this up in the 18th century and questioned the usefulness of classical orders.<sup>6</sup> But classical architecture still continued to be the source of authority. Although Perrault suggested that proportional systems are a matter of habit, he maintained that antiquity was rational and must therefore be used as a unifying source in architectural design.<sup>7</sup> Following a thorough exposition of classical and Gothic constructions, Laugier also came to the conclusion that primitive antiquity is the only source of rational architectural principles.<sup>8</sup> In England during the 17th and 18th centuries architectural principles were handed down to architects by their patrons. Personalities like the third Earl of Shaftesbury and Lord Burlington advocated the need to return to the harmony of nature and Palladio's architecture was found to be quite in-keeping with this attitude.<sup>9</sup> In spite of a number of academic works questioning various principles, classical architecture furnished the basic alphabet and grammar for Baroque, Rococo and Neoclassicism.

Nevertheless in the evolution of architectural theory arguments about rationalism played an important part. Lodoli suggested that rational principles could be formulated independently of any source of authority.<sup>10</sup> Boullée argued that the Vitruvian constituents created a confusion between cause and effect, and declared that the effects of architecture were caused by light and that the first principles of architecture must be explained in terms of the use of perfect architectural shapes like cubes, pyramids and spheres.<sup>11</sup> Ledoux was a student of Boullée and carried his ideas further by attempting to create dramatic effects using cubic and spherical



volumes.<sup>12</sup> He insisted further that buildings must express what they are meant for by means of association of ideas.<sup>13</sup> J.N.L. Durand was also influenced by Boullée but his rationalism differed considerably. To him rationalism meant economics.<sup>14</sup> He preferred the circle as an ideal plan, for it produced greatest volume for a given area of enclosing wall. In Britain the break with classical antiquity was started by John Van Brugh and Nicholas Hawksmoor. They were quite happy to design in any style, be it classical or Gothic. John Soane who admired their work went further, and rejected the disciplined use of architectural elements of antiquity. All three were interested in novel ways of combining classical motifs and devices.<sup>15</sup> Once classical elements began to lose their position as sources of authority, architects turned their attention towards Gothic architecture. Pugin criticised antiquity and attempted to show the logic upon which the Gothic system of design was based.<sup>16</sup> Furthermore, Pugin and Ruskin urged the adoption of Gothic on religious grounds as well.<sup>17</sup> To the French architect Viollet-le-Duc Gothic architecture was a prototype of the rational.<sup>18</sup> In the nineteenth century we also see a further extension of the idea that architecture consists of elements like mass and light. Ruskin suggested that architecture is composed of factors like mass, space, line and colour and that a 'principle of right' should govern the correct combination of these factors.<sup>19</sup> Although he disagreed with Ruskin, on many issues, Geoffrey Scott reached a similar conclusion when he stated that "Architecture .... is a combination revealed through light and shade of masses, of spaces and of lines". Moreover, he suggested that the principle of 'coherence' should tell the architect how he should combine these factors.<sup>20</sup> Here we see the beginnings of the idea of space as a

positive architectural element, and twentieth century authors like Zevi<sup>21</sup> and Cornell<sup>22</sup> have extended this concept. They have also introduced the notion of diffuse space, but as Norberg-Schultz points out this notion confuses the effect created by boundaries, illumination and motifs of spaces and the simple three-dimensionality of any building.<sup>23</sup> A further development of the confused notion of diffuse space is the introduction of a fourth dimension.<sup>24</sup> The abstract concept of space/time which originated from relativity in physics has nothing to do with the idea of space in architecture. As Vincent Scully - writing on Giedion's space/time concept - suggested, "this capabilistic conjunction had both the qualities necessary for an acceptable architectural slogan: at once a spurious relation to science and a certain incomprehension except in terms of faith."<sup>25</sup> In architecture there is no need to use the word 'space' to refer to anything other than three-dimensionality of space. Other architects in the twentieth century have sought to derive instruction for design from within the technical tasks of architecture. The theory that form must follow function was expanded, interpreted differently by different architects and is now discredited. The functionalism of the 'twenties and 'thirties provided the first systematic attempts at the formulation of architectural tasks, but unfortunately led to an exaggerated emphasis on minimum dimensions and to a belief that architecture is concerned above all with efficiency and economy. There is a range of other theories which have derived their rationale from the technical tasks of architecture. Viollet-le-Duc and Choisy proposed the theory that form followed structure;<sup>26</sup> In England Lethaby echoed this and added to it his interest in construction.<sup>27</sup> We also notice similar preoccupations

in Nervi's<sup>28</sup> and Khan's<sup>29</sup> writings. Futurists sought to derive instruction for design from contemporary environment and architects like Mies van der Rohe derived inspiration from the potential of modern materials. Expressionism attempted to depict violent emotions, and Brutalism tried to show that buildings were made of bits and pieces of materials. We owe broader theories to authors like Norberg-Schultz<sup>30</sup> and Kevin Lynch,<sup>31</sup> who drew from a wealth of material from philosophy and the social sciences. Norberg-Schultz describes the purpose of a building as consisting of: a) physical control; b) the accommodation of various activities; c) the creation of a social milieu; and d) the creation of cultural symbols. Items a) and b) are self-explanatory, but the other two need to be looked at more closely. The social milieu is concerned with the social purpose of architecture and is indeed a controversial area. Many architects believe that the physical environment affects the social well-being of users, and works of social scientists like Festinger et al.,<sup>32</sup> Caplow<sup>33</sup> and Lee<sup>34</sup> offer support to this view. But other social scientists<sup>35</sup> either reject this view or are at least sceptical of it. Architects like Ivor Smith put forward the view that sometimes the physical environment could affect the social milieu, whereas at other times it remains just a background.<sup>36</sup> In housing, for example, the social milieu probably depends on factors other than the physical environment, whereas in environments where there is a sense of occasion (restaurants, concert halls) the physical environment can be expected to make a contribution to the social milieu. In fact it would be difficult to describe the quality of an environment solely in terms of its physical features without any reference to the interaction between the environment itself, the objects in it, and

the users.

We have looked at symbolic aspects of architecture in Chapter V. But as Norberg-Schultz points out architectural theories tend to treat symbolic aspects and aesthetic problems together and very often in a confused way.<sup>37</sup> If we isolate aesthetic principles, they seem to amount to some form of development of the traditional notion of 'taste'. Typically, they begin with assumptions like 'we prefer Lincoln Cathedral to that of York' and attempt an explanation of why this is so.<sup>38</sup> Another by-product of this kind of approach is to identify certain architectural devices and put forward an explanation of what effects they create; for example solidity may be suggested by rounded corners; height and distinct quality of walls may be emphasised by a glass corner; clear-storey continuous windows lead us to see buildings in terms of horizontal layers; and so on.<sup>39</sup> This type of architectural aesthetics has been challenged directly or indirectly by a number of authors on the grounds that these works deal with critics' or architects' feelings about buildings and environments and not with how users experience them. There are at least three approaches which attempt to deal with quality of buildings and environments from the point of view of users. The first group attempts to explore how buildings as objects are perceived by the users, and by far the most interesting method in this group is the one proposed by Manfred Kiemle and developed further by Adrian von Butler and his associates.<sup>40</sup> At an exhibition entitled 'Environmental Game' held at the Hayward Gallery, London, they presented their method which can be explained in a simplified way as follows: the method is concerned with aesthetic perception and not with symbolic content. The reason for concentrating on aesthetic perception is that while

symbolic content varies considerably with the cultural, educational and social background of the onlooker, in theory at least aesthetic information of the kind described is broadly constant for everybody. The method itself is based on information theory. When we are exposed to a complex object like a building, our mind can only absorb a limited amount of information. This information is more or less constant for all observers and can be quantified and expressed as 160 binary units per 10 seconds. In order to transform what it sees into a legible whole, the eye clings to observed patterns or rhythms amounting to 160 binary units. This reduced field of vision is called 'super-sign'. Having performed this process of reduction, the eye uses this super-sign as a network, and extends its awareness by accommodating in places some of the signs that had been omitted in the first place. Aesthetic perception depends on the amount of information added on in the second part. If there is complexity in the object the mind registers it as interesting, and there is much information to be absorbed, but if the object is over-simple and there is not so much to be absorbed, the object is registered as 'dull'. As it turns out, the application of simplification/amplification theory by Adrian von Butler, rather than providing models for future design unveils in a general way the aridity of modern buildings.

The next category of works which aim to explain the impact of the physical features of an environment in the mind of its users is shown by Kevin Lynch's The Image of the City.<sup>41</sup> This is an attempt to analyse the mental picture of the environment which people build for themselves. According to Lynch, clarity and legibility are of crucial importance in urban design. Drawing from a variety of disciplines such as anthropology, history, literature and sociology, Lynch explores the central

question: what produces imageability? Selecting three very different urban environments - Boston, Jersey City and Los Angeles - research workers under his guidance interviewed a representative sample of citizens and obtained their reactions to visual and psychological experiences their cities offered. The interview included requests for descriptions, locations, sketches and performance of imaginary walks; these were supplemented by systematic field reconnaissance by trained observers and in some cases photographic recognition tests. Although the size of sample for each city was small, Lynch contends that the "material is rich in suggestion and has sufficient internal consistency to indicate that substantial group images exist and are in part at least discoverable by some such means." Lynch classifies the contents of group image into five types of elements: paths, edges, districts, landmarks and nodes. The first four of these are self-explanatory, but the last requires comment. Nodes are strategic points in a city into which an observer can enter, and which are the intensive foci to and from which he is travelling; they may be primarily junctions, places of a break in transport routes, a crossing or convergence of paths, moments of shift from one structure to another. Or, nodes may simply be concentrations which gain their importance from being the condensation of some use or physical character, as a street corner or an enclosed square.

The third and last group of approaches which attempt an explanation of qualitative aspects of architecture in ways that are related to the experience of users is offered by social scientists. They have proposed the use of descriptions - such as quietness, pleasantness, privacy, impressiveness, spaciousness, friendliness, beauty, smallness, safety, and so on. A social scientists's appraisal usually consists

of questionnaires using these notions, and in order to deal with the fuzziness of these terms and enable the survey findings to reflect users' feelings quite closely a technique known as factorial analysis<sup>42</sup> is usually employed. This approach to the qualitative aspects of architecture raises two points. First, evaluation procedures such as these show when a building is unsatisfactory, and this is valuable as analytical background but needs to be supplemented with other positive directions for the designer. Second, it is one thing to know when an environment is considered unfriendly or ugly by the users, but another to know what makes the users think that way. To some extent methods of environmental appraisal can be devised such a way to yield these data (see Appendix 3).

This concludes our description of past theories of architecture. Although the terminology and the aims of these theories are varied, they all deal with some aspects of the desirable features of good architecture and/or with certain values and beliefs held by architects at different periods. With some editorial work, references to values and beliefs and terminological inconsistencies may be removed to produce certain generalisations. We end this appendix by indicating these generalisations and their relationship to the function/feature model of architectural quality described in Chapter V.

Architectural quality cannot be discussed in isolation from the utilitarian demands of buildings. Directly or indirectly past theories speak of effects created by elements of architecture. We may use these generalisations as the two major functions of qualitative features of architecture, as follows:

Increasing effectiveness of  
the functional/practical



creation of effects

Past theories speak of constituents of good architecture in terms of elements such as mass, void, space, line, elementary volumes, paths, nodes, etc., and their interrelations. We may employ the terms 'elements' and 'relations' as universal categories to refer to a variety of features with which the creation of architectural quality is concerned. There are also abstract characteristics such as privacy, friendliness, and so on, which are also qualities of environments. Lastly, descriptions of environments without reference to actions and events produced by the interaction between users, objects and environment is only to a limited extent possible. This exposition of the relationship between our function/feature model and past theories of architecture has of necessity been limited, but has shown that there is nothing in old theories of architecture that cannot be absorbed into our model in a meaningful way.

#### Notes

1. Vitruvius, De Architectura, London, 1940.
2. (a) Wittkower, Rudolf, Architectural Principles in the Age of Humanism, London, 1949.  
(b) Panofsky, E., Meaning in the Visual Arts, New York, 1955.
3. (a) Perrault, C., Les Dix Livres d'Architecture de Vitruvius, Paris, 1673.  
(b) Perrault, C., Ordonnance des Cinq Espèces de Colonnes, Paris, 1633.
4. Norberg-Schultz, Christian, Intentions in Architecture, Oslo, 1963, p.92.
5. Hume, David, On the Standard of Taste, 1757.
6. (a) Laugier, Observations sur l'Architecture, 1765, See Part II, 'Des Inconveniences des Ordres d'Architecture' III, I, note 37.  
(b) The break with Vitruvian ideas can also be sensed in the manuscript written by Boullée in the late 18th century (not published until 1953). See Collins, Peter, Changing Ideals in Modern Architecture, London, 1965, p.24.
7. Op.cit.



8. Op.cit.
9. Smith, Donald, 'Towards a Theory', Architectural Review, Feb.1965, pp.101-104.
10. Summerson, Sir John, 'The Case for a Theory of Modern Architecture', RIBA Journal, June 1959, pp.309-11.
11. (a) Boullée, late 18th century and 1953, op.cit.  
(b) Collins, Peter, op.cit.
12. Collins, Peter, op.cit.
13. Ibid.
14. Summerson, Sir John, op.cit.
15. Collins, Peter, op.cit.
16. Pugin, A.W., The Principles of Pointed or Christian Architecture, 1841.
17. (a) Ibid.  
(b) Ruskin, John, The Seven Lamps of Architecture, London, 1849.
18. Viollet-le-Duc, Dictionnaire Raisonné de l'Architecture Française de XI<sup>e</sup> au XVI<sup>e</sup> Siècle, 1854-1858; and Entretiens sur l'Architecture, 1863 and 1872.
19. Ruskin, John, op.cit.
20. Scott, Geoffrey, The Architecture of Humanism, London, 1914.
21. Zevi, Bruno, Architecture as Space, New York, 1957.
22. Cornell, E., Humanistic Enquiries into Design, Gotburgh, 1959.
23. Norberg-Schultz, Christian, op.cit., p.96.
24. Giedion, S., Space Time and Architecture, Cambridge, Mass., 1941.
25. Scully, Vincent J., 'Modern Architecture - Towards a Re-definition of Style', Perspecta Yale Architectural Journal, VII, 1957, pp.5-10.
26. Viollet-le-Duc, op.cit.
27. Lethaby, W.R., Architecture: An Introduction to the History and Theory of the Art of Building, London, 1911.
28. Nervi, P.L., Costruire Correttamente, Milano, 1955.
29. Khan, Louis, 'Form and Design', Architectural Design, April 1961, pp.145-152.
30. Ibid.
31. Lynch, Kevin, The Image of the City, Cambridge, Mass., 1960.

32. Festinger, L., Schachter, S., and Black, L., Social Pressures in Informal Groups, New York, 1950.
33. Caplow, Theodore, 'Neighbourhood Interaction in a Homogeneous Community', American Sociological Review, Vol.15, No.3, June 1950.
34. Lee, Terence, 'Urban Neighbourhood as Socio-spatial Schema', Human Relations, Vol.21, No.3, August 1968, pp.241-67.
35. (a) Webber, Melvin M., 'The Urban Place and the Non-place Urban Realism' in Explorations into Urban Structure, Webber, Melvin (ed), Philadelphia, 1964.  
 (b) Hare, E.H., and Shaw, G.K., Mental Health in a New Housing Estate, London, 1965.  
 (c) Broady, Maurice, 'Theory in Architectural Design', Arena, January 1966, pp.149-54.  
 (d) Gans, Herbert J., Levittowners, New York, 1967.
36. Smith, Ivor, 'Approach to Architecture', RIBA Journal, July 1967, pp.271-80.
37. Norberg-Schultz, Christian, op.cit., pp.122-127.
38. Scrutton, Roger, 'Architectural Aesthetics', British Journal of Aesthetics, Autumn 1973, p.327.
39. Norberg-Schultz, Christian, op.cit., pp.138-39.
40. (a) Kiemle, Manfred, Aesthetische Probleme der Architektur unter dem Aspekt der Informationaesthetik, Quickborn, 1967. This work was reviewed by Arnheim, Rudolf in the Journal of Aesthetics and Art Criticism, Summer 1970, pp.551-52.  
 (b) Adrian von Butler et al. presented their method at the exhibition entitled 'Environmental Game' held at the Hayward Gallery, London, between April 12 - June 24.
41. Lynch, Kevin, op.cit.
42. Harmann, H.H., Modern Factor Analysis, Chicago, 1960.

## APPENDIX 6.

## ESTABLISHED SPACE STANDARDS AND STANDARDS OF PROVISION FOR HALLS OF RESIDENCE : EXTRACT FROM U.G.C. RECOMMENDATIONS

ESTABLISHED STANDARDS

The accommodation contained within a building unit can be subdivided into:

- 1) the flat - which is made up of:
- a) personal space
  - b) communal space
  - c) circulation space
- 2) communal facilities associated with each building unit

a) Personal Space

<u>Item</u>	<u>No. of Users</u>	<u>Recommendation - Space Standards</u>
single study bedroom	1	U.G.C. recommends 11sq.m. (120 sq.ft.)
double study bedroom	2	none

b) Communal Space

<u>Item</u>		<u>Area</u>	
		sq.m.	sq.ft.
social room	up to 8	7.5-9.5	80-100
(kitchens with space for eating and entertaining)	up to 15	13-19.0	140-200

		<u>Recommendation - Standards of Provision</u>
sinks	up to 8	one small sink
	up to 15	double sink
boiling rings	up to 8	two
	up to 15	four
grill	up to 8	one
	up to 15	two
length of worktop (excluding cooking and sink area)	up to 8	1,200 mm. (4ft.)
	up to 15	1,800 mm. (6ft.)
oven	not normally provided. It may, however, be as economical to install a domestic cooker with oven, as separate boiling rings and grills.	

ventilated cupboards	up to 8	
	up to 15	
refrigerators	up to 8	0.08cu.m. (3cu.ft.)
	up to 15	0.11cu.m. (4cu.ft.)

**Bathrooms, showers and lavatories:**

<u>Item</u>	<u>Minimum Provision</u>	<u>Recommended Provision</u>
baths	one to every 4-6 persons	a combination of both baths and showers is generally advisable. Showers should be fitted with an adjustable nozzle for female users and special filters for hairwashing purposes.
showers	" " " " "	
W.C.	" " " " " (if W.C. is separate from bathroom)	in women's residences incinerators should be included with each group of W.C.s.

<u>Item</u>	<u>Recommendation - Space Standards</u>
storage	none
circulation space	none
corridors	corridor can rarely be narrower than 4'0" (1,200mm.)
staircases	minimum width of escape staircases in a one staircase building is 914mm. (3ft.)

**Communal facilities associated with each building unit :**

<u>Item</u>	<u>No. of users</u>	<u>Recommendation - Space Standards</u>
laundrettes	100	18 sq.m.
linen	100	5 - 7 sq.m.
cleaners' room	1	3 sq.m.

**Principal Pedestrian Route**

<u>Item</u>	<u>Recommendation</u>
walkway	none
casual social areas	0.65 sq.m. per user

## APPENDIX 7.

## HOUSING FOR OLD PEOPLE - A SKETCH SCHEME

No worked example so elementary as a sketch scheme can represent everything that is involved in this thesis. But even a sketch scheme, despite its excessive simplicity, can provide a link between reality and conceptual frameworks. One of the aims of this thesis is to achieve an increased understanding of the design process, and in the following we indicate as far as possible where such an understanding has influenced the project.

The brief for the project was devised after discussion with members of an architectural practice who were once asked to design a housing scheme for old people on the same site. We begin by describing the brief, make some comments on it, explain the project and finally show how the conclusions of this thesis have influenced the nature of the design.

The Brief

## 1. Location

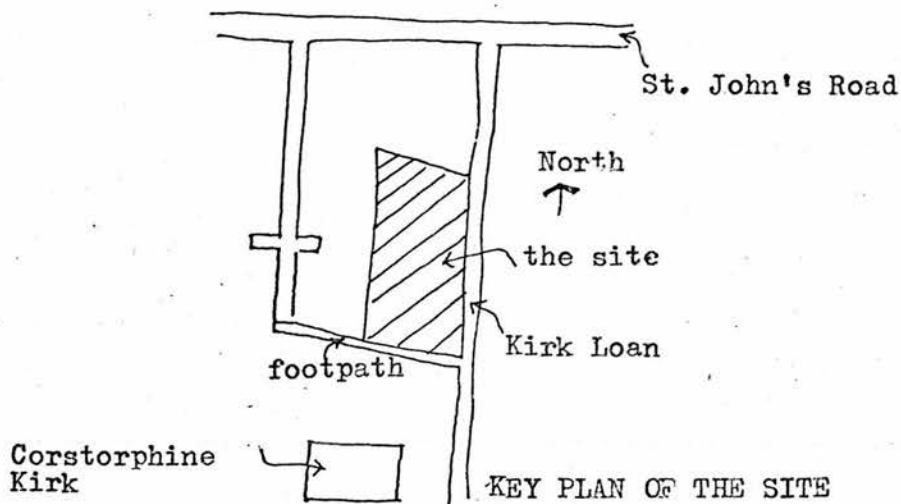
Grid Ref. : N.T. 2072 N.W.

Area : 24 hectares

## 2. The Site

The site is located North of Corstorphine Kirk. It is a flat site surrounded by Kirk Loan on the East and by a pedestrian path on the South which runs between the site and the kirk. The pedestrian walkway connects Kirk Loan and Glebe Road; thus pedestrian access to the site is possible from Glebe Road, the path on the South, and Kirk Loan. There is an attractive stone boundary wall along Kirk Loan;

this and some of the mature trees on the site must be preserved. The church, which is an impressive building (founded in 1405), and its yard offer a pleasant outlook from the site.



### 3. Accommodation

The site is to be developed to provide a warden scheme consisting of the following Type 2 accommodation:<sup>1</sup>

- A. Seven one-bedroom houses with living room : 21 m<sup>2</sup>, kitchen : 10 m<sup>2</sup>, bed : 18 m<sup>2</sup>, bath, store, lobby.
- B. Three three-bedroom houses (one of which is to be occupied by the warden) with living room : 21 m<sup>2</sup>, kitchen : 10 m<sup>2</sup>, two bedrooms : 18 m<sup>2</sup> each, one bedroom : 11 m<sup>2</sup>, bath, separate WC with washhand basin, store, lobby, staircase.
- C. Seven bed sitting room flats (to be occupied by active elderly, some of the staff, and possibly some young people) with bed sitting room : 18 m<sup>2</sup>, bath, lobby.
- D. Two guest rooms : 16 m<sup>2</sup> each with shared bathroom and lobby.
- E. One caretaker's flat with bed sitting room with dining alcove : 25 m<sup>2</sup>, kitchen : 15 m<sup>2</sup>, bath, store.
- F. Communal sitting areas : 55 m<sup>2</sup>, dining area : 50 m<sup>2</sup>, kitchenette : 12 m<sup>2</sup>; staff sitting room : 30 m<sup>2</sup>; warden's office : 15 m<sup>2</sup>.

#### 4. Roads, footpaths and carparking

Vehicular access will be from Kirk Loan. Since plenty of carparking spaces are available in the area there is no need to provide any within the site. No public footpath should pass closer than five meters from a major window of a room unless separated by a screen wall or fence of at least 1.9 m. above the path level. Changes of level should be avoided as far as possible.

#### Comment on the Brief

As has already been pointed out in the main text, in actual practice briefing and design processes are quite varied. Sometimes the architect is involved right from the early stages and plays an active part in developing the brief; sometimes he just gets an outline brief; and at other times he gets a highly developed brief formulated without his help. It is pointless to produce a briefing procedure for an ideal situation. In the present instance the brief is to be taken as an outline brief to which the architect adds formulations on qualitative aspects and demonstrates their use in the process of design.

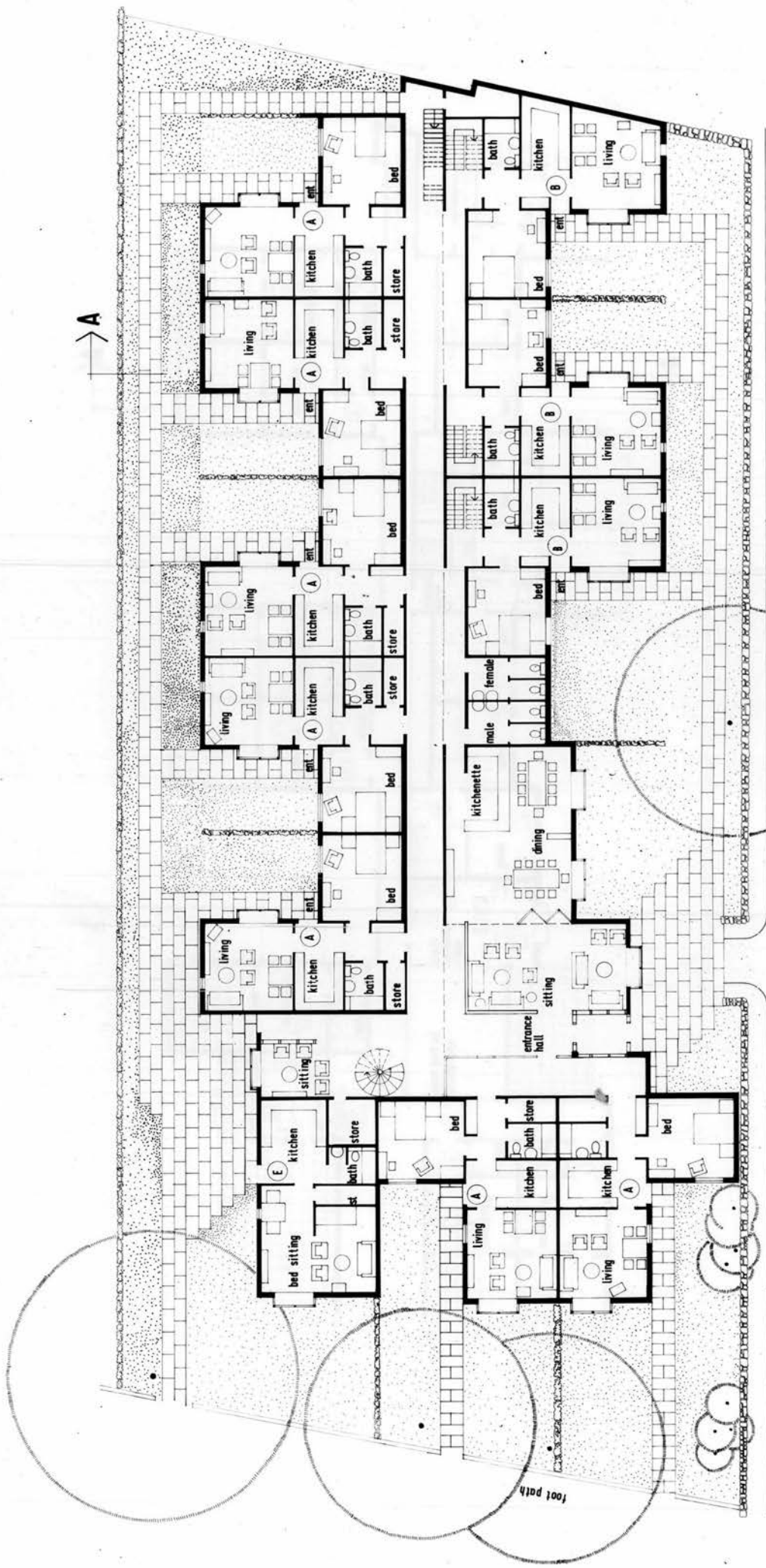
#### Explanation of the Scheme

The siting of the building along three footpaths on the East, West and South sides allows all the houses (A, B and E above) to be located on the ground floor and to have internal and external front doors to each house. It is intended that the bed sitting room flats located off the first floor gallery should be for active elderly, short-term residents, members of the staff, some young people, and for those who dislike sleeping on the ground floor.<sup>2</sup> The larger

flats (B) are intended for those who would like to have additional accommodation for another member of their family, for lodgers or for au pairs. It is hoped that this will be a way of providing an opportunity for companionship for those who wish it; it is also another way of encouraging old people to be independent as long as possible. The communal sitting areas and the staff sitting areas are located where the internal streets meet and near the entrance hall, where there will always be some activity. Uniformity in the internal appearance of flats has been avoided by creating a possibility for a variety of furniture arrangements and for tenants to bring their own furniture. No house has less than two orientations. The open spaces just outside the houses and the terraces on the first floor will be sheltered places where residents can sit in privacy in the summer.

Construction is using load bearing fair-faced cavity blockwork with rafters or rafters and collars covered with 300x600 asbestos slate tiles to 100 mm laps on reinforced bituminous felt and glass-fibre insulation. In order to avoid cutting concrete blocks, the triangular portions of the gable walls are to have panels made from studs with friction fit rigid insulation and clad with 't' and 'g' diagonal boarding covered with building paper and shiplap weather boarding. End of parapet walls can be made of repetitive, 45% verge blocks which may be easily batch produced on site from standard blocks by cutting with diamond-tipped saw using a simple gig. Rooflights in the internal streets are made of wrought soft wood framing and  $\frac{1}{4}$ " Georgian wired polished plate glass. Although constructional details have not been worked out, the feasibility of the constructional system has been ascertained by sketches and study of previous works using similar constructions.<sup>3</sup>





**GROUND FLOOR PLAN**

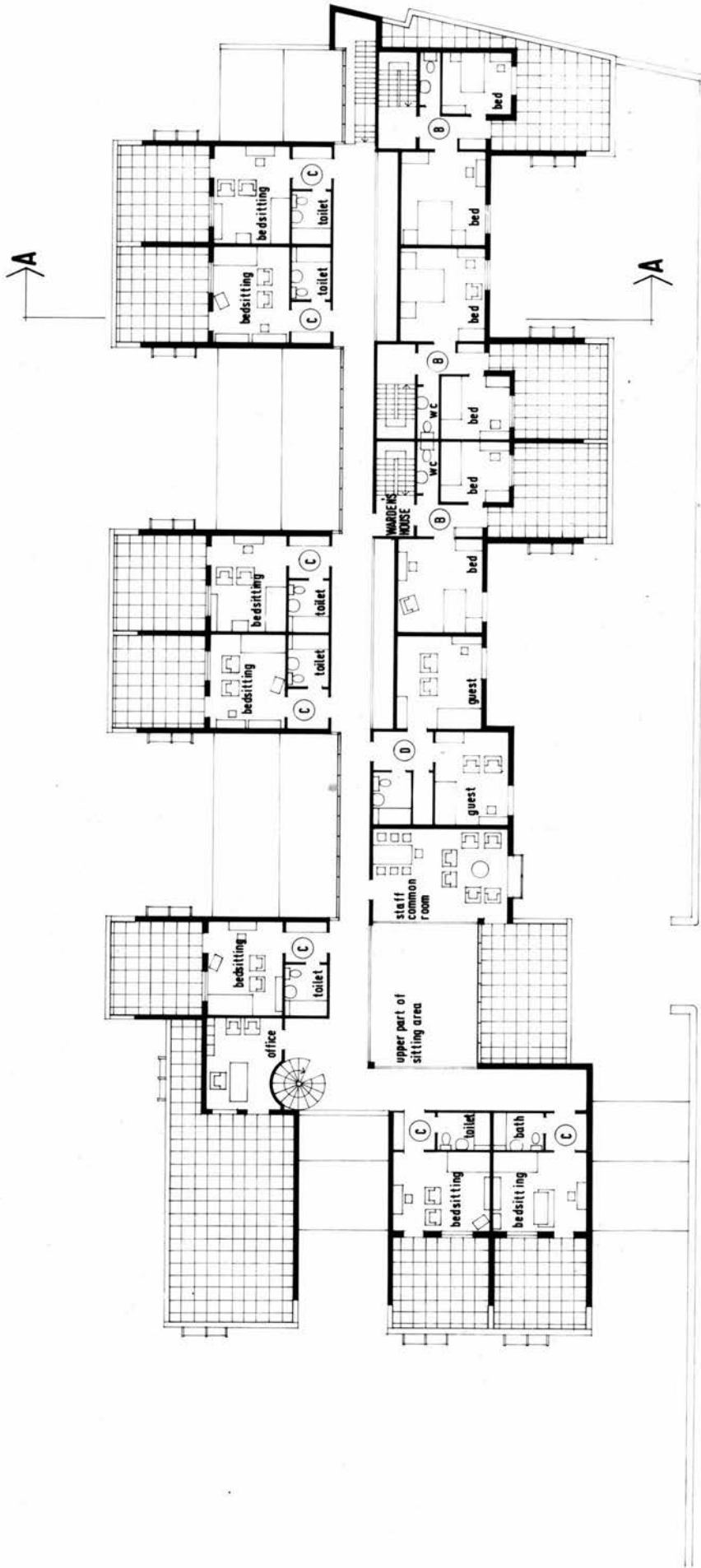
**FIG 7.1**

0 1 2 3 4 5 6 7 8  
 N →

- Legend
- A one-bedroom house
  - B three-bedroom house
  - C bed-sitting room
  - D guest-room
  - E caretakers flat

KIRK LOAN

foot path

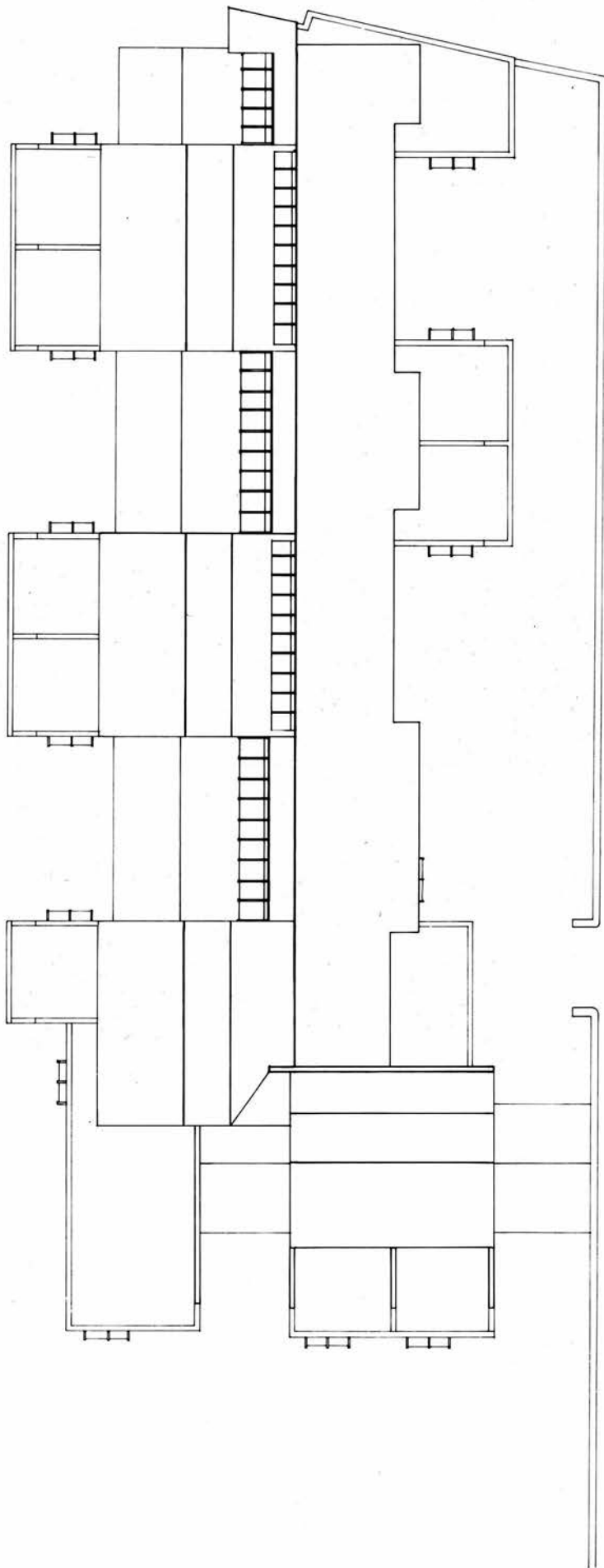


**FIRST FLOOR PLAN**

**FIG.7.2** 



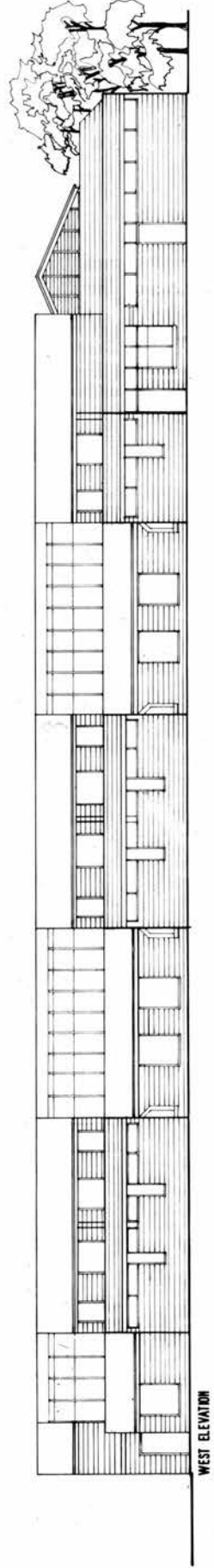
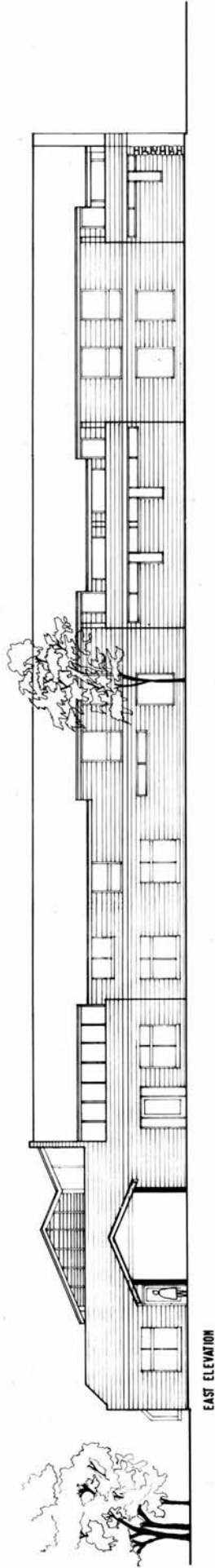
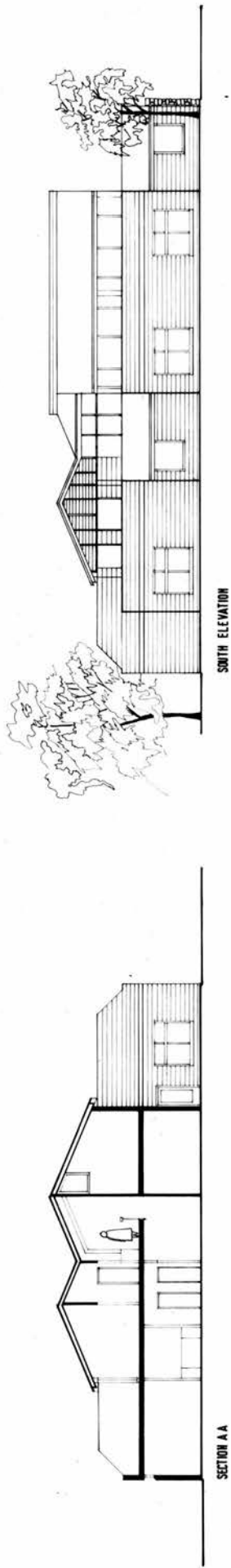
- legend  
 B three-bedroom house  
 C bed sitting room  
 D guest rooms



**ROOF PLAN**

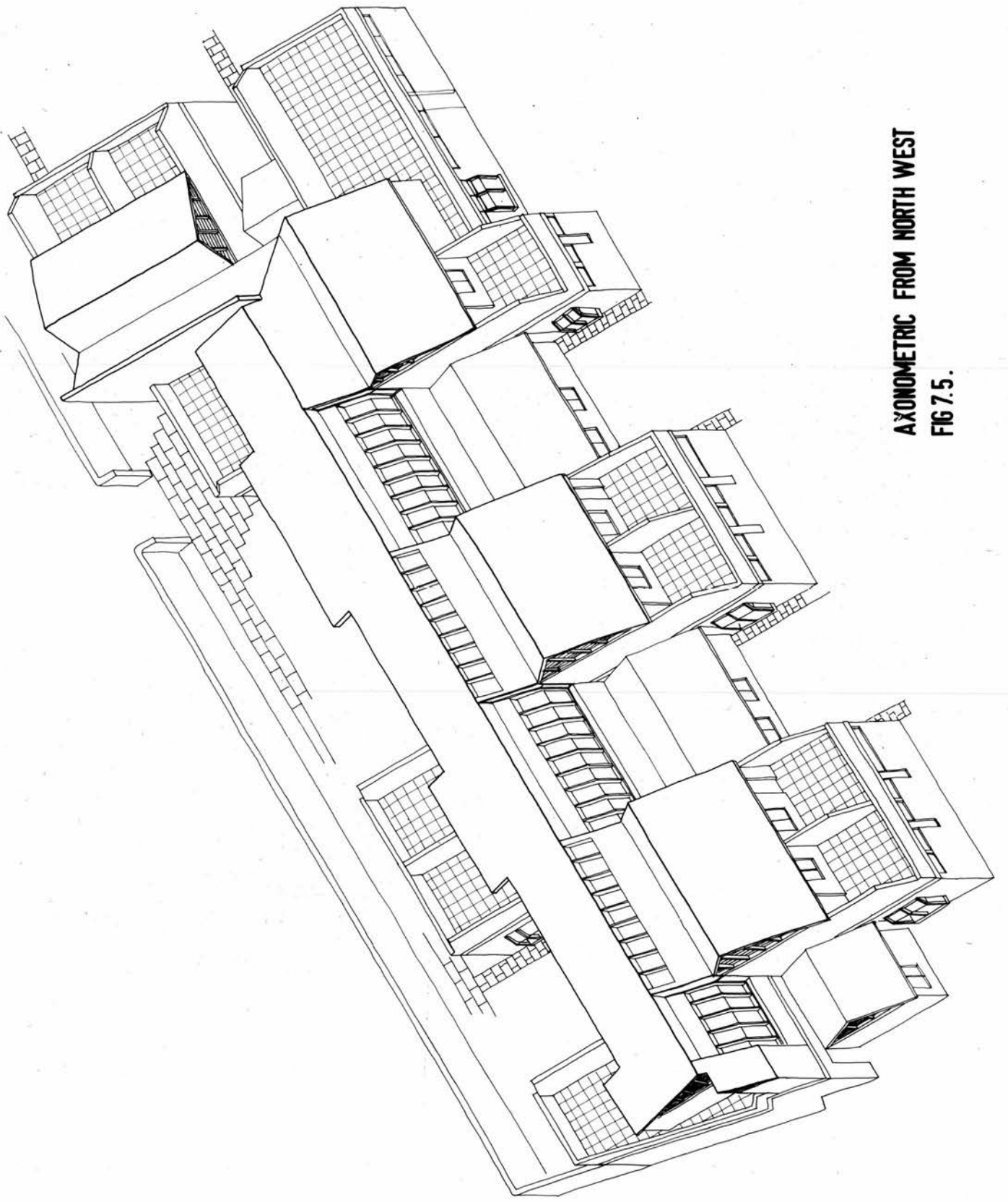
**FIG 7.3**





**ELEVATIONS AND SECTION**

**FIG 7.4.** m 1 2 3 4 5 6 7 8



**AXONOMETRIC FROM NORTH WEST  
FIG 7.5.**

Comment on the Relationship between the Scheme and the Conclusions of this Thesis

With reference to the conclusions on model theory in general and to models used as aids to the discovery of form in particular the understanding one achieves from these conclusions is more important than any attempt to apply them in practice. It would have been possible to give examples of previous design work done by the author to illustrate the use of personal prototypes in design, but analysis of the works of others is more practicable than the analysis of one's own designs. With reference to emergent models those who know Nicholas Lacey's entry for the Architects' Benevolent Society's competition will know how much the present scheme owes to this work.<sup>4</sup> Lacey's work can in fact be regarded as an established achievement as far as the design of Type 2 accommodation is concerned. The essence of the model is the provision of internal as well as external front doors to each flat, so that the scheme may combine the advantages of a hostel and of a group of individual cottages. Once this concept is accepted there is a kind of inevitability about the layout of each dwelling. It must however be noted that Lacey's scheme is not simply transferred to the present situation, but that it is given a new interpretation to suit the circumstances of this project. Nevertheless the model characteristics between the two projects persist.

With reference to our conclusions on components of tacit knowing, they do throw light on questions like : what is design ability all about? Why is it that it works the way it does? What is it that people who have design talent have got? Yet these cannot be used as tools of introspection. Again an understanding of what goes on

is far more important than a publicly conducted self-analysis.

Finally in our design we put to use only one of our theoretical models, namely that of feature/function classes of architectural quality, as the other - the model of interpersonal communication - is difficult to put to any practical application in a sketch scheme of such a limited scope. We conclude this Appendix by indicating how the feature/function classes (see Fig.5.16) were used as a tool in designing the project.

### ELEMENTS

### CLASS A

Increasing the effectiveness of the functional/practical

### CLASS B

Enhancement of users' interest, creating effects and increasing impact

- |                            |  |  |
|----------------------------|--|--|
| 1. Windows of living rooms | a) viewing possibility from both sitting and standing position - the main windows have low sills<br>b) facilitating observation of what goes on outside the house - bay windows large enough to form seats | Avoid a sense of being shut in - bay windows face the garden - clere storey windows and a small window on the other wall gives a sense of openness   |
| 2. Furniture               | must allow tenants to bring their own furniture and allow for display of personal possessions  |  |
| 3. Living room as a whole  | possibility for a number of different furniture arrangements (this also applies to bedrooms)   |  |
| 4. Bed                     | possibility for different bed locations; possibility for reading in bed  |  |
| 5. Wardrobe                |  | built-in wardrobes are unfamiliar things for old people - they can adversely affect the domestic feeling which the houses should create <sup>5</sup> |

ELEMENTSCLASS ACLASS B

6. The houses as elements

the internal arrangement is as compact as possible

elements such as pitched roof and small gardens are used to give the connotations of domestic environment

7. Open spaces

private and semi-public open spaces are carefully marked

8. Internal entrances to flats

the corridor widens in front of entrance doors and additional lighting in the form of windows and rooflights at those points is provided. This makes the entrances to flats a pleasant place and should therefore encourage neighbourly contacts

ABSTRACTSCLASS C

Related to functional effectiveness

1. Acoustic privacy between the internal street and houses is provided either by using baths, stores, etc. as buffer zones or by thick walls.

2. Sense of security is increased by restricting entrance to the whole scheme at two points.

3. The rooms are spacious and the areas are above the minimum stipulated standards.

4. Quietness of the development is increased by the provision of a small private garden in front of each house.

CLASS D

Related to creation of interest, effects and impact

1. Institutionalism is avoided by a) not having any ceremonial entrances; b) by preventing both internally and externally the appearance of a monolithic building; c) by breaking down the long length of corridor by a gallery, rooflights and possibility for external outlook; d) by not having any large windows for communal rooms to preserve the domestic appearance.

2. Privacy for the residents is offered by screening off open spaces and terraces.

3. Being able to choose from a variety of accommodation ranging from bed sitting room flats to three-bedroom houses should give the elderly a sense of dignity.



## RELATIONS

CLASS E

Concerned with the functional/practical

1. Effective relation between houses and communal rooms are used to combine the virtues of a hostel and of a group of cottages.

2. Simple relation between various elements - the house, the communal rooms, the open spaces, etc. should facilitate direction finding.

3. The manner in which the open spaces are distributed should increase the possibility for surveillance.

4. Boundaries between private, semi-private, communal and semi-communal elements are clearly indicated.

CLASS F

Concerned with the creation of effects, interest and impact

1. The feeling of a domestic environment is reinforced by correct combination of houses, flats and communal areas.

2. Monotonous appearance is avoided by providing an amorphous yet ordered clustering of different elements into a complex rather than a single building.

3. Internally different elements like bedrooms with pitched roof, living rooms with flat roof, communal areas with a combination of double and single storey heights, internal street with gallery and rooflights offer contrasts in effects created by different elements.

**CLASS G ACTIONS AND EVENTS :** Elderly people are often faced with the problem of having nothing to do. The provision of a garden for each house (although it will be looked after by the caretaker/gardener) provides an opportunity for the tenants to be interested in their patch of garden. A number of possibilities for sitting at the bay windows or in the common room to look at what goes on outside are provided. The scheme is laid out such a way to increase chance encounters of people. The internal front doors of the houses should encourage neighbourly contact and prolong conversation. The communal areas should favour the organisation of a number of social events and entertainment.

Notes

1. In deriving the schedule of accommodation a number of design guides and bulletins were consulted. The areas given in the schedule are in excess of the minimum areas stipulated by the Scottish Development Department for this kind of buildings. See the New Scottish Housing Handbook, Bulletin No.3 Housing for Old People, HMSO, 1970.

2. Surveys have shown that most people over the age of sixty-five can manage one flight of stairs, and there are many old people who dislike sleeping on the ground floor. See Epson, M. and Sheppard, N.J., "Housing for Old People" in Architects' Journal, 18th July 1967, pp.177-80.
3. Two buildings of similar constructional systems are: a) Physically Handicapped Children School at Bromley Hall, London (the author worked on this project). See Architects' Journal, 27th August, 1969, pp.507-517. b) Maguire and Murray's Student Housing at Surrey University. Maguire explains the constructional implications of using fair-faced blocks in "Bending the Modern Rules" in Official Architecture and Planning, September 1971, pp.679-81.
4. It was felt that the inclusion of Nicholas Lacey's scheme as an illustration here would have confused the presentation. But it may be found in Bill Apps's article on the competition entries entitled "A Community for the Old" in RIBA Journal, September 1972, pp.387-96.
5. See Epson, M. and Sheppard, N.J., op.cit.

## BIBLIOGRAPHY

AALTO, Alvar, 'Abstract Art and Architecture' in Domus, 223-225, 1947, pp.3-20.

ABERCROMBIE, M.L.J., 'Perception and Construction' in Design Methods in Architecture, ed. Broadbent, G., and Ward, A., London, 1969.

ABERCROMBIE, M.L.J., The Anatomy of Judgement, Harmondsworth, 1969.

ABRAMS, M.H., The Mirror and the Lamp, Oxford, 1953.

ACKERMAN, James, 'The Demise of the Avant-Garde: Notes on the Sociology of Recent American Art' in Comparative Studies in Society and History XI, 1969.

ALEXANDER, Christopher, et al., Houses Generated by Patterns, Berkeley, 1969.

ALLPORT, Floyd H., Theories of Perception and the Concept of Structures, New York and London, 1955.

AMESTOY, Joseph, 'Architectural Reflections' in American Institute of Architects Journal, September 1967, pp.66-67.

APPS, Bill, 'A Community for the Old' in RIBA Journal, September 1972, pp.387-96.

BARTLETT, F.C., Remembering, London, 1932.

BATCHELOR, Peter, 'The Origins of the Garden City Concept of Urban Form' in Journal of the Society of Architectural Historians, Vol. XXVIII No.3, October 1969 (in subsequent entries the abbreviation JSAH will be used).

BERNE, Eric, The Games People Play - The Psychology of Human Relations, London, 1966.

BLACK, Max, Models and Metaphors, New York, 1962.

BRAWNE, Michael, 'The New Universities - An Appraisal' in Architectural Review, Vol.147, No.878, April 1970, pp.250-85.

BROADY, Maurice, 'Theory in Architectural Design' in Arena, January 1966, pp.149-54.

BROLIN, Brent C., and ZEISEL, John, 'Mass Housing, Social Research and Design' in Architectural Forum, July/August 1968, pp.66-70.

BRUNER, J.S., 'On Going beyond Information Given' in Contemporary Approaches to Cognition, Harward, 1957.

BRUNER, J.S., GOODNOW, J.J., and AUSTIN, G.A., A Study of Thinking, New York, 1956.

BUILDING CENTRE, Forum on 'Briefing the Architects', Proceedings, London, 1966.

CAMPBELL, Kenneth, 'The Rise and Fall of the Tower Block' in The Architects' Journal, 23 July 1969, pp.151-52.

CAMPBELL, Sheila, 'Architectural Values as a Measure of Design Decision Making' in Architecture and Social Sciences, Edinburgh, 1973, pp.134-57 (edited by Raman, P.G.).

CANTER, D.V., and WOOLS, R., 'A Technique for the Subjective Appraisal of Buildings' in Building Science 5 (3 and 4), 1970, pp.187-94.

CAPLOW, Theodore, 'Neighbourhood Interaction in a Homogeneous Community' in American Sociological Review, Vol.15, No.3, June 1950.

COLLINS, George R., 'The Ciudad Lineal of Madrid' in JSAH, Vol. XVIII, No.2, May 1959, pp.38-53.

COLLINS, George R., 'Linear Planning throughout the World' in JSAH, Vol. XVIII, No.3, October 1959, pp.74-93.

COLLINS, Peter, 'The Origins of Graph Paper as an Influence on Architectural Design', in JSAH, Vol.XXI, No.4, December 1962, pp.159-62. Also, letters to the Editor about this article in JSAH, Vol.XXII, May 1963, p.107.

COLLINS, Peter, Changing Ideals in Modern Architecture, London and Montreal, 1965.

COOK, Barbara, 'A Residential Complex whose Form Followed Findings about Users' Wants and Needs' in American Institute of Architects Journal, June 1974, pp.28-32.

CORNELL, E., Humanistic Enquiries into Design, Gotburgh, 1959.

CRANE, Diana, 'Social Structure in a Group of Scientists: A Test of the Invisible College Hypothesis', in American Sociological Review, XXXIV, 1969.

DALEY, Janet, 'The Myth of Quantifiability' in The Architects' Journal, 21 August 1968.

DE CARLO, Giancarlo, 'Architecture in the Seventies - An Architecture of Participation' in The Melbourne Architectural Paper, No.3, 1971.

DE CARLO, Giancarlo, 'Architecture of Participation' talk given at the Department of Architecture, University of Edinburgh, October 1974. (transcript available from the author)

- DIENES, Z.P., and JEEVES, M., Thinking in Structures, Stroudsburg, Penn., 1965.
- DOMINOWSKI, R.L., and EKSTRAND, B.R., 'Direct and Associative Priming in Anagram Solving' in Journal of Experimental Psychology, No.74, 1967, pp.84-6.
- DONAT, John, World Architecture, I, London, 1964.
- DOWSON, Philip, 'A Room of One's Own' in Architectural Design, April 1968, pp.164-72.
- DURKHEIM, Emile, Education and Sociology, translated by Fox, S.D., Glencoe, Ill., 1956.
- ENCYCLOPAEDIA OF THE PHILOSOPHICAL SCIENCES, 'Hegel's Philosophy of Mind' translated by Wallace, W., Oxford, 1874.
- EPSON, M., and SHEPPARD, N.J., 'Housing for Old People' in The Architects' Journal, 19 July 1967, pp.177-80.
- EVANS-PRITCHARD, E.G., Anthropology and History, Manchester, 1961.
- FESTINGER, L., SCHACHTER, S., and BLACK, L., Social Pressures in Informal Groups, New York, 1950.
- FIELD, Walker, 'Origins of the Balloon Frame', in JSAH, Vol.V., No.4, October 1946.
- FINGESTEN, Peter, The Eclipse of Symbolism, South Carolina, 1970.
- FITCH, James Marston, American Building, Boston, 1947.
- FORSTER, Norman, 'Architects Approach to Architecture' in RIBA Journal, June 1970.
- GANS, Herbert J., Levittowners, New York, 1967.
- GIEDION, S., Space Time and Architecture, Cambridge, Mass., 1941.
- GLEASON, Henry Allan Jr., Workbook on Descriptive Linguistics, New York, 1955, pp.266-83.
- GOFFMAN, Erwing, The Presentation of Self in Everyday Life, London, 1959.
- GORDON, Alex., 'Architects Approach to Architecture' in RIBA Journal, April 1968, p.172.
- GOMBRICH, E.H., 'Meditation on a Hobby Horse or the Roots of Artistic Form' in Aspects of Form edited by Law Whyte, Lancelot, London, 1951.
- GRIBBEN, J.A., 'Solution-word letter sequences in anagram solving' in Journal of Experimental Psychology, No.85, 1970, pp.192-97.
- HAGSTROM, Warren O., The Scientific Community, New York and London, 1965.

- HALL, Edward, The Hidden Dimension, New York, 1966.
- HAMPSHIRE, Stuart, Thought and Action, London, 1959.
- HARE, E.H., and SHAW, G.K., Mental Health in a New Housing Estate, London, 1965.
- HARMANN, H.H., Modern Factor Analysis, Chicago, 1960.
- HARRE, J.R., 'The Ethogenic Way' in New Society, 8 April 1971.
- HAYNES, K.J., and RAVEN, J., 'Old People - Study of Living Patterns', in The Architects' Journal, 26 October 1966, pp.1051-66.
- HEAD, H., 'Disorders of Symbolic Thinking and Expression' in British Journal of Psychology, XI (1920-21), part II, pp.179-93.
- HERTZBERGER, Herman, Architectural Record, July 1968, p.119.
- HESSELGREN, Sven, The Language of Architecture, Kristianstad, 1967.
- HONIKMAN, Basil, 'Environmental Cognition: its Potential for Enhancing Design and Policy Formulation' in Proceedings of the EDRA 5 Conference, Vol.XI, 1974, edited by Honikman, Basil, Milwaukee, 1974.
- HORN, Walter, 'On the Origins of the Medieval Bay System' in JSAH, Vol.XVII, No.2, May 1958, pp.2-23.
- HOWARTH, Thomas, Charles Rennie Mackintosh and the Modern Movement, London, 1952.
- HUFF, William S., 'An Argument for Basic Design' in Architectural Design, May 1966, pp.252-56.
- HUME, David, On the Standard of Taste, 1757.
- HUSSEY, Christopher, 'The Personality of Sir Edwin Lutyens' in RIBA Journal, April 1969.
- HUTTEN, Ernst, The Ideas of Physics, Edinburgh, 1967.
- JENKINS, Frank, Architect and Patron, New York, 1961.
- JENKS, Charles, 'Andrew Melville Hall - Charles Jenks Offers a Semiotic Analysis' in Architectural Forum, September 1970, pp.55-57.
- JENKS, Charles, and BAIRD, George (eds), Meaning in Architecture, London, 1969.
- JEPHCOTT, Pearl, 'Homes in High Flats - Some of the Social Issues', in Architecture and Social Sciences edited by Raman, P.G., Edinburgh, 1973, pp.71-95.
- JOHNSON, Donald M., Systematic Introduction to the Psychology of Thinking, New York, 1972.

JORDY, William H., 'The Symbolic Essence of Modern European Architecture of the 'Twenties and its Continuing Influence', in JSAH, Vol.XXII, No.3, October 1963, pp.177-87.

KAPALAN, I.T., and CARVELLAS, T., 'Effect of Word Length on Anagram Solution Time' in Journal of Verbal Learning and Verbal Behaviour, No.7, 1968, pp.201-6.

KAYE, Barrington, The Development of the Architectural Profession in Britain, London, 1960.

KELLOGG, Rhoda, Analysing Children's Art, Palo Alto, 1969.

KHAN, Louis, 'Form and Design' in Architectural Design, April 1961, pp.145-52.

KIEMLE, Manfred, Aesthetische Probleme der Architektur unter dem Aspekt der Informationsaesthetic, Quickborn, 1967.

KUHN, Thomas, The Structure of Scientific Revolutions, Chicago and London, 1962.

KUHN, Thomas, 'Reflections on my Critics' in Criticism and Growth of Knowledge, edited by Lakatos, I. and Musgrave, A., Cambridge, 1970.

LAING, R.D., and EASTERSON, A., Sanity Madness and the Family, London, 1964.

LANDAR, Herbert, Language and Culture, New York, 1965.

LANDAU, Royston, 'Towards a Structure of Architectural Ideas' in Arena, June 1965.

LANE, Michael, (ed.) Structuralism, London, 1970.

LANGER, Suzanne K., An Introduction to Symbolic Logic, New York, 1953.

LAUGIER, Abbé, Observations sur l'Architecture, 1765.

LEACH, Edmund, Genesis as Myth, London, 1969.

LEE, Terence, 'Urban Neighbourhood and Socio-Spatial Schema' in Human Relations, Vol.21, No.3, August 1968, pp.241-67.

LETHABY, W.R., Architecture : An Introduction to the History and Theory of the Art of Building, London, 1911.

LYNCH, Kevin, The Image of the City, Cambridge, Mass., 1960.

MACKAY, D.M., 'Information Theory and Human Information Systems' in The Impact of Science on Society a UNESCO Publication, 1957.

McKEAN, Charles, 'Homes fit for Humans' in RIBA Journal, August 1973, p.374.

- McKINNON, D.W., 'The Nature and Nurture of Creative Talents' in American Psychology, Vol.17, 1962, pp.484-95.
- MACLEOD, Robert, Charles Rennie Mackintosh, Feltham, 1968.
- MAGUIRE, Robert, 'Architects Approach to Architecture' in RIBA Journal, April 1971, pp.140-48.
- MAGUIRE, Robert, 'Bending the Modular Rule' in Official Architecture and Planning, September 1971, pp.679-81.
- MAIR, N.R.F., 'Reasoning in Humans: II The Solution of a Problem and its Appearance in Consciousness' in Journal of Comparative Psychology, 12, 1931, pp.181-94.
- MARS, John, 'Where Architectural Historians Fear To Tread' in JSAH, Vol.XXVIII, No.1, March 1969, pp.3-8.
- MARUYAMA, Magoroh, 'Principle of Heterogenization and Symbolization; Implications for Planning and Environmental Design' in Proceedings of the Environmental Design Research Conference - 4, Vol.II edited by Wolfgang Preisler, Pennsylvania, 1973, pp.18-34.
- MARX, Carl, Early Writings, translated and edited by Bottomore, T.B., New York, 1964.
- MASTERMAN, Margaret, 'The Nature of a Paradigm' in Criticism and Growth of Knowledge edited by Lakatos, I. and Musgrave, A., Cambridge, 1970.
- MAYZNER, M.S., and TRESSELT, M.E., 'Anagram Solution Times: A Function of Letter Order and Word Frequency' in Journal of Experimental Psychology, No.56, 1958, pp.376-79.
- MEDAWAR, Sir Peter, Induction and Intuition in Scientific Thought, London, 1969.
- MILLON, Henry A., and Wittkover, Rudolf, 'Architectural Principles in the Age of Humanism: their Influence on the Development and Interpretation of Modern Architecture' in JSAH, Vol.XXXI, No.2, May 1972.
- MINISTRY OF HOUSING AND LOCAL GOVERNMENT, 'Space in Home, Metric Edition' in Design Bulletin No.6, HMSO, London, 1968, p.30.
- MITCHELL, William J., 'Vitruvius Computatus' in Proceedings of the Environmental Design Research Conference - 4, Vol.I edited by Wolfgang Preisler, Pennsylvania, 1973, pp.384-86.
- MOHOLY-NAGY, Sibyl, Matrix of Man, London, 1968.
- MOORE, T.V., 'The Temporal Relations of Meaning and Imagery' in Psychological Review, No.22, 1915, pp.177-215.
- MORRIS, Charles W., Foundations of the Theory of Signs, Chicago, 1938.
- NERVI, P.L., Costruire Correttamente, Milano, 1955.



- NEWMAN, Oscar, Defensible Space, New York, 1973.
- NIDA, Eugene A., Toward a Science of Translating, Leiden, 1964.
- NORBERG-SCHULZ, Christian, Intentions in Architecture, Oslo, 1966.
- NUFFIELD FOUNDATION, Division of Architectural Studies, The Design of Research Laboratories, Oxford, 1961.
- OLDFIELD, R.C., 'The Analysis of Human Skill' in General Psychology, edited by Halmos, P. and Iliffe, A., London, 1954.
- OLDFIELD, R.C., 'Experiment in Psychology - A Centenary and an Outlook' in Readings in Psychology, edited by Cohen, John, Woking, 1964.
- OSGOOD, C.E., 'The Cross-Cultural Generality of Visual Synesthetic Tendencies' in Behavioural Sciences 5, 1960, pp.146-69.
- OSGOOD, C.E., SUCI, G.J., and TANNENBAUM, P.H., The Measurement of Meaning, Urbana, 1957.
- PANOFSKY, Erwin, Meaning in the Visual Arts, 1930. English translation New York, 1955.
- PASSMORE, J.A., 'Commentaries (on Problems of Historiography)' in Scientific Change, edited by Crombie, A.C., London, 1973.
- PERRAULT, C., Ordonnance des Cinq Espèces de Colonnes, Paris, 1633.
- PERRAULT, C., Les Dix Livres d'Architecture de Vitruvius, Paris, 1673.
- PEVSNER, Nikolaus, An Outline of European Architecture, Harmondsworth, 1943.
- PEVSNER, Nikolaus, 'Modern Architecture and the Historian - or the Return of Historicism', in RIBA Journal, April 1961, pp.230-40.
- PIERCE, Charles Sanders, Collected Papers, Cambridge, Mass., 1931.
- PIETILA, R., 'Architects Approach to Architecture', talk given at the Royal Institute of British Architects in 1970. Paper not published but privately obtained by the author.
- POLANYI, Michael, Personal Knowledge, Chicago, 1958.
- POLANYI, Michael, The Study of Man, London, 1959.
- POLYA, G., How to solve it, New York, 1957.
- PONFI, Gio, 'Espressione dell'Edificio Pirelli in Costruzione a Milano' in Domus, 1966.
- POOLE, Roger, Deep Subjectivity, London, 1972.
- PUGIN, A.W., The Principles of Pointed or Christian Architecture, 1841.

- RAMAN, P.G., 'Design Education and Curriculum Development', unpublished paper.
- RAMAN, P.G., 'Towards a Social Psychology of Design' in Proceedings of the Environmental Design Research Conference - 5, 1974, Vol.XI, edited by Honikman, Basil, Milwaukee, 1974.
- RASMUSSEN, Eiler, Towns and Buildings, Cambridge, Mass., 1951.
- REICHENBACH, Hans, Symbolic Logic, New York, 1947.
- RIBA JOURNAL, 'Queen Elisabeth Hall : An Appraisal', June 1968, pp.258-59.
- RICHARDS, J.M., 'The Hollow Victory, 1932-1972', in RIBA Journal, May 1972, pp.192-97.
- RIETMAN, W.R., Cognition and Thought, New York, 1965.
- RITCHIE, T., 'Plank Wall Framing, a Modern Wall Construction with an Ancient History' in JSAH, Vol.XXX, No.1, March 1971, pp.66-70.
- ROKEACH, M., The Open and Closed Mind, New York, 1960.
- ROSENTHAL, Earl, 'The Antecedents of Bramante's Tempietto' in JSAH, Vol.XXIII, No.2, May 1964, pp.55-74.
- RUSKIN, John, The Seven Lamps of Architecture, London, 1849.
- SCHUTZ, A., Collected Papers : I The Problem of Social Reality, The Hague, 1967.
- SCOTT, Geoffrey, The Architecture of Humanism, London, 1914.
- SCOTTISH DEVELOPMENT DEPARTMENT, The New Scottish Housing Handbook, Bulletin No.3, 'Housing for Old People', HMSO, 1970.
- SCRUTTON, Roger, 'Architectural Aesthetics' in British Journal of Aesthetics, Autumn 1973, p.327.
- SCULLY, Vincent, 'Modern Architecture - Towards a Re-definition of Style' in Perspecta Yale Architectural Journal, VII, 1957, pp.5-10.
- SEGAL, Walter, 'Low-cost Housing and User Participation' in Architecture and Social Sciences, edited by Raman, P.G., Edinburgh, 1973.
- SERENYI, Peter, 'Le Corbusier's Changing Attitude toward Form' in JSAH, Vol.XXIV, 1965, pp.15-23.
- SMITH, Donald, 'Towards a Theory' in Architectural Review, February 1965, pp.101-4.
- SMITH, Ivor, 'Architects Approach to Architecture' in RIBA Journal, July 1967, pp.271-80.

SORIA Y MATA, Arturo, Cosas de Madrid: Appuntes y Comentarios Municipales, Madrid, 1935.

SPRADLEY, James P., (ed.) Culture and Cognition, San Francisco, 1972.

STRAWSON, P.F., Individuals - An Essay in Descriptive Metaphysics, London, 1959.

SUMMERSON, Sir John, 'Antithesis of the Quattrocento' in Heavenly Mansions, New York, 1948.

SUMMERSON, Sir John, 'Violet-le-Duc and the Rational Point of View' in Heavenly Mansions, op.cit.

SUMMERSON, Sir John, 'The Case for a Theory of Modern Architecture' in RIBA Journal, June 1959, pp.309-11.

TOULMIN, Stephen, The Philosophy of Science, London, 1953.

UNIVERSITY OF EDINBURGH, Department of Architecture, 'Environmental Appraisal - a Ten-Day Stint' unpublished paper prepared by students of the Department.

VAN der RYN, Sim, and SILVERSTEIN, Murray, 'Dormitories as a Form for Student Living' in Architectural Design, December 1966, pp.622-24.

VITRUVIUS, De Architettura, London, 1940.

VIOLLET-LE-DUC, Dictionnaire Raisonné de l'Architecture Francaise de XI<sup>e</sup> au XVI<sup>e</sup> Siecle, 1854-1858; and Entretiens sur l'Architecture, 1863 and 1872.

WADDINGTON, C.H., Behind Appearance, Edinburgh, 1968.

WATKINS, J. 'Hume, Carnap and Popper' in The Problem of Induction edited by Lakatos, Imre, London, 1968.

WEBBER, Melvin M., 'The Urban Place and the Non-Place Urban Realism' in Explorations into Urban Structure edited by Webber, Melvin M., Philadelphia, 1964.

WEBER, Max, The Interpretation of Social Reality, edited with an introductory essay by Eldgrige, J.E.T., London, 1970.

WELFORD, A.T., Ageing and Human Skill, Oxford, 1958.

WIGGINS, J.C. 'Some Relationships between Stimulus Structure and Ambiguity in the Solution of Anagrams' in Journal of Clinical Psychology, No.12, 1956, pp.332-37.

WILSON, Susan, Introduction to Logic, Bletchley, 1971.

WITTKOWER, Rudolf, Architectural Principles in the Age of Humanism, London, 1949.

ZEVI, Bruno, Architecture as Space, New York, 1957.