THE GENERATION OF A THEORETICAL BACKGROUND

FOR AN ARCHITECTURAL DESIGN FRAMEWORK

(TOWARDS THE DEFINITION OF THE SYSTEMS THINKING ARCHITECT)

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.... And I wish also to thank everyone and anyone who might feel that he/she had a role and contribution in the formation and completion of this work from the start to the end....

DECLARATION

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SUMMARY OF THE THESIS
&
CLAIMS FOR ORIGINALITY

The objectives of this research were ambitious: the definition and development of a structured methodology that:

1   captures the total environment of complex architectural design problems,

2   enables the many parties and interests in an architectural development to communicate and understand each other,

3   provides a framework that can embrace the many sub-problems and conflicts that are bound to arise during the definition and appraisal of a design,

4   provides a sequence of procedures that enables a design to be elaborated that both solves the technical problems and induces consensus between the interests.

It is realized immediately that the problem field is complex and will involve many disciplines - hence the code CMOAS to represent "Complex Multiple Objective Architectural Systems".

The problems invoked by CMOAS will be technical, aesthetic, social, personal, environmental, financial and regulatory. Coverage of such problems entails expertise in many professional fields, but the experts involved are more often than not expert in only one field with points of view that are less than harmonious with other experts. Other parties may be non-expert but will represent the most important interests of all, eg the client, the future users of the building, and the community into which the development is to be inserted. Thus the methodology has to provide a route whereby the many interested parties, both expert and non-expert, can understand all problem dimensions, discuss them in a mutually comprehensible language, and arrive at interpretations of the issues and of the possible design resolutions. The route or framework for this consensual-design process is coded ICU to represent "Interpretation, Communication, Understanding". In fact the process is cyclic: the first pass interprets the design brief with a view to understanding the total design problem and all the side issues; the second (reverse) pass moves from this understanding towards the resolved architectural design that is the factual interpretation of the original brief. In order to highlight this two-pass cycle the process is usually coded as ICU-UCI.

Such a problem field poses many challenges. To System Science there is the challenge of providing the all-embracing structure, framework and methodology. To Architect-Designers there is the challenge of submitting their creative approach and design procedures to structured thinking and modelling required by Systems Science. Systems Science itself must make room for the very personal creative impulses within Architecture with its emphasis on aesthetic values. Developers and Planners have to come to grips with structured thinking requirements as a means for developing a systems perspective from which to view their local interests. And the over-arching challenge is to make the whole methodology comprehensible to the non-scientific and

perhaps inarticulate user of the end-product. A challenge for both Systems Science and Architectural Design Method indeed!

The many strands in the CMOAS "tapestry" have to be integrated into a final comprehensive and structured methodology. But the approach to the final resolution starts from several disjoint expert fields which must be first described (for the benefit of the experts in the other fields) and then focussed towards the emerging methodological structure. Each of these sectors represents a contribution to understanding-as-a-whole, but an individual sector may have little interest for a reader already expert in that particular field. This is one of the fundamental difficulties that interdisciplinary Systems Science always has to face: the weaving together of many local strands in order to gain a total structure and resolution above and beyond the lower level particular solutions.

The five individual strands that have to be woven together by the thesis, together with their originating disciplines, are listed below:

1   Architecture as Vision and Process   (out of Architectural Design Methodology)
2   Design as Creativity and Methodology (out of Design Philosophy)
3   Systems Thinking and Analysis   (out of Systems Science)
4   Structural Modelling   (out of Graph Theory)
5   Multicriteria Evaluation   (out of Value Theory and Multiattribute Utility Theory)

The thesis addresses these strands and builds up to the final resolution and test of the ICU-UCI methodology for CMOAS. But a presentational constraint is applied to the thesis in accordance with the desire for communicability that is imbedded in the methodology. Strands 3, 4, 5 come out of Scientific Method and Logic and can be highly mathematical within their local literatures. However these scientific/mathematical roots are not included as they would mystify if not antagonize the principal customers desired for the methodology: architects. This demonstrates another of the difficulties encountered by Systems Science when it is directed towards a general audience: there is no general audience - it is either artistic and literate, or structured and numerate; fully developed hybrids are rare.

*   The thesis is itself an exercise in bridging the gap between "The Two Cultures".

The incremental contributions from the thesis sectors are summarized below. The thesis is conveniently divided into two sections:

1   Groundwork and Build-up (Chapters 1 - 8)
2   The Integrating Methodology (Chapters 9 - 13)

Architecture as System
(Chapter 1)

This provides a two-way introduction that places Architecture inside a Systems perspective, and enables the systems-like properties of architecture to be recognized.

* **The implication of the section is the proposition that architecture, in all its aspects, is a valid subject for systemic study.**

Political Economy of Architecture
(Chapters 2, 3, 4)

These three chapters provide an extended essay into the "mindscape" of architecture so that the aspirations of architecture, its creative process and the way it is done may be comprehended by the non-architect in preparation for turning the artistic elements and the client/architect interface into structured representations for the later methodology.

* **The section indicates the nature of the subjective and technical problems that are imbedded in the practice of architecture and which systems methodology will have to confront if integrating structure is to be brought to bear.**

The Mental Processes of Design
(Chapters 5, 6, 7)

The design process itself entails mental activities involving imagination and creative synthesis as well as the management of structure and detail. The left/right brain metaphor provides a useful template on which to build a model that is fruitful for synthesis within systemic structures. Design involves the finding of a resolution of the interacting aspirations, problems and conflicts; the final resolution may be considered "optimum": but that in itself is a value judgement with many facets that have to be reconciled.

* **The section outlines the many aspects, attributes and conflicts within design, particularly as applied to architecture, that will have to be harmonized if the final methodology is to be operational rather than a vision. The difficult interface (bridge) between design optimization and human aspirations is highlighted.**

A Mission Statement for Architecture
(Chapter 8)

The researcher (a qualified architect) introduces a heartfelt statement on a major conflict in the practice of contemporary architecture: the need to balance the legitimate aspirations of architects to make strong artistic statements through their work with the

need to satisfy both the client and the prevailing social norms as to what is acceptable.

* The resulting orientation towards "Community Architecture" provides a value system on which to build a consensus-seeking methodology.

The build up towards the integrating methodology is now complete.

Systemic Design Framework for the ICU-UCI Process
(Chapters 9, 10, 11)

A methodology provides a structured approach to problem-solving. Consequently the first step towards an explicit statement of the ICU-UCI methodology is a careful synthesis between architectural thinking and systems thinking. From here the detailed framework for the ICU-UCI methodology can be evolved. The methodology incorporates the RIBA recommended procedures, formal iterative problem-solving procedures, and Multicriterion Decision Analysis.

Operationally reliance is placed on Group Conferencing Methods whereby members of the design team, clients and public interests may be facilitated to define the problem, objectives, criteria and assessments as appropriate during the various stages of the process. The complexity level of real problems is such that interactive computer-aids are imported: in particular:
   (i) Interpretive Structural Modelling (ISM) for problem structuring, prioritizing.
   (ii) Systemic Worth Assessment Procedure (SWAP) for multicriteria assessment and the reconciling of different value perspectives.

* An integrating methodology is offered that enables architectural teams to develop and assess their work with respect to the objectives and values of all the parties and interests entailed by the building proposal. The methodology can be used:
   (i)   by the architectural team as an in-loop design aid.
   (ii)   by the architectural team role playing the other interests as an aid to the resolution of design conflicts.
   (iii)   as a public consensus building procedure with facilitated Group Conferences involving representatives of the various interests concerned.

An Operational Application and Test
(Chapters 12, 13)

The operation of the methodology is demonstrated by an application to a large scale development project which for security reasons is referred to only as "LBR". This was a proposal for the development of a desolate factory area which had eventually been refused planning permission by the Local Authority. The SWAP method was

used to elicit the value systems of the four interested parties together with their likely assessments of the LBR scheme (from drawings and models). The researcher role-played the interested parties (architect, developer, Local Authority, the local community) with the help of expert facilitation. (The researcher had been a full member of the architectural team involved with the LBR scheme, consequently the role-playing inputs carry considerable insight and validity).

The results of the exercise served to indicate why the proposal was refused planning permission, and could have been used by the architectural team to "tune" the design in such a way that the objections would have been met before submission of the designs.

*   Although limited in scope (by necessity) the exercise can be considered to be a proper and successful demonstration of the ICU-UCI methodology as a practical design-aid for architects that is both systemic in its coverage, and flexible/fast in its application.

CLAIMS for ORIGINALITY

The research behind this thesis concentrated on bringing architectural design methods into the highly structured approach to design problems as recommended by Systems Science. As such the research is an example of interdisciplinary transfer made more difficult than usual because the disciplinary interface involved the Arts - Science chasm.

The research was brought to a successful conclusion and the following claims may be made:

CONTRIBUTIONS TO SYSTEMS SCIENCE

1   A limited search of the Systems and Architecture literatures suggests that this research represents a pioneering application of Systems Science methodology within the architectural field.

2   Demonstration of the power of Structural Modelling techniques in that they can successfully capture and articulate messy problems and subjective perceptions across the science-arts divide.

3   Demonstration that successful trans-disciplinary applications of Systems Science methodology benefit from very careful study of the mindset, values and procedures of the professionals in the receiving discipline.

4   Demonstration that Systems Science can be used to provide a "language" that enables communication and understanding between diverse professional and lay interests.

5   Demonstration that the process of Architectural Design can be structured and modelled as a sequence of systemic procedures, with particular reference to the provision of proper accountability to the impacts that the building design may have on the total community and environment into which the building is to be inserted.

6   Demonstration that the highly structured approach of Systems Science to problem-solving can be applied successfully to a field (architecture) in which the creative arts play a significant part.

CONTRIBUTIONS TO ARCHITECTURE

7   The development of a new and comprehensive methodology that enables architectural teams to understand better the total "political" environment in which the design task is set.

8   The ICU-UCI methodology represents a fully worked out form of a Third Generation Design procedure that provides a successful synthesis of the strengths of Second Generation Design and avoids the pitfalls of both First and Second Generation Design procedures. (Architectural design jargon is being used.)

9   Demonstration that the methodology works in an architectural context, and can be used by non-scientific staff provided that structured thinking concepts are applied, and (for complex problems) that suitable computer aids are available for structural modelling.

10   The methodology can be adopted and used by architects as an operational aid to their design work. Three helpful modes of operation can be exploited:
     (i) as a design aid for achieving optimum solutions.
     (ii) as an aid to understanding better the constraints that may be placed on a design by clients and other external interests, hence more successful design proposals.
     (iii) as a means for generating public consensus for design proposals.

11   Demonstration that the structured methods of Systems Science could be usefully incorporated within architectural thinking and teaching.

12   Demonstration that the ICU-UCI methodology could enable architects, clients, public to understand each other better, and so allow architectural progress to be made more smoothly without the need for antagonistic public debate.

INTRODUCTION AND THE PROCESS OF PROBLEM DEFINITION

1. Problem Structure:

There is a need to talk about ill-structured and well-structured problems. We often see that when organisations or individuals have a feeling that a problem exists in a certain situation, a proposal is made which shows that the problem they are talking about is not structured in a very clear way. The discussion, which includes all the ad-hoc adjustments needed to move from an ill-structured to a well-structured problem, demands a clear picture of the true nature of the problem. In this research project the first steps to be taken were to define the problem to determine all the necessary steps needed for a solution to be found, and to have a clear sense of direction and scope for the project.

In addition to the published literature in considering problem definition it was found useful and very tangible to also benefit from ones own experience. It did not matter whether the experiences were in the fields of architectural design or whether they were of a general research nature.

Bruce Archer says "Design methodology is alive and well and living under the name of design research". [5] In other words, design research by definition refers to the methodologies which result in a higher standard in the final outcome.

If Archer's assumption is correct, then to illustrate how a

problem moves from an ill-structured state to well-structured, it is neither necessary nor indeed possible to find an architectural example of all the events involved in a design research project over the previous five years which itself has passed through a process of modification from an initial to a final form.

2. Theoretical Framework and Practical Considerations:

The following proposal is felt to be a valid experiment if it shows, concisely and accurately, how modification becomes necessary and brings a conclusion, e.g. in this case, development of a theoretical framework, abbreviated as ICU-UCI.

To determine the scope and direction, and all the steps to be followed, an appropriate methodology was required. Therefore there was a need for a sound understanding of methodologies and for discovering one most relevant for the definition of problem areas.

At the beginning the search in this project was for the application of systems thinking and problem solving methodologies in the design and evaluation of complex multiple objective architectural systems (CMOAS) by way of man-machine communication systems.

However, at the beginning of the project it was not possible to have an appropriate knowledge of the available resources which could achieve a well-structured problem.

Additionally this entire project was about studying methodologies that are applicable to architectural design. This meant firstly defining the problem itself, for which several ad-hoc adjustments would be needed in the future. As Holt says "the methodology concerning problem definition is that part of the problem-solving process which is least developed".[39] This meant that even if one knew all the methodologies, one would still have a lack of direction, and not know all the steps that would need to be taken.

After the literature survey had been completed it then became necessary for the project to be scaled down from ambitious early plans to ones which could be completed within the limits of time and resources.

One key aspect in going from an ill-defined to a well-defined structure is to check the availability of resources. One may have a feeling about certain circumstances, arriving at an explanation of them as perceived, and naming them as the problem. No doubt that feeling might be valid even if the project proceeds and ends with a different topic. The reality of the situation forces one to accept and admit the constraints of, for example, work environment, availability of resources and the very important component of time or amount of labour one can put into the project.

Holt points out that "the facts are that problems do not come 'ready structured'".[39] It was evident from the

beginning therefore that some external constraints would adversely affect the chances of any ambitious-looking proposal becoming a manageable project, bringing it to the stage that could be regarded as a well-structure problem.

The presenting of a new area of design research would be an original contribution to the development, existence and validity of the concept of design methodology.

Initially, research students try to change an ill-structured problem into a well-structured one, or justify making all the ad-hoc adjustments to the topic in question. This is felt to be a very important part of the design research process, to see how for instance, when the discussion is about complex multiple objective architectural systems, first feelings on the project evolve into final feelings, i.e. whether or not the feeling about the problem 'now' is as it appeared at the beginning.

3. Disunity Among Architects:

A start was made by looking at a problem area which has been under consideration for several years. At the start and during the forming of a research proposal, the problem seemed to be summed up by the question:

'Why are architects not united in the process of solving the problems of mankind, as far as they can contribute?'

Their contribution firstly is in the area of housing.

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Millions of people do not have even primitive shelter, while architects enjoy the use of technology for their own satisfaction and to satisfy certain select clients' requirements. Even from within that section of society that employs architects, complaints are voiced about the architects' inability to interpret or understand clearly the stated needs. Therefore there is a need for:

1) a design methodology to bring them to some kind of unified approach in their dealing with problems; or

2) there is a need to establish beyond doubt the root of the problem at the heart of the social system. The architect's role in the total production process must be clarified. In addition, it must be understood that although an architect may be chief producer of an architectural product, the final outcome is not necessarily a result of his performance alone. Consequently all aspects regarding the involvement of others should be highlighted to identify the various responsible parties. It has long been suspected that there is a lack of proper communication, understanding, and interpretation of the responsibilities devolving on various people in the total process of an architectural production.

Referring to the assertion that architects are not united, it is realised that their interests vary and their cognitive backgrounds present different mappings which are difficult to superimpose, especially when they belong to

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differing social classes. Architecture is a profession which cannot be of immediate benefit to society. It is not like the medical profession, where, for example, illness is dealt with by telephoning the doctor who provides a service, recommends a medicine and mostly solves the patient's problems almost on demand. Architecture requires many resource concentrated together at the beginning of a process, which is seen through to a final outcome.

Presentation of the final outcome is usually no guarantee of satisfaction. The profession, while requiring so much effort and consuming so many resources, may produce an uncertain and complex outcome, especially if there has been no proper interpretation, understanding and a way of communication to examine the architect's interpretation and future production of the user's requirements. Any positive move towards the solution of this problem is to be regarded as an original contribution to architectural education, practice and to society in general.

Of course, the introduction of a suitable framework requires support and proper backing by the legislator to bring it to its most practical stage. Such a methodology and/or framework even when there is no possibility of uniting the architects around a certain goal, at least helps to reduce the level of complaints by users, clients, architects, non-architects and society. In the search for an environment in which such a project can be carried out, the architectural schools come first to mind. It soon

became obvious that architectural schools ignore the scientific aspect of any methodology. In other words, architects while liking to be regarded as scientists, still want to have their freedom to talk, act and function within an artistic paradigm.

4. Work Environment:

The nature of artistic criteria largely rules out the notion of a united opinion, but science, in its use of measurement and scaling, leaves much less room for miscalculation. In addition, where precise measurements cannot be made, the possibility of mistakes arises, and where such measurements are possible, mistakes occur only when the process of measurement is not done correctly. There is thus the need for a proper work environment in order to carry out scientific research.

If the subject were to be an architectural school as the main work location, there would have to be another environment to provide access to the scientific elements needed for the generation of a thesis. A suitable place would be 'Department of Systems Science'. What was realised was the need to concentrate solely on such a work environment and to see how an architect could benefit from its resources, mainly regarding mathematics and science (i.e. computer facilities, methodologies for design, engineering aids and optimizations).

A supporting work environment could be an architectural

office providing a certain type of project having a research demand appropriate to the scientific environment. As experimental material, it could then be investigated to yield the required results as far as the Department of Systems Science was concerned.

As the design of an architectural product embraces technological, social and environmental considerations, each of which may give rise to problems, the work environment was felt to be the appropriate place from which to derive problem-solving methodologies during the search for a design framework.

During the preparation of the proposal, literature in Systems Science, Systems Design and Systems Engineering was reviewed, leading to a closer understanding with these disciplines and an increasing confidence in the belief that in-depth reading of related literature would bring a greater understanding of systems thinking, enabling tangible progress with the project.

In reality much of the content of the course irrespective of mathematics and the terminologies is very similar to that used in architectural education, i.e. 'designing' involves establishing decisions in the same way as those presented in the literature. Architecture uses empirical, analytical and instrumental levels, but lacks the normative level.

It was also firmly believed that the summation of the parts would not result in the whole. To put it in architectural terms, the aggregate total of doors, windows, floors, ceilings, walls and all other miscellaneous items would not equate to the building itself. There is a firm understanding that a building is a holistic system. Thus the proposal as presented addresses, among other questions, who takes the blame for bad design?

5. Formulation and Aims of the Proposal:

The proposal was formulated under the heading: 'The application of systems thinking and problem solving methodologies in the design and evaluation of complex multiple objective architectural systems by means of a man/computer system of communication'.

The aims of the research were:-

a. To establish the relationship between architecture on the one hand, and systems-thinking and problem-solving methodologies on the other.

b. To develop a man/computer design and evaluation

framework that can be of use in the production process of complex multiple-objective architectural systems from beginning to final product.

c.   To assess the potential influence on, and contribution of systems science to, architectural education and practice.

d.   To evaluate the ways in which a man-computer style of communication can contribute to the speed of production and the quality of the final product, i.e. the architectural production.

It was conceded that the scale of the proposed work might prove to be too wide as the studies progressed, as a result of which ad hoc adjustments were made.

A check on suitable sources of literature indicated five areas requiring thorough investigation. These were systems thinking, systematic problem solving methodologies, design, evaluation and Human Computer Interaction (HCI).   (Fig.1)

6. Structuring the Problem:

In the first three months of the project it became evident that there would be a need for adjustments in order to achieve a well-structured problem. As the aim of the project was to benefit from systems thinking and systematic problem solving methodologies, a good deal of revision of these areas was needed during this time. The appropriate methodology, chosen from the problem solving methodologies, was ISM (Interpretive Structural Modelling) which, as far

Fig.1   DIAGRAM OF THE STRUCTURE OF THE AIMS AND AREAS
OF RESEARCH IN THE PROPOSAL.

WORK ON THE LITERATURE

SYSTEMS THINKING

PROBLEM-SOLVING METHODOLOGIES

APPLICATION

IN THE DESIGN OF

FOCOUSED OBJECTIVE ARCHITECTURAL SYSTEMS

MULTIPLE OBJECTIVES ARCHITECTURAL SYSTEMS

COMPLEX MULTIPLE OBJECTIVE ARCHITECTURAL SYSTEMS.

C.M.O.A.S.

A MAM-COMPUTER DESIGN FRAMEWORK

WORK ON THE FRAMEWORK
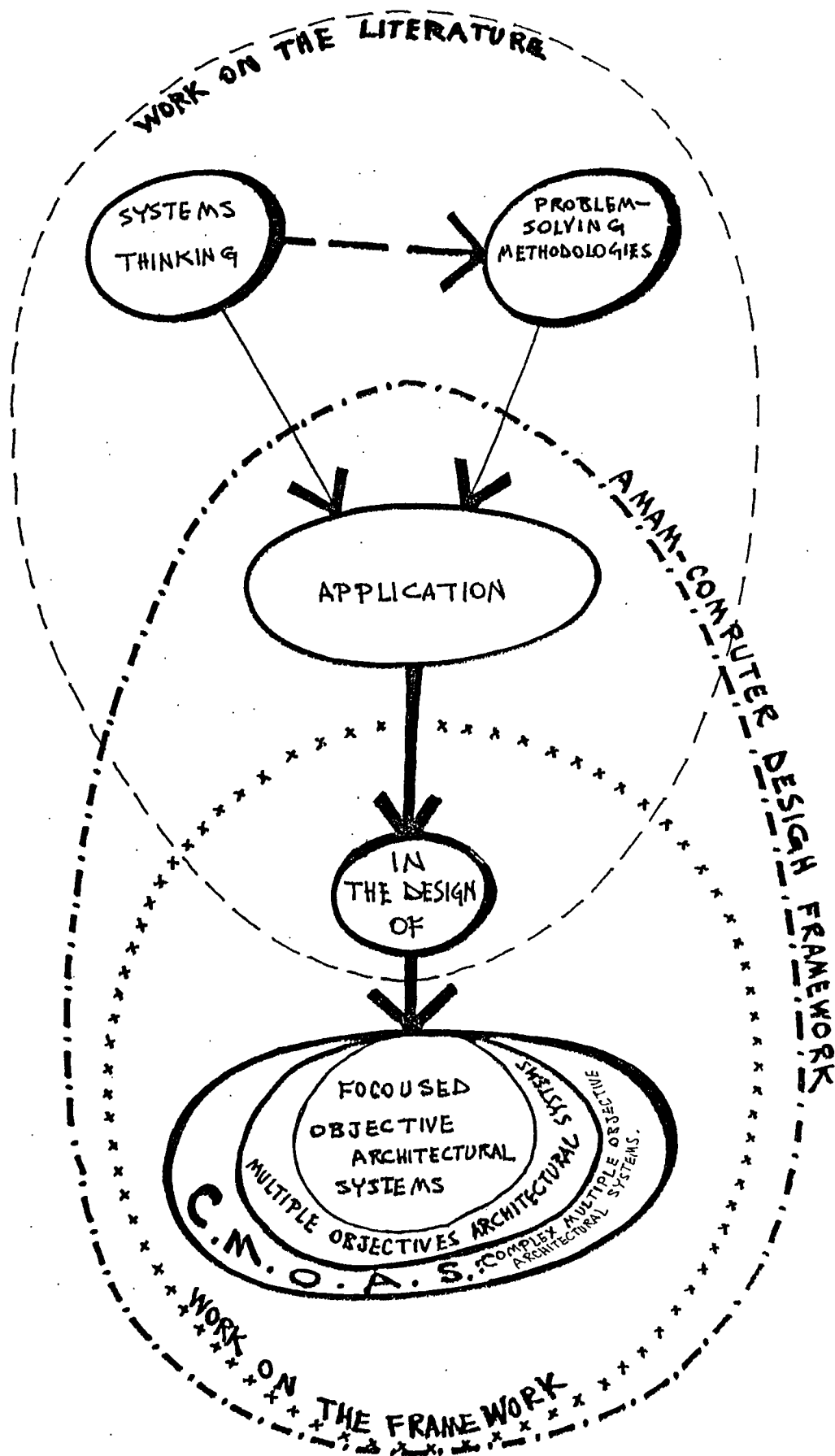
as systems thinking was concerned, was clearly relevant in synthesising the system structure by use of the elements and their relations.

To recapitulate, the ingredients of architecture are art, science, and technique or craftsmanship. In many architectural schools the emphasis is more towards the artistic side, since it is difficult to measure and judge the correctness or otherwise of art. But it is possible to measure the scientific part, or at lease to scale it to quite a large extent, for example, in measuring lighting or acoustic levels.

However, determining whether or not the environment is pleasant or beautiful is a matter of opinion which offers little in the way of a scientific basis for the opinions of architects. Instead, they resort to explanations in the light of their experience, and do not normally tackle problems of a scientific nature in a scientific way.

The architect therefore comes as an outsider to a strange, scientific work environment. The language, vocabulary and terminology is strangely different from that of his architectural environment, and thus represents a problem area.

Therefore a given topic needs proper explanation in the language of the new department to fulfil its requirements. Once having talked in the language of the department, the problem passes to the architectural people. This is

another stage of the problem, i.e. to think of how to proceed without involving excessive mathematical procedures such as decision theories and evaluation systems, since, if the architect is going to use the solution of your design research as his design framework, it has to be acceptable to him. If he cannot accept it after consulting the first four pages of introduction, it will be rejected, and the outcome thus ends in failure. Thus the conclusion would be that the solution of the problem did not follow a path appropriate to architects or people in architecture.

There are always, of course, scientists who may read the outcome and see some progress in a particular field, but the aim is to come to a conclusion which may be used by others in architectural practice or education. Then it has to be presented in language which enables any architect or anyone from any other discipline as a comparative layman to understand the workings of the outcome of the research.

It was thus realised that there was a close understanding between systems people and architectural people. A holistic system is exactly like an architectural system, and as such is a very familiar area.

7. Adjustments, Ideas and Attitudes:

The next stage of problem definition involved a first adjustment to avoid unnecessary mathematics and a language unacceptable to architects, following which the project had to be operated in a proper environment. One idea was to

mix for instance an architectural work environment with a system work environment. A project, i.e. a complex architectural system from one architectural office was to be examined to see how it had been handled, and to be brought to the department i.e. the research work environment, to see what improvements could be made in dealing with it, with reference to the stages of its design. Such a project proved not to be available.

Another idea was to take the knowledge from systems into an architectural environment. A project from an architectural office had to be compared with the way of solving the project problem in the systems department to see how this one case study could help to formulate a design framework.

This also proved not to be possible due to lack of access to an architectural office. Then an exercise in imagining a complex multiple objective architectural system was considered. The danger there was that by mistake a particular problem could be introduced which was in fact imaginary or not a real work problem. The solution would thus also be imaginary and at the end, for those involved, the work could have seemed imaginary and invalid. It could not then qualify as a design research project, and thus was another example of the project being modified in the light of the availability of resources. There still remained various areas to be covered in the review of literature, including design literature, evaluation literature and

man/machine communication methods, and it became apparent at the time that this in itself needed team work. It was obvious that it would not be possible for a full-time PhD student, to accomplish the same volume of work equal to the outcome of 2 to 3 years' team-work. The time factor was a very important consideration that modified the scale of the project to constrain it to a feasible level.

Another consideration compelled a further adjustment to exclude the evaluation part from the proposal. This decision arose after exploring the problem further. With every design decision, there is an evaluation process. (Fig.2)

8. Evolution of the Project Title:

In choosing between two elements and their connection, evaluation also includes elements excluded from the decision. For instance, consider the designing of a two-storey building, in which the elements of the architectural system are bedroom, bathroom, and study room. In order to decide how to connect the bathroom with the bedroom and with the study room, an evaluation is made regarding which will go next to which, and the final idea is reached after the appropriate self-interactions. It represents a kind of evaluated decision. Since this evaluation is within the design process, the word 'evaluation' can be excluded because it gives the erroneous impression that the research functions to evaluate other projects. Therefore the topic title which emerged was 'The Application of Systems

Fig.2   DESIGN DECISION PROCESS (INCLUDING EVALUATION)

DESIGN OUTCOME

IT IS NOT A
DESIGN, BUT
ENABLES TO REACH
A DESIGN STEP BY
STEP.

INFORMATION AND DATA ANALYSIS

DECISION MAKING

COMMUNICATION METHODS, STYLE + PRESENTATION

THE LIMIT OF
INDIVIDUAL
DESIGNER'S
DESIGN-DECISION
PROCESS

FUTURE STATE. i.e.
(GAINED EXPERIENCE)

THE OUTCOME
IS NOT A DESIGN, BUT
USEFUL FOR DESIGNER

THERE IS A
LIMIT FOR
INDIVIDUAL DESIGNER'S
PROGRESS IN EVERY
PROJECT

OUTCOME DESIGN
BASED ON DESIGNER'S
LIKES + DISLIKES

INDIVIDUAL
DESIGNER
IN THE GROUP'S
DESIGN ACTIVITY

OUTCOME
DESIGN

Thinking and the Problem Solving Methodology for DESIGN of Complex Multiple Objective Architectural Systems by way of Man-Machine Communication' which was then modified to 'Generation of a Design Framework for Complex Architectural Systems based on Systems Thinking and the Interpretive Structural Modelling of the Individual's Architectural Interpretations'.

9. Identifying Problems and Areas of Disunity:

As the process of problem-structuring progressed, the topic was finalised as 'The Generation of a Theoritical Background for an Architectural Design Framework (Towards the Definition of the Systems Thinking Architect)'. A deeper look at the problem in architecture, i.e. why blame is placed on architects, indicates first of all that the organisation of an architectural product is not understood.

The 'flag waver' of an organisation i.e. the architect, may be the only person, in the eyes of the public, associated with a building, and they may be unaware of other institutions involved in reaching a satisfactory result. It was realised that the public are not well-informed about the responsibilities and role of the architect.

Another realisation, after defining the architect's role, was the cause of problems between the architect, the user and others, in that they misunderstand each other, or rather misinterpreted each other's requirements.

An architect may like to enjoy fame, and plenty of freedom in translating his ideas into three dimensions, but people's requirements must answer their needs and necessities in a very tangible way.

If the designer's goal is to think of his own importance, to enjoy his own free running imagination, and to force others to accept his product while not knowing what their problems really are, misunderstandings arise, as do failures of communication between the two parties, both of whom are responsible for the product.

A 'take it' or 'leave it' attitude is unacceptable. One cannot take it if it is not satisfactory and one should not be forced to take it if it is not going to answer the requirements, unless that understanding is the only one available at the time, i.e. it is not possible to do better, but the hope of progress is expected in the future.

To come to such a conclusion and understanding between the users and the architect requires a process to bring the interpretation of each of them to a high level of understanding as a result of a successful exercise in communication. <u>This</u> <u>is</u> <u>the</u> <u>fundamental</u> <u>nature</u> <u>of</u> <u>the</u> <u>problem</u>.

That is not to say that this was not at the heart of the first topic right from the beginning. All the elements of the first topic existed in the last topic, but it was realised that since the resources were seriously limited

and timing led to certain circumstances which compelled an assessment of the problem from other angles, that a different type of conclusion was expected, and this process was a natural outcome.

For example, a man may have a problem at work which he feels is the most important problem for him, and nothing else can really occupy his mind. He wants to solve the problem, it remains of great importance to him, and he sets off home pre-occupied with it. On his way home, he is hit by a car and ends up in hospital. He is then wondering whether he is going to live or die, and although the original problem still exists, he is no longer looking at it from the same angle. Other problems have created a new situation which changes his attitude to the first one, his feelings change, and so do his priorities.

Thus circumstances can be seen to change the way of looking at a problem, to view it from different angles, and to formulate it in different ways at different stages of its development. So, as in the case of this project, the time factor, availability of resources and talents of the department all led to thinking of a framework based on

coping with the root of the problem, i.e. the
misunderstanding, misinterpretation and poor communication
between the architect and the non-architect.

For that, it was not necessary to set a particular kind of
example, because the example was not the main interest.
The focus is on the types of attitudes that exist in
society, of architects towards people and of people towards
architects. In considering the disunity of architects, the
idea of varying talents never being united was suggested.
This was discounted, since becoming united is determined by
the common objective. The goal clearly seen as 'to serve
people' unites those involved even though they may have
differing degrees of creativity.

The root of the problem of disunity among architects goes
back to the differing maps derived from their cognitive
backgrounds, their social dependency and the different
classes they come from. They are not usually from the
working classes, but from affluent sections of society, or
the middle classes, or they may be among those who wish to
imitate upper classes.

In other words their motives are not towards understanding
the requirements of the masses, but rather to become
servants to the elite or to those in a position to buy
architectural products. The point of emphasis is that the
root of the problem lies not just in interpretation,
understanding and communication, but goes far beyond that,

to social structure.

So when the proposed design framework is applied, in one instance, in a small office, and in another, in a large architectural organisation, and if nothing else changes and the method or framework works perfectly, a move from one society to another will produce a different result.

Since it is a matter of interpretation from one social system to another the interpretation of 'freedom', 'rights', and 'necessities' might change. Irrespective of how many social groupings can be identified, each has its individual influence on the architectural product.

Of course a good designer will doubtless create an enjoyable environment but that is always the case for those who can afford his services. On the other hand, mass production geared to offering a service to the masses, as with say council housing, adversely affects the architect's performance, due to the limited availability of resources, but it is still possible for an architect to produce good design.

A client having the financial resources to employ, for example, the three most famous architects in the United Kingdom, namely James Sterling, Richard Rogers and Norman Foster, would be presented with an above-average specification. The client would then find himself having to raise his expectations to meet these high standards.

But even in these circumstances after using their product for some time he may realise that some part of the system is not working to his satisfaction. In that case however, they will re-interpret his requirements to secure a proper understanding between both parties. The client, in paying very high fees, takes care to brief the architects as concisely and comprehensively as possible. They, for their part, are expected to absorb the information and come to an agreement.

Generally speaking, a different arrangement applies when introducing a framework. A system or model has to be introduced which offers, in an unbiased form, the opportunity for both sides to examine the interpretations each is making of the other's performance.

A Complex Multiple Objective Architectural System (CMOAS) exists for all architectural systems, regardless of size. If the project is big, complexity is expected to arise and is extended to include the social expectations. If a unit of a building, e.g. a small flat, cannot satisfy the user, then complexity is evident. Complexity exists in all buildings and the intention of a framework is to eliminate it. After gathering all the facts and figures and analysing a situation to bring about an understanding of the complexities, the new constructional ideas are aimed at bringing about a resolution of any complexity. In addition, progressive architectural processing is required, using a system to take care of further complexities that

will arise in the future of any architectural building.

10. Two-way Communication via the ICU-UCI Framework:

The previously mentioned ICU-UCI framework gives total
freedom to architects to sort out self-interactions
involved in the decision making process, while at the same
time giving the users the opportunity to thoroughly examine
the outcome of an architect's product. After that, his
decisions are translated into architectural language which,
being in the form of architectural graphics, might not be
intelligible enough for the users to make a judgement. In
the structured interpretation that an architect makes of
the requirements, the users examine whether his
interpretations in fact represent a clear understanding.
That can quite possibly be achieved by the architect using
the ICU-UCI framework for presentation of maps of his
interpretation covering the full potential of the product.

The philosophical point now reached is the primary
conclusion that the architect is given total freedom, and
that total freedom is also available for the non-architect
to enable him to examine the architect, by means of the
ICU-UCI design framework. The framework is not tested
here, because access to a project is not available, but the
framework has its own logic which can be examined.

The point about the credibility of ICU-UCI is that its
benefits arise from the method of registering an
individual's decision processes and mapping them, without

the need to go to a particular example of architecture. A project can be any kind of interpretive case work and the discussion associated with it. Later discussions show how one interpretation can produce different understandings and different reactions, which is felt to be a major achievement in this project.

The assertion is not being made that the second generation design method is dead or that the first generation design methodology is the only way. Here the expert's role is identified, the second generation's influence is employed and the resulting outcome expected to be more acceptable to the architect as a professional man and to non-architects as those responsible for looking at the negative and positive sides of all the architect's decisions. BUT there also has to be room for the architect to function as a responsible creative person, which is his role.

Consequently, the project concentrated in its final ad hoc adjustments in the question of how to produce a better architect. It is believed that a "better" architect can produce a better design. This, of course, in the opinion of the researcher is found more important than any methodology. As a result System Thinking explored and recommended with various interpretations as a form-giving and fundamental to the production of System Thinking Architect as a better architect. The whole work of the thesis achieved to be a theory of experimental philosophy

concerning the relationship between the role of architect and a society. This theoretical work introduces an extremely important area for wide range of experimental work to be based on Interpretation, Communication and Understanding, for establishing the design method of ICU-UCI for solving Complex Multiple Objects Architectural Systems, CMOAS.

CHAPTER 1

ARCHITECTURE AND SYSTEM

CHAPTER 1

ARCHITECTURE AND SYSTEM

1.1. Definition of Architecture:

In the Oxford English Dictionary 'architecture' means 'the science of building'; 'thing built'; 'style of building'; 'construction'. Grammatically, it is a noun, i.e. a "word used as the name of a place, thing, stage, or quality". This indicates firstly that in general the word 'architecture' is used as the name of a product. An example of such a product is a building. A building is a place. It can be a good place or a bad one. Since the word architecture can also be used with reference to a quality product, qualitative criteria may be adopted in support of the desire to make 'architecture' synonymous with 'good buildings'.

Such thinking can be seen in the speech, written work and every day communication among critics and among some people working in architectural offices and in education. R. Green's statement (1985): "To provide a building which... provides the public with a piece of architecture".[34] is an example of the implications of quality, as though there are only certain kinds of buildings with architectural value. Every building has architectural value, depending on the relative quality of the design and/or evaluation criteria.

In relation to the definition of 'good buildings', it has

been suggested rather vaguely that 'good' (i.e. architectural) depends not on the product but on some undefined process, and more specifically that this process involves an architect. At this point, a second conclusion emerges, i.e. architecture is a process. Such a meaning, derived from the word 'architecture' is given by Tom Heath (1984): "Architect, after all, means 'master builder', and architecture might therefore be expected to mean the activity of such people".[37] To establish the constituent parts of architecture and describe the structure of the whole as an aid to further understanding, it may be useful to look further at the given meanings.

Architecture as the science of building: science is defined as: 'systematic and formulated knowledge; branch of knowledge, organised body of knowledge that has been accumulated on a subject'; 'building' may mean 'house' and 'edifice'. 'House' is 'a building for human habitation' as well as 'a building to contain animals or goods'. 'Edifice' means 'building, especially large and stately one'. Architecture is thus seen as a systematic and formulated branch and organised body of accumulated knowledge on the subject of building, large-scale or modest, stately or humble, for human habitation or for containing animals or goods.

This establishes a third conclusion that architecture comprises communication channels in which the data input and information output are the contribution of more than

one architect and more than one discipline. Such multi-source information, acquired over a long period, is a product of the efforts of individuals and groups of varying backgrounds, in terms of building needs, cultures and industry.

Another point is that architecture is like music, involving the same mental processes. Popper has said "A musical composition has a very strange sort of existence. Certainly it at first exists encoded in the musician's head, but it will probably not even exist there as a totality but, rather, as a sequence of efforts or attempts; and whether the composer does or does not retain the total score of the composition in his memory is in a sense not really essential to the question of the existence of the composition once it has been written down. But the written-down encoding is not identical with the composition - say a symphony".[77] Architecture falls into exactly the same category; but with this emphasises that the total score of the composition, i.e. the wholeness should exist in the imagination/mind of the architect before he produces the final design.

1.2. A Building as a System:

Any building serving a function, can be regarded as a 'system', which in fact is what it is; therefore the process of producing an architectural system can benefit from systems thinking. A building consists of the

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arrangement and combination of, but not the aggregation of, elements. A building is something more than the sum of the elements. In other words, the layout may be changed but a feeling of still having the original building remains. A good example is London Bridge which is in the United States of America, having been taken there by an American, dismantled and re-assembled in precisely its original form. The bridge has no function in London, but is a bridge from London, known as London Bridge. On sight one is reminded of the same bridge in London but it now has its own characteristics based on its new location, and creates a different impact on people and the new environment. That means that it is something more than its re-assembled parts, but rather, something that the original designer included that you actually in some way register in your mind as equally important. This goes back to the description of a system. A system is more than the sum of its elements.

The same holds in architecture. A building is more than the sum of its windows, walls, floors, ceilings, doors, materials used, and all elements used inside and outside the building. Therefore, we can speak of a system or a building as they both mean the same thing, which is an architectural i.e. holistic system.

1.3. Systems Complexity in Architecture:

In every day communication the words 'complexity' and 'complex' are used without qualification, limit,

hesitation, or regard for their precise meanings. The reason lies in the nature of the layman's emotional reaction to a static structure or the way in which the dynamic behaviour of a 'thing' acts upon him as a stimulus. The character of his response varies according to his experience, background knowledge and ability to analyse intuitively, particularly in relation to the 'thing'. Considering a variation in the response, he may, out of habit, use the words 'complexity and 'complex' when in reality he means 'difficulty' and 'difficult'.

The difficulties created by inappropriate vocabulary in a productive communication go beyond the literal meanings of words, creating a chaotic lexicon in the channels of communication. Such problems are available in science, but they are always present in art. Consequently architecture suffers a great deal from a loose use of words, particularly at the stage of producing a brief, and in educational tutorials. These are aspects of the problem of complexity in architecture, and are common at various levels in the business of translating the ideas of a 'sender' into words, then into the imagination of the 'receiver', then into the result produced by them both.

To improve communication - and thus productivity - precise meanings of words should not be left to individual intuition. Broadbent (1973) suggests "If words can only have meanings because society has agreed that they should,

then individuals within society are bound to use words in those meanings if they are to make themselves understood.[12] For some individuals to make themselves understood, they do not blend their language with that of the whole society. At most they blend it with certain sections of society by trying to make their language as appealing as possible to the intuition for the benefit of their audience as well as themselves.

Such conduct is common among professionals in general. J.N. Warfield's seminar: 'Strategy for Overcoming Limits to Problem-solving' (1983) and Robert Venturi's 'A Gentle Manifesto' from his book 'Complexity and Contradiction in Architecture' (1966) allude to this. Warfield points out aliases for the definition of complex problems, and says "Complex problems have been called 'Messes' by Ackoff, 'Double-loop' by Argyris, 'Horizontal' by Cleveland, 'Wicked' by Rittel, 'Unprogrammable' by Simon". Venturi, the only practising architect, whose book according to Scully (1977) is the most important writing on the making of architecture since Le Corbusier's "Vers Une Architecture" (1923), developed a manifesto which "has had an extraordinary impact in architectural circles"... and "conducts the discussion on the levels of... personal taste".[101]

He (Venturi) says "I like complexity and contradiction in architecture... I welcome the problems and exploit the uncertainties... I like elements which are hybrid rather

than pure, compromising rather than clean, distorted rather than straight-forward, ambiguous rather than articulated... boring as well as interesting... I am for messy vitality over obvious unity... I prefer 'both and' to 'either or', back and white and sometimes grey, to black or white... 'more' is 'not less'.[101] In short, if it is found inevitable for language to appeal to the intuition, then an alternative choice for words such as 'complexity' may give a more accurate understanding.

'Complexity and 'complex' are loaded words in the lexicon of system theory for which accurate definitions are required for their use within a system, to achieve completeness, connectivity, to preserve character and to resolve or avoid conflicts. However, when something is only 'difficult', one may see 'difficulty' in comprehending it. Expressing an immediate view of that 'something' by one's "two different processes of knowing: explanation and understanding", (Angyal, 1941) [26] does not mean that a precise solution cannot be achieved, later, in different words i.e. the 'something' was neither a 'complex system' nor was a 'system complexity' involved. The term 'difficult' merely means 'hard to do, troublesome'. 'Difficulty' only means 'being difficult to accomplish, understand'. In other words, it is the case of attempts by the layman to sort out a relatively small number of interacting signals, stimuli, and responses, in order to establish a solution. This therefore means that precise

measurement and/or scaling and/or adaptation level can be obtained. Having done that, the layman will adopt a new level of 'knowing', in which the elimination of the terms 'complexity' and 'complex' from his definition of the 'something' becomes conscious and inevitable.

He may still unconsciously continue using the same terms for the same 'something' and make his communication understood, on the basis that everyone seems to understand 'complexity' until such time as it becomes necessary to define the word. Angyal (1941) states "A complex relation can always be analysed into pairs of relata, while the system cannot be thus analysed. A system is not a complex relation"[26].

Therefore 'complexity' in systems refers to states in which the result of outcomes of "static structure or dynamical behaviour is "unpredictable," "counterintuitive," or "complicated," or the like"[13].

1.4. Complex Multiple Objective Architectural Systems (CMOAS):

C   stands for complexity.

MO   for its being multiple objective.

AS   stands for architectural system.

The conclusion so far is that any building can be known as an architectural system. A building is a system and this goes back to the meaning of a system. A system is the inter-connection of elements which creates a whole, and the function of the whole is important. In architecture, while the function of that whole is important, the function of the elements is also important because the elements within themselves also function as a sub-system of the whole.

For instance if a building is a combination of windows, walls, doors, floors and ceilings, etc. then the function of every window is important. It is a combination of so many other elements that create this little sub-system which functions by way of controlling the interchange between the external and internal environments to some degree.

When a building is big, the first thing that comes to mind is its size, and the number of different functions associated with it suggests that it is a difficult building to construct.

In the case of, for instance, a theatre or concert hall, many things are involved. There are, for example, places for the audience, players, management, services, building

services and storage. Moreover one needs to consider the
acoustic characteristics, and the way the elements should
be arranged to achieve the required effect. For example,
the orchestra plays, the entire audience should be able to
hear clearly, without being disturbed by echoes. A theatre
is therefore a major task in every sense, embracing
acoustics, lighting, air-conditioning, and so on. The
creation of this architectural system involves
contributions from many different experts.

With increase in scale and in the face of limited knowledge
about arranging and executing all the requirements,
complexities inevitably arise. This is one aspect of big
buildings, their various functions and the need to
harmonise them. There is complexity therefore in
arranging, calculating, designing and putting together all
the functions. In other types of buildings which might
look simple, e.g. blocks of houses or a new shopping
centre, there are also complexities which might not be
apparent initially.

One obstacle may be how tenants take to a building.
Although their initial reaction may be favourable, the way
they are going to live and their circumstances will create
a new kind of environment. If the spatial arrangement of
the architectural design hinders them, more problems will
arise.

The behaviour of the public towards a building is very

complex. So in erecting any structure in the world today, the size and scale of it will determine the degree of public attention it attracts. Focussing that attention, in terms of either getting support for or opposition to the existence of a particular system creates complexity, since the response of the public in the total life time of the building cannot be known. Such unknown response also helps to categorise any building as a CMOAS in general. To recognise a building as a CMOAS the criteria shown in Figure 3 can be considered.

1.5. What is a 'Good' Building?

A good building is a building that first of all functions properly and an analogy might help us to understand this better. In observing and liking or disliking a human being, there are certain obvious visible criteria such as beautiful eyes, full lips and fine body, but there are other things which you might 'see' in someone who is not beautiful but which nevertheless evoke feelings of fondness or even love. Such things cannot be calculated.

Not everything that goes into the definition of a good building can be calculated. One may get to like it simply through getting used to it or, right from the beginning, because of some particular aspect, or perhaps the atmosphere of the building evokes pleasant memories. But scientifically speaking, a building which is functioning very well is a 'good' building.

1. • WHEN THE PROBLEM IS A UNIQUE AND UNKOWN ONE FOR THE DESIGNER;

2. • WHEN THERE ARE NO PRECEDENTS SOLUTIONS TO THE PROBLEM EITHER DUE TO ITS UNIQUENESS AND/OR UNACCESSIBILITY TO PAST SOLUTION;

3. • WHEN THERE ARE NO EXPERTS KNOWLEDGEABLE ABOUT THE TOTAL PROBLEM AREA;

4. • WHEN THE PROBLEM AREA SPANS MANY DISCIPLINES AND PROFESSIONS;

5. • WHEN A LARGER QUANTITY OF DATA CAN BE PROVIDED AND EXPECTED FROM THE COLLECTIVE MEMBERS OF A GROUP OR TEAM THAN FROM INDIVIDUAL;

6. • WHEN PRODUCTION BASED ON THE SOLUTIONS FROM LARGER NUMBER OF IDEAS AND ALTERNATIVES OUT-COME OF INTERACTIONS;

7. • WHEN SUCCESS OR FAILER OF THE FUTURE OF THE PROJECT IS NOT PREDICTABLE IN FULL DUE TO THE RESPONCE OF FUTURE USERS;

8. • WHEN THE PROJECT INVOLVES MANY SUB-SYSTEMS IN WHICH THEY REQUIRE TO APPEAR AS A WHOLE A LARGER SYSTEM.

Fig.3   CRITERIA FOR RECOGNITION OF
A PROJECT AS A "CMOAS"

(CMOAS : COMPLEX MULTIPLE OBJECTIVES ARCHITECTURAL SYSTEM)

Returning to the analogy of a human being, if that human being is healthy, has good sight, hearing, and sense of smell, has good teeth and walks firmly, with all the indications of proper functioning, then that human being can be said to be a 'good' person. Of course, the possession of good attitudes towards living and life and following standards that certain societies require for good living all add up to a 'good' human being.

A building can be considered in exactly the same way. From the heat-gain or heat-loss point of view, the absence of draughts and dampness, no unsecured structures, good materials and the use of strong acoustics barriers begin to add up to a 'good building'. Further aspects of the building relevant to the requirements can then be considered, e.g. the sizes, and dimensions, which being found adequate, make the building even more desirable. This becomes apparent as the building is used. At first sight what appears to be a good building may turn out, after experiencing using it, to be unpleasant to use, and by definition then qualifies as a 'bad' building.

The reverse is also correct. A building may be disliked, but enforced occupation of say, a council house, where that house is a 'good' house, turns the dislike into fondness. The adaptability of the occupant creates a feeling of liking towards the house. It is not a case of all the characteristics of the building coming into play, but

rather the relationship between the occupant and the building, together with the environment, that creates likes or dislikes. To recapitulate, a 'good' building is one seen to be functioning properly, that is to say, the arrangement of the elements is correct and the outcome is not unexpectedly undesirable.

The expression 'optimum solution' is not used, since the outcome of the architectural production is not simply based on acquiring, for example, a cost-effective building or getting the best-calculated type and size of windows or lighting. It is not any single one of these, but rather all of them put together, and the acid test is whether it is satisfactory or not. A room may offer the optimum solution in terms of heat gain or heat loss, control of Heating, Ventilation and Air-conditioning (HVAC), acoustics, and so on, but the user might, for example, feel a sense of insecurity. The appearance of the room may be disliked and changes desired to make it acceptable.

Therefore, because of the multi-objective nature of an architectural production, the optimum solution of the whole is not sought - in fact it is meaningless. The best solution may involve a consensus, and even then the consensus is not fixed, i.e. not acceptable for ever. The future and the passing of time may bring out other complexities differing from those of an earlier period, which will then require different solutions.

The system has to have this flexibility and be capable of being modified to the requirements of the day and of the users; it is not a search for an optimum solution but for a desired, pleasant and ultimately functional solution, in the sense that the system satisfies all requirements.

CHAPTER 2

DESIGN PROCESS: PROBLEMS AND RELATIONSHIPS BETWEEN
ARCHITECTS AND NON-ARCHITECTS

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DESIGN PROCESS: PROBLEMS AND RELATIONSHIPS BETWEEN

ARCHITECTS AND NON-ARCHITECTS

2.1. Difficulties During The Architectural Design Process:

In the process of producing an architectural system, an assessment should be made of the relationship between the clients, users, other participants and the architect, as those having the problem, as well as being problem solvers.

To understand the architectural process we have to know first that in the design or production process, the parties involved are designer, client, user and legislator, who originate design constraints. The designer's approach is towards flexibility and a greater possibility of options. The legislator has a more rigid standpoint, where everything is mandatory (Fig.4).

The work of the designer, i.e. the design architect, cannot be produced without the involvement of other like-minded people rather than those allied to the client, user or legislator. They support the designer in producing the outcome, and are involved in the design process of architecture. They are people such as draughtsmen who have their own part to play in the whole process.

The proportion of an architect's involvement in a project is very different today from that of the past. If in 1914 the architects responsibility was fixed at 100%, the figure

FLEXIBLE optional

RIGID mandatory

DESIGNER

CLIENT

USER

LEGISLATOR

DESIGN CONSTRAINTS
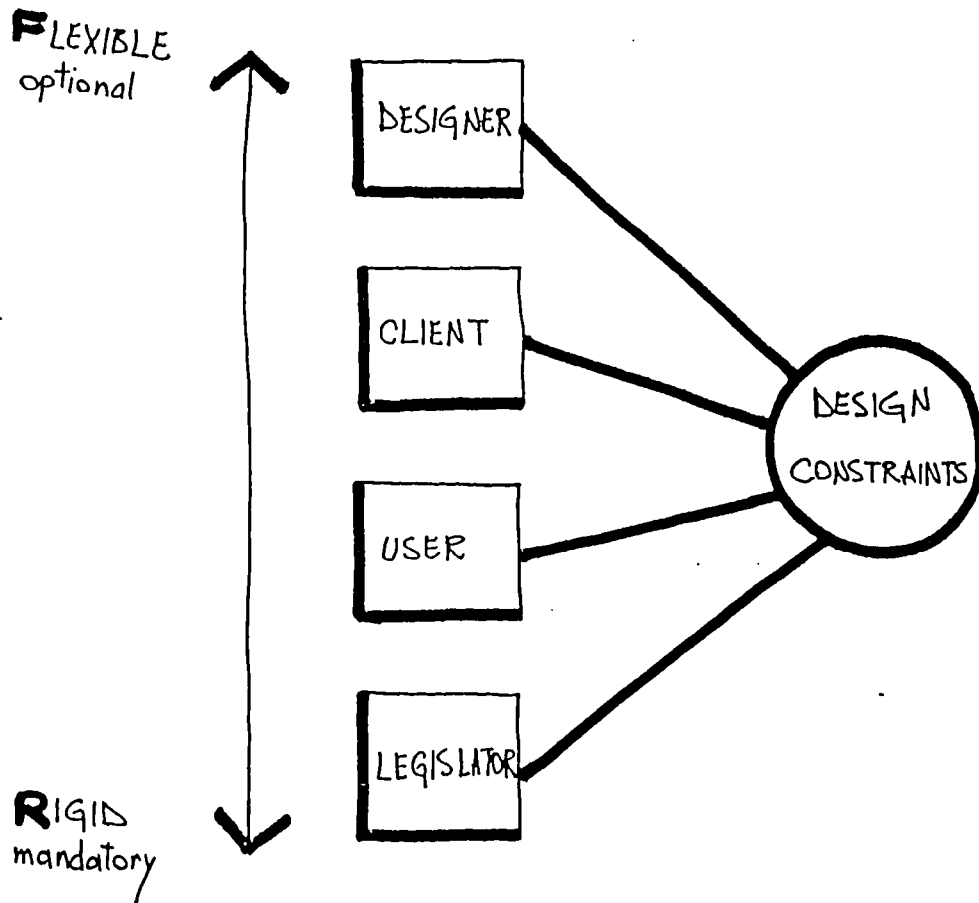
Fig.4 THE GENERATORS OF DESIGN CONSTRAINTS

comes down to 48% in 1939 and 35% in 1979 (Fig.5). Thus, as the role of architect in the process of architectural production declined, other people became involved, e.g. consulting engineers took 40% of the total job, and quantity surveyors took 12% to 23%. Structural engineers took 18% and others such as services engineers (for lighting, acoustics, air conditioning, etc. 12%). Management consultants had a 4% involvement, other consultants 4%, specialist designers 2%, and landscape architects 2%.

These participants in the design process have their own requirements and their own way of doing things to achieve a satisfactory final product. Therefore the term 'architectural design process' is an inappropriate expression since reference has to be made to a production process involving those concerned with the design aspect or creation of the system in the form of plans, drawings, models etc.

Today people requiring a building expect an architect to be 'on their side' and firmly under their control, in other words they want the architect as a member of their team. They do not want the architect to have a dominant influence over their preferences. Thus, the wish of the team is to limit the architect's responsibility as much as possible. There is then, ultimately, a risk that the architect will lose himself between the standard definition of an architect and that of a facilitator who has to convince the

ARCHITECT _____ **100%**

CONSULTING ENGINEER, 40%

QUANTITY SURVEYOR, 12% → 23%

STRUCTURAL ENGINEER, 18%

SERVICES ENGINEER, 12%

MANAGEMENT CONSULTANT, 4%

VARIOUS CONSULTANTS, 4%

SPECIALIST DESIGNERS, 2%

LANDSCAPE ARCHITECT, 2%

1914

48%
1939

35%
1979
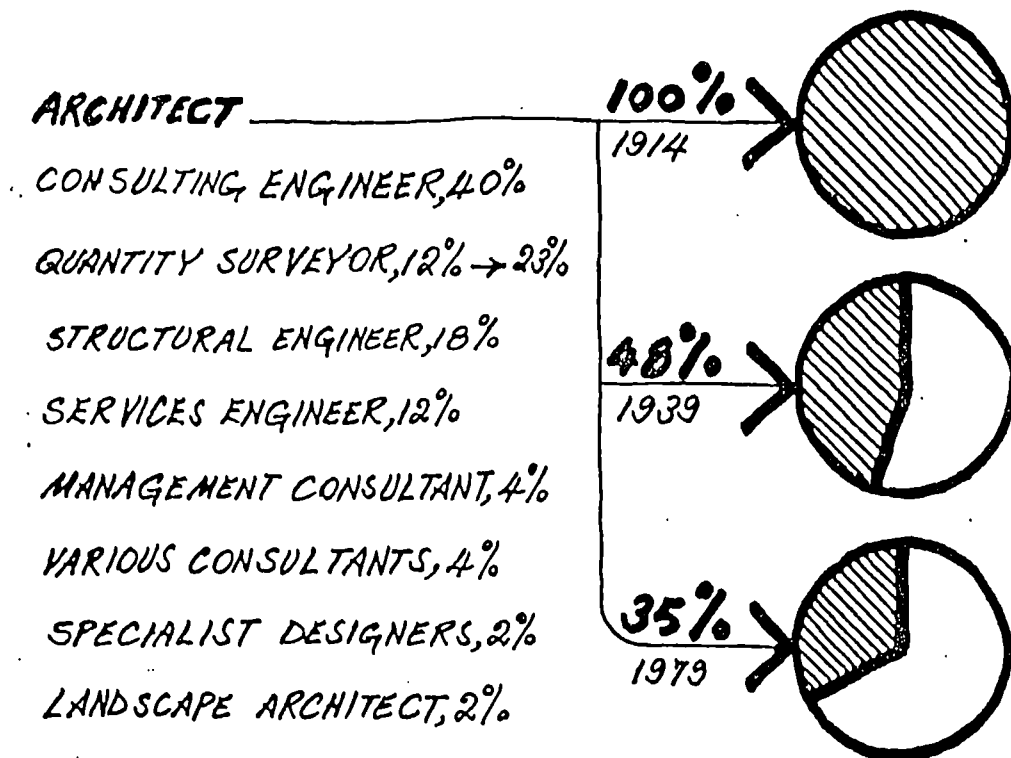
« EXPERT PARTICIPANTS IN THE DESIGN PROCESS »

Fig.5

professional bodies that he is following standard practice.

If he does not participate creatively in the process of production but merely tries to satisfy other team members by way of facilitiating their own most creative thinking, then his involvement, if not irrelevant and experimental, is certainly different from that expected in the established profession of architecture. Although serving needy people is (or should be) his main objective, there is still an obligation to see that an architect is responsible and creative, and given the opportunity, to make the environment better.

The beginning of, or rather the solution to, the problem is when the users give a brief to the architect. If the architect interpretation's of their needs differs from precisly what they have in mind or in their list of requirements, the final production is most probably going to be unsatisfactory.

There are examples of dissatisfaction such as, in the public sector, council housing, and in private housing and in buildings in general. When you see people complaining about buildings in their environment, their line of argument implies that the only person responsible is the architect. They do not show an understanding of his role, which, though crucial, is limited.

It may be that unconciously the architect is assumed to

have exercised total creativity, which the users do not trust and want to limit. This creates an irreconcilable situation. The alternative would be a design method/ framework which, while giving every opportunity to an architect to exercise his creativity, also offers the same chance to the non-architects, enabling them to contribute their own ideas. The design framework should provide the means to achieve this by examining the map of the architect's understanding of the needs and necessities, upon which a map of their own understanding can be based. This enables the architect subsequently to use their understanding as the basis for creating a new map based on his new interpretation of their understanding. This reciprocal activity can be used repeatedly until an agreement for the further progress of the work becomes evident to both sides.

2.2. Lapses in Communication:

However, there is always a possibility of poor communication. When an architect sees that the client or non-architect fails to appreciate his work, or their complaints do not convince, he may conclude that they are illiterate or ignorant of his efforts. In self-defence, he may then refer his work selectively to elitist or above-average people who appreciate or accept it.

To overcome the communication problem, some architects who do not know how to use methodologies or design frameworks establish what is termed 'dishonest/salesperson

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communication'. They show full appreciation of the client's needs and requirements by always saying 'yes' to all his requirements, then, having passed some stages of the work that they actually can produce, put the client or the user (i.e. non-architect) in a position of not being able to go back to the beginning of the project. From then on, continuation of the work is, of course, unsatisfactory which further adds to the degree of user-dissatisfaction suffered by the architect at the end of the job.

This is an example of a lack of proper communication, giving rise to an unprofessional way of handling the job. The project is handled to its completion, the production is there for all to see, and both sides are not really happy with each other. The architect says derogatively, that the client is merely a merchant or businessman whereas the client asserts that the architect's dominance should be limited as much as possible.

Even if some improvement is seen in the relationship between client and architect, when user and architect come under the total control of the client (as exemplified by some housing associations), or of any body which has the money to give to the architect to carry on with the job, the architect may simply act in his own interest. The final product might not then be the outcome of better communication between architect and users, and may also ignore the importance of user-satisfaction.

Of course, in some cases, it may not be possible to establish user-satisfaction at the outset if the users are not known. However, certain people are taken as examples of average users, and a way becomes available of securing, as a result of the improved communication provided by the design framework between the client and the architect, the fulfilment of their requirements.

2.3. Architects and the way they work:

To find out what kind of people architects are and the way they think in their decision making, i.e. the design process in architecture, a study has to be made of the brain-mind relationship with respect to the controversial discussion regarding the right and left hemispheres of the human brain. Apart from that however, for the UK there is an established model of the design making process by the Royal Institute of British Architects (RIBA). Different countries have their own bodies to which reference can be made for advice on the standard and scope of the production and the scale of charges to be made. In costing a job the whole production process has to be broken down into categories, identifying every stage and introducing the appropriate scales of fees for each part regardless of the kind of architect in charge of the design process, (e.g. a convergent or a divergent, an analytical thinker or a gestalt thinker).

2.4. With Regard to the RIBA Model:

The RIBA model is shown in Figure 6. After getting involved in the 'work-assimilation stage', stages of general study follow, then development and then communication. Of course between the various stages there is a feedback loop which is repeated until the relevance of the general study to the work the client requests is clearly established. Assimilation is listening and interpreting, communicating and establishing. Understanding is the process of actually seeing what kind of general study is required to produce a proposal for the client.

As with any study at the beginning there is little guidance on the direction in which to proceed, but the process is taken as far as possible. After that, client pressure results in the acquiring of more relevant information. Even if the stage of relating this information to the architect's involvement with the project is limited by time etc., at this stage even if it is known that the study is not enough, it should be stopped because the time has arrived when he is involved enough with the problem and wishes to propose a solution. With that solution there is a stage of development. If the development, i.e. if what is being produced is found unsatisfactory after communication with the client, then the process reverts to general study. A return is made to the assembly stage and there is always feedback between these three stages until
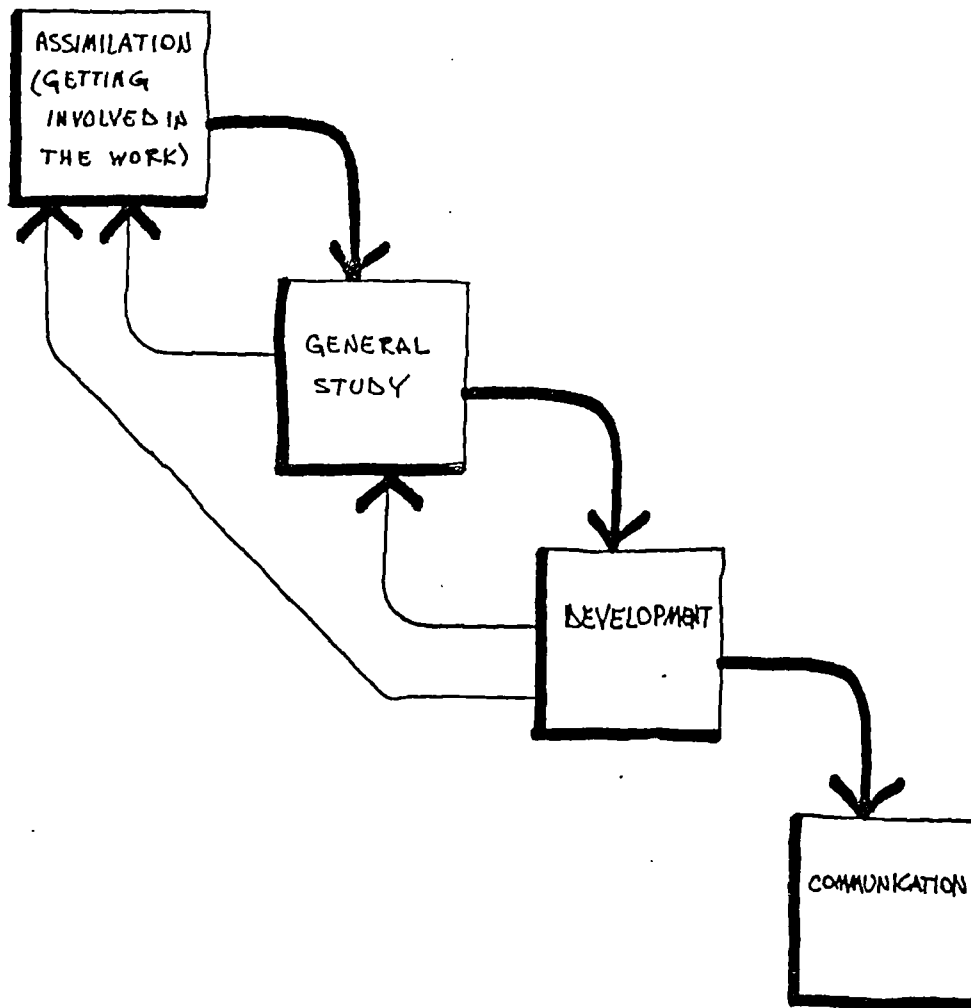
Fig.6   THE RIBA'S PLAN OF ARCHITECTURAL WORK

Note: THERE IS NO RETURN LOOPS FROM COMMUNICATION
STAGE TO OTHER STAGES ...

problems are reconciled and final production is agreed upon, which can be offered for a final discussion with the client.

Of course in the three stages of assimilation, general study and development, the main participants are not clients but the architect's colleagues. It is they who have to support architects with the general information concerning councils, officials and other authorities, which is advancing the whole project towards the development stage. Detailing or drawing may not be involved, so there is this communication between the architect and his colleagues, 'the team' until a proper communication stage is reached with the client, and any other feedback from any other stages can be examined.

But if you come to the development stage and become able to make a proper communication you are in a stage of a kind of agreement with the client and also a good deal of understanding of what the problem is. In other words your interpretations from his problems and requirements were good enough to go to the stage of that level of communication.

Every country has its own model of the production process. The wording may be different, as may be the interaction between the stages but the stage-by-stage process is necessary. The fact that one country for instance may consider some areas of activity as one stage and another

country as two is not important. The point is the stages have to be passed through to come to completion. These stages are inception, feasibility, outline proposals, scheme design, detail design, production information, bills of quantities, tender action, project planning, operations on site and the completion. (Fig.7)[6]

These stages in the RIBA model are the distribution of an architect's work and have different percentage values in terms of the time he and his colleagues spend on the whole production process. Initial studies take about 15%, outline proposals, about 13%, sketch design and detail design, 34%. Production and documentation take 38% (Fig.8)[6].

From initial studies to sketch and detail design takes 62% of the total work of the architect. To recapitulate, as far as the architect is concerned there are other people involved participating in his work, but the discussion here refers only to the architect. So for the 62% of architect's work, which is purely architectural (not, for example, for production documentation), a design framework called ICU-UCI has been introduced in this research work.

2.5. The Architectural Design Framework:

The methodology, it is felt, can also improve this 62% of the work, which is in fact where most disagreements or complaints arise as a result of failure or misunderstanding in the area of initial study, outline proposal, sketch

Fig.7 A Combination of the RIBA model of the work with the Proposed framework.
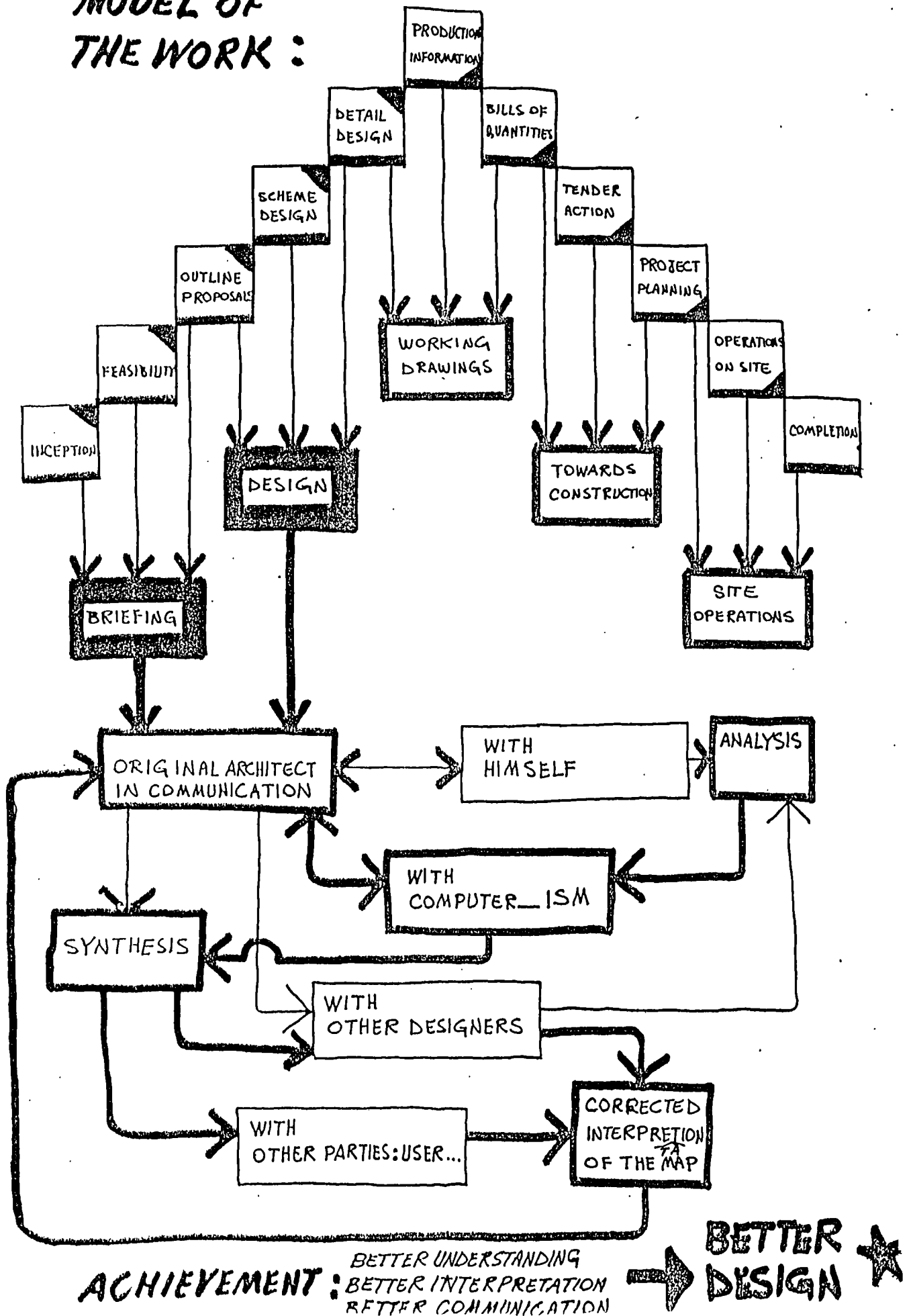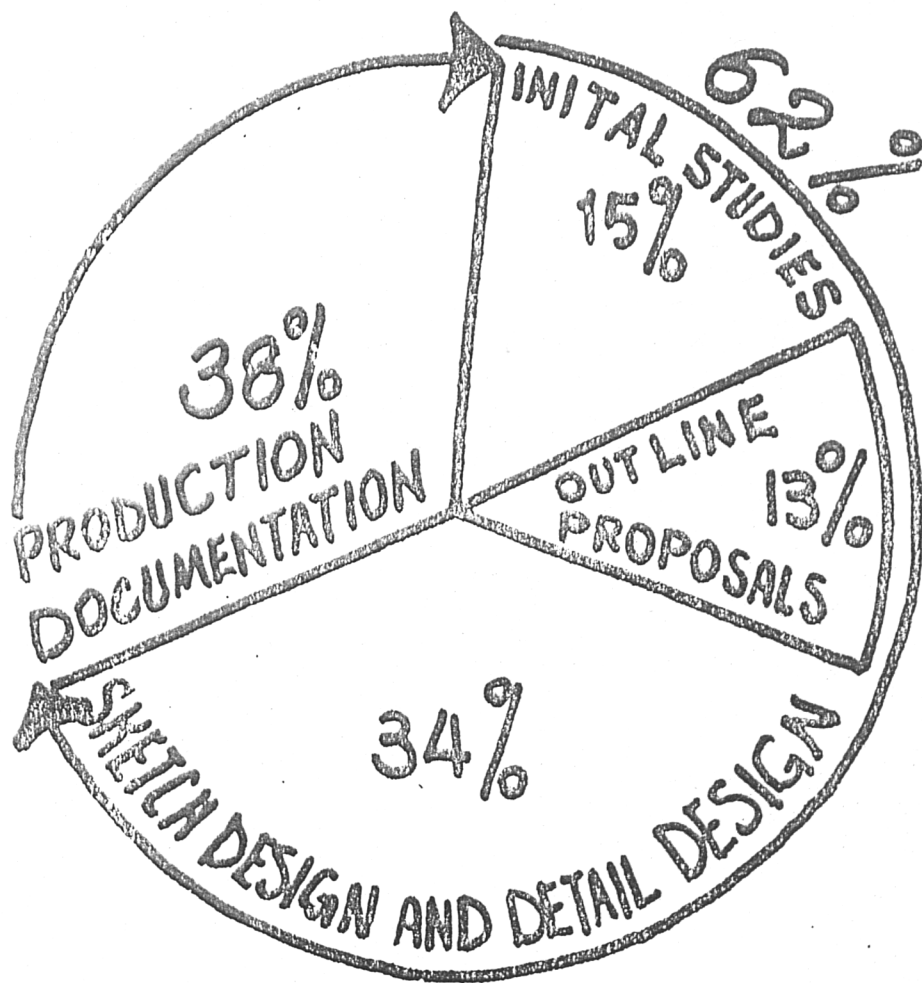
Fig.8　The current distribution of an architect's time at work (RIBA).

design and detail design. Other things are within the offices. Inception, feasibility and outline proposals in fact are the briefing stage. Outline proposal, detail design and scheme design are in the design stage. Detail design, production information and bills of quantities make the working drawings. Bills of quantities, tender action and project planning enable the move to be made towards construction. Project planning, operations on site and completion make up the site operations.

In the proposal the primary contribution is a design framework which can cover the briefing and design stages i.e. the 62% which is the architect's proportion of the work. RIBA has more detailed stages of the plan of work but here the intention is to see how an architect faces the design process, and not actually what is officially asked of him in relation to the schedules and fees for the job.

Although in a well-established architectural office every stage may be followed according to the RIBA plan of work, the same may not apply in a small office with say, one architect and two assistants. The whole production process, when an architect involves himself with a problem and searches for a solution if the design is to be considered as a solution, can be more or less the same for all 'design architects'.

In a big office which has established documentation and better access to information, some stages can be covered

quite easily. There is, however, a point at which an architect should decide that he has enough information to begin the design, since there is no point in gathering a mass of information and then losing his way in attempting to find a proper answer to the interaction which exists between the elements of the information.

Since the nature of the job is more creative, as soon as the architect is really involved with a full understanding of the work required, he is at the stage of being able to produce something which merits the criticism or support of the others who are going to judge him. The crucial part of the judgement process is then whether or not there is good communication or a valid way of discovering how the architect's decision is going to be realised in the final product.

If the architect, after conceiving a problem, is expected to apply thought then he should use some kind of methodology to come to a solution. That methodology is either the way he designs, or is one borrowed from another mathematical discipline, etc. It all depends on (1) the scale of the job, (2) the ability of the architect to understand the use of the methodology, and (3) the time available for him to see whether he can apply all the available technology and all means to achieve the most desirable solution.

After getting involved with a problem, there is a stage of

thinking, then the use of a methodology to look for solutions. In terms of systems, the stages are divided into (i) intelligence-gathering, (ii) design, (iii) choice, and (iv) implementation.

The intelligence stage for architectural work is briefing, i.e. ideas generation and conjecture analysis. The design stage is synthesis and design itself, i.e. how the requirements are synthesised. In fact, although it is a part of the design stage, it is in the form of 'agreements' presentations rather than drawings and it can be verbal. You say, for example, "I want room 1 next to room 2" simply in writing, which is part of the design stage but it is not actually design language. It involves synthesis and design itself i.e. the thinking process and its presentation.

The next stage is evaluation which is when choices are made regarding which of the alternative designs is acceptable to the user or those who are the users of the end product.

The final stage is implementation, which is the construction stage.

Of course within the stages of briefing, systhesising and evaluation, there is always feedback and the three stages continuously change and interact with one another if only one person, i.e. the designer, is dealing with the problem. In other words, the three stages sometimes do not appear distinctly separate until a mature outcome emerges, enabling a final decision to be made before moving towards

construction. (Fig.9).

When a possible solution is found, the question 'can this design be improved?' is posed. (Fig.10)[35] If the answer is 'no' then that is the end of the product i.e. the design is final. If the answer is 'yes' then the solution has to be improved and the question repeated until the answer is 'no'.

From the designer receiving a briefing to doing all the research, getting information and analysing and choosing all the relevant information, there is a point at which he pauses and designs with a new cognitive map of himself. At that stage his past experience, education, state of health and his knowledge of the brief in hand and of the characteristics of users, are brought to bear, all of which will guide him into drawing the lines which represent a solution. That is the creative part of the work.

2.6. Creating, Motivation and Work Stages:

Studies show that due to the differing nature of human beings, different types of people are called creative. For instance some use the word to describe people who are convergers, whereas other refer to divergers as creative. The studies show for example that if a person is disciplined, prejudiced and unsociable, a kind of 'well-organised' person, he can be more creative than one who is sociable, tolerant and less scientific.

This is felt to be incorrect, since it does not matter what

PROBLEM →THINKING→ METHODOLOGY → SOLUTION

SYSTEM

INTELLIGEN-CE → DESIGN → CHOICE → IMPLEME-NTATION

BRIEFING GENERATOR CONJECTURE ANALYSIS → SYNTHESIS + DESIGN → EVALUTION + DECISION → CONSTRUC-TION
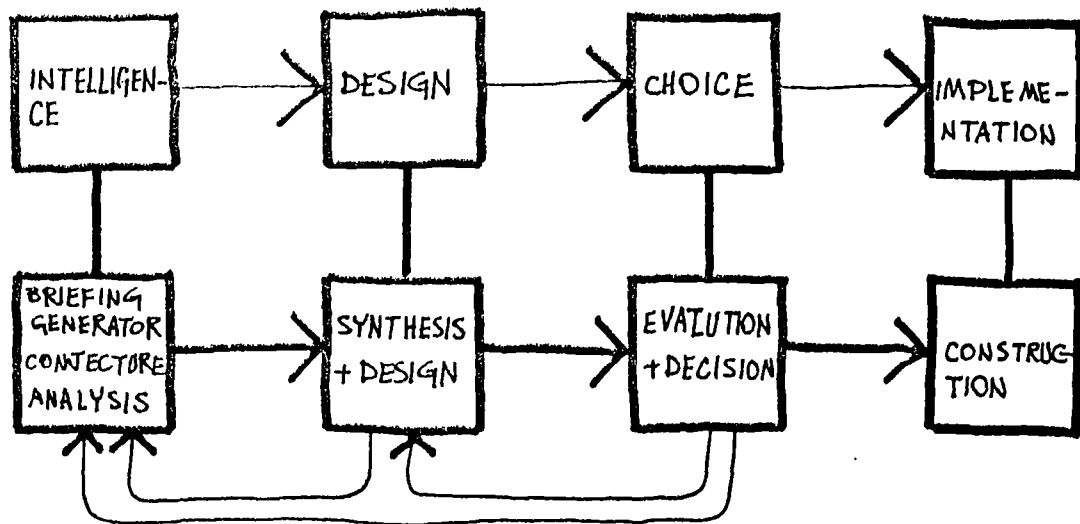
ARCHITECTURE

Fig.9   COMPARISON BETWEEN SYSTEMS DESIGN AND ARCHITECTURAL DESIGN.
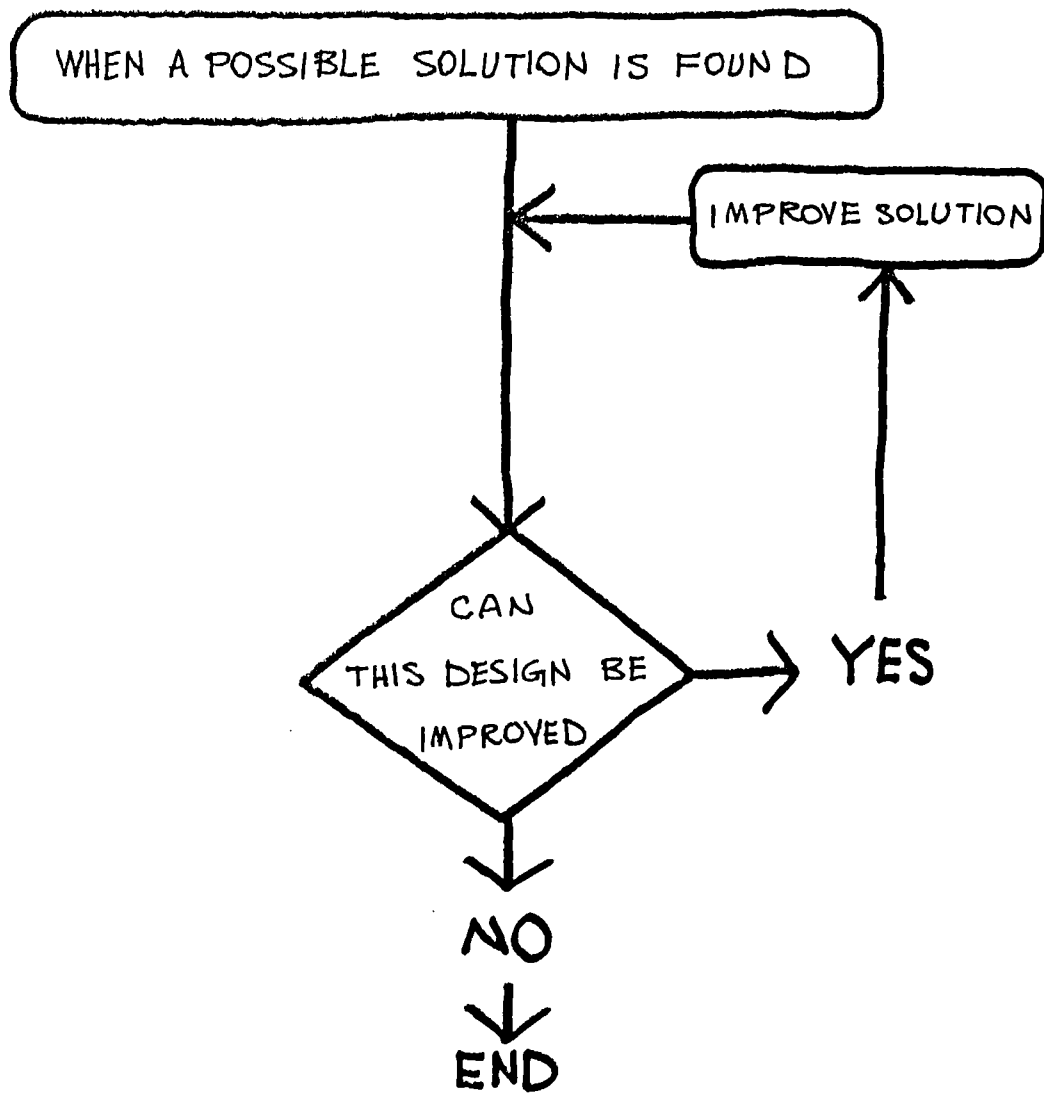
Fig.10 FLOWCHART OF SOLUTION IMPROVEMENT

kind of outcome might result from the creativity of a
person of one kind or another. The important point is
regarding the stage at which one should think and seek to
do something. It involves a way of doing things and a way
of processing information in the mind, irrespective of
labels like 'converger' and 'diverger'. In other words
every line is drawn represents a process of choosing
between at least two areas or entities, and whether these
two elements should combine or stay apart they are in the
process of being arranged. The stage of arranging and
continually rearranging is in fact creative. The outcome
of the creation cannot be guaranteed to be better for, say,
a diverger than a converger. Creativity depends very much
on one's state of health, plus experience in the sense of
background knowledge, ability to concentrate and
motivation.

If an architect is highly motivated, then for the sake of
this argument, it does not matter if it is in two-
dimensional or three-dimensional work. Such motivation
provides the drive to think of new ideas.

Where such motivation is absent the converger or diverger
is a non-producer, a non-creator. The term 'design stage'
refers to the point at which the architect involves himself
with the problem and the process in which he makes
decisions and represents his decisions with lines, surfaces
and   dimensions.

The actual work as an outcome of design from an architect is the whole creative idea of the system. That idea is expressed mainly in graphic language communicable to others. After that, everything that is done leads to technical drawings, etc., which are very much managerial in nature, so that any further creativity at this point comes from the contribution made by management.

CHAPTER 3

THE ROLE OF THE ARCHITECT

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3.1. Emotions and Poetry:

Eldred Evans and David Shalev have said in an article entitled 'A Sense of Place' that "it is difficult to define architecture, but one of the most beautiful descriptions of it came from Le Corbusier: "The business of architecture is to establish emotional relationships by means of raw materials.""[28] This could contrast vividly with the quotation "The design of a system represents a decision about how valuable resources should best be physically transformed into more valuable products, how, for example, land, labour, and material should be transformed into housing units."[92]

The architect, in satisfying Le Corbusier's definition, is required to answer the question regarding emotional relationships. What is meant by a system as a building and design here, is as Norman Potter's (1969, 1980) quotation from Le Corbusier, "Architecture is organisation. You are an organiser, not a drawing board stylist".[78] These statements specify that the role of the architect is to organise parts and elements involved or required in a building to satisfy not merely the functional needs of the users and designers but the answers to the emotional and subjective aspects of the users, as well as all people involved with, and encountering, <u>incidentally,</u> the building.

To elaborate, Le Corbusier is a good example of a capable architect, one who, in his day, stood out as a leading architect. By comparing the two quotations from the same architect we see that on the one hand, he takes care of the emotional side of his work, that is the subjective part of the needs and necessities of users, non-architects and architects, and on the other hand we see the architect as system designer who views the profession as an organisation of the parts. The organising is the creation of a whole in which there is a clear, conscious understanding of the connections and relationships of the parts. The architect, in this sense, is an organiser rather than one merely good at presentation drawings and artistic presentations.

His role as architect is seen in a spectrum which, at one extreme, he is involved with subjective aspects of the final production, and at the other he has the responsibility of organiser, having to think mathematically to some degree. However difficult it is to measure the subjective part in any pair of elements, he sees that these relationships should support each other in order to enable the architect to envisage an organisation which can function properly. The word 'function' here does not necessarily mean 'physically satisfy'. As already mentioned, the relationships between the materials should also bring emotional satisfaction.

Ralph Erskine has qualified the previous statement in his

article 'Democratic Architecture' as follows: "The role of a creative architect is not in the practice of styles, but poetically and truly to satisfy human needs, to do this with honesty in form and technique."[27] 'Honesty in form' is defined by Le Corbusier, already quoted, in that one should not be as a drawing board stylist. That means that any facade or nice arrangement in the plans is not an end in itself but has a content. If the content does not match the appearance of the form in that it has a misleading effect, the building is not being produced with integrity, and the role of architect is not being practised honestly. For an architect to be creative he cannot disregard the needs which have to be met - those of the non-architects requesting a service.

The satisfying of those needs is, according to Erskine, through true production of forms, and through design. In the case of a facade, if the need is e.g. for a window 2m by 2m to provide adequate daylight without incurring over-heating but achieving good sound insulation, then the desired product that fulfills the requirements can be arrived at with the use of proper techniques. What is not included in the specified criteria goes into making up the facade.

An architect's creativity should satisfy the needs and requirements of the user. Designing in a given climatic environment places certain constraints on creativity. Hot

and humid conditions cannot be satisfied by creating a nice facade which ignores the people's needs. Such 'creativity' is typical of Le Corbusier's 'drawing-board stylist', unlike the 'organiser' who finds the relationships between the needs, necessities, parts and components of the building in such an organised way as to take account of the subjective aspects of the product.

This subjective aspect is implicit in the creative role and ability of an architect, and when disregarded, means that the role is not fulfilled. The definition here of 'role' is not strictly according to Le Corbusier or anyone else. Rather it depends on the ability of the brain. What has been established so far about the functioning of the brain in terms of the type of task, is that the satisfaction of all subjective and objective aspects requires a brain trained in both hemispheres.

Where the left hemisphere of the brain is more trained than the right, the expectation of creativity is diminished. This does not mean that when indicating an architect's role he should be trained in both hemispheres - that depends upon the training acquired in the educational system. It is possible though to have an architect who understands his role as organiser of the materials, parts and components in such a manner as to answer human needs, without missing the emotional aspect. His success depends upon experience, training and other external effects. So long as he knows the criteria of his role, then he remains responsible even

when other factors affect the final product.

"Systems have many objectives and measures of effectiveness; outcomes of designs depend on outside events and may not be known with certainty"[52]. The statement is correct because the architectural work is only partly carried out by architects, the rest going to management which is supposed to provide satisfactory conditions for implementing the design; the conditions are in terms of providing materials, labour and other requirements, ensuring that the materials comply with the detailed design which then leads to a final outcome.

The external events are not restricted to the management aspect of the production process. The construction phase of the work is affected by events outside the industry. Melvin Lifson (1982) has said in 'Decision and Risk Analysis for Construction Management': that the design and development phase transferred design requirements into drawings specifications and instructions for producing, testing, constructing, installing, using, supporting and maintaining a facility. It is therefore possible that the input of the architect is not implemented fully in any phase of the product. While he has accomplished his role as a designer, other responsible participants may not be able to support the architect's work in full. The chances of this happening depend on events outside the construction environment.

Observing the complete situation, the role of the architect in the total process is severely limited. Erskine (1983) has said that with some justification, it could be said that it was not architectural philosophies which were today the instruments of change which might affect architecture by the insights of scientists, economists, philosophers, authors and many other opinion-formers interacting with national and international institutions of political and economic power. The special dynamic for architectural change had come when such insights had been formalised in building and other laws. This is qualified by a statement from the book: 'New Directions in British Architecture' (1986), that "the great majority of architectural work is carried out, as it has been for the past fifty years or more, by large architectural organisations, now mostly private rather than public, which have next to no interest in the practice of architecture as an art".

Considering this pronouncement, one realises that if the architect is attempting to satisfy the emotional needs of human beings, while the implementation of his product - the design - is carried out by organisations which have no interest in architecture as an art, then it is not surprising that the final outcome loses its desirability - a loss which is due to the negligence of the organisations. It would thus be unfair to criticise the architect for those aspects which he had been unable to address in full even though he wished to consider them as within the range

of his responsibilities in terms of practising architecture as an art in order to satisfy the emotional parts of the work.

The architect maintains a responsible attitude, but the production of his work is carried out by people who do not see architecture as the combination of art, technique and science, and who ignore the artistic part while devoting their efforts to aspects which interest them. Their interest, arises from the external forces exerted upon them which emanate from politicians, economists, and other opinion-formers who lead the rest of society in effecting a change to its needs and requirements. If such forces create an atmosphere which goes counter to the architect's role, the organisations responsible for the production ignore the artistic aspects, as though they are not needed by the users.

The interpretation of 'needs' becomes 'physically functional items' in the final product, disregarding the emotional part completely as 'an obscure decision process' in the minds of the responsible creative persons. The latter is emphasised to insist on cases other than 'drawing-board stylists'. In summary, when selecting architects for a job, a way must be found of discovering whether or not they are responsible, creative persons. Having established such a framework for assessment, a reliable way of implementing their ability to produce the

end result must be arranged. Only then can the work be viewed in an honest, critical light.

3.2. Who takes the blame?

If for external economic reasons an organisation changes e.g. one material for another in the production of, for example, a facade, then there is no doubt that the architect who specified the initial material, for specific emotional effects, is not responsible. When such changes are made, then it is not fair to criticise the architect, as always happens in society. At the end of an architectural production its merits or faults are always associated with the architect. This represents a poor understanding of the architectural process and the bodies responsible for the production. Such ignorance has to be remedied, and the public needs to be made aware of who has what role in the building process, and how many key roles exist within it.

One way of accomplishing this is to give the architect the right to explain his decision processes, and to explain the method by which he has arrived at the final design ideas for various parts of the building. He will nevertheless be unable to explain the creative processes which took place in his mind (even if the left hemisphere of his brain is well trained. Recent understanding is that many things occur in the 'dark' side of the brain which the 'light' side cannot arrange such that they can be taught to non-creative people).

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On the question of whether or not the architect will be taking on more and more of other people's responsibilities, the architect's goal cannot be certainly to take over all decision processes. What should be attempted is to properly define those parts of the decision which he alone must take and present to others. Understanding this, his role within the industry, as defined in the book 'Managing Systems Creation', is thus: "Nobody questions the role of the architect in civil engineering, although his individual engineering skills are no different from, and may be no better developed than, those of the civil engineering contractors. His major contributions are creativity, structure and balance within constraints imposed by a particular situation"[38]. The architect is seen, therefore, as a creative person. Going back to what Le Corbusier says about his being an organiser, like a system designer, then the last part of the remainder of the quotation becomes interesting.

It says that so it should be for the system designer; he too covers a broad span of disciplies, and seeks to bring creativity, structure and balance to design; and he too deserves separate recognition. So if a systems designer is doing the things that an architect is already doing, then considering Le Corbusier's idea of architect as 'organiser', and in view of what the previous reported quotation asserts, the architect is obviously a system

designer. This is a key point in the definition of the role of an architect. It is in that area of responsibility in which the architect considers that any system that does not serve the public is an immoral system.

Not all architects realise this point. The aim here is to base a theory for design framework that even when an ignorant but creative architect is commissioned to do a job, that enables his decision processes to be registered as faithfully as possible. The designers' board or coalition team is responsible for examining whether he is fulfilling his role with respect to the needs and necessities of the final users. While defining his role, and while making the public aware of them, he is given the right to exercise his creativity while the framework allows him and his assessors to assess the fulfillment of his role in relation to the codes and regulations set by society.

CHAPTER 4

PROBLEM SOLVING AND THE ARCHITECT AS PROBLEM SOLVER

CHAPTER 4

PROBLEM SOLVING AND THE ARCHITECT AS PROBLEM SOLVER

4.1. What is Problem Solving?

Thinking, decision-making, designing, choosing, making, building, producing, investing, as well as waiting, eating, drinking, moving and re-doing can all be considered as problem-solving.

When we are considering these activities as problem-solving, we may actually be creating problems for others. The action of problem-solving itself may create problems for others. Problem-solving aims to bring benefits and the problem-solver therefore may be human, animal, machine, man-made or natural materials, or nature itself, and time. All can be categorised as problem-solvers.

There are problem-solving phenomena such as revolution, modernisation, perestroika, democratisation, participation and refurbishment, all of which are different types and which can also create problems. When the appropriate kind of action is not known, the nature of the problem is being experienced. The chosen solution to the problem may have side-effects which can become the roots of future problems.

The problem-solving process should be considered as an open-ended action in which the whole aim is progress. From this viewpoint immediate problems can be dealt with, and future problems anticipated. Of course, the efficiency of the solutions brings a decision-making stage in which the

success or otherwise of the problem-solving process can be assessed.

To reduce the chances of failure more problem-solving activities should be involved. Instead of one person thinking of a problem, more viewpoints should be considered, bringing in more solutions or at least ideas for them. The ability to work out the interaction between the solutions, will produce a more reliable outcome.

4.2. Aims and Ideas of Using Methodology:

The idea of having methodologies is to facilitate as much as possible different individual solutions. If the kind of solution which answers the needs of all (or at least the majorities) is aimed for, then methodologies should be available to create a systems solution to the parts received from the contributors. Each part may in itself be a complete sub-systemic solution. Since the goal is to create the type of solution which brings minimum dissatisfaction in others or does not create any problems for them, the task of amalgamating the parts and creating a total system is fundamental.

In a democratic decision-making situation, the requirement is not to add up the decisions of all participants in order to arrive at an outcome. Instead the arrangement or natural outcome of the decisions is sought, even though an individual decision may not be accepted or appear as offered during group sessions. The democratic approach can

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in fact show the reasons for a decision not being considered in the conclusion.

An individual may rely on his intuition for solving his own problems. When it comes to offering a solution covering the masses, the architect should be able to use his planning abilities and intuition to ensure the creative element of the solution and implementation by a planned approach in which the sequence of required actions clearly reflects the views and decisions of the contributors.

Therefore it has been said that when the action one should have taken was not immediately clear, then a problem was said to have existed; it might have been concerned with identifying as closely as was possible what improvements were required, identifying the means of achieving those improvements, or identifying both the necessary improvements and the means of achieving them. The problem itself barred one's achievement of the goal; its presence was undesirable and action had to be taken to remove it. Problem-solving, therefore became a goal-directed activity.

When faced with a problem, the idea is to get to its root. The feeling that the problem may be ill-structured requires that it be broken down into its component parts, which enables the establishing of a sequence of actions to improve the situation. Dealing with problem-solving does not mean implementing the solution. The exercise is theoretical until the actions are taken and placed in the

required <u>sequence</u> <u>to</u> <u>reach</u> <u>the</u> <u>solution</u> - identified by
Archer as the aim of problem-solving objectives, and the
aim of condition-correcting goals. Of course this is not
always the case. The problems need not always be broken
down before the actions needed to correct the condition are
considered, but as Broadbent has said, in most cases one
needed to resolve the problem before one could correct the
undesirable condition.

4.3. Finding the Architect's role with respect to the team:

The role of an architect, is analagous to that of a single
number in the code of a combination lock which can be
opened only when the correct numbers in the correct order
are used. The architect is like one number in the total
combination. In itself, that one number cannot open any
lock, and without it the lock cannot be opened. After
finding his position in the combination, then certain
activities occur in that position to bring up the correct
number.

The design team is like the total combination required to
open the lock. The conclusion is:
1)   To make proper interpretations of needs and
necessities which are the key points in making a better
environment. Proper interpretation results in a logical
interpretation, and that leads towards creation of
functions, which is the creation of a system. When
referring to the term 'function', everything is considered

to be functional in terms of cost, arrangement, appearance, space and everything to the 'nth' consideration, that is to say, the functional whole.

With respect to needs and necessities therefore, the intent is to determine priorities. This leads into defining priorities of the masses and assembling a responsible coalition design team consisting of users, clients, architects, and other concerned people, who produce a brief. The brief goes to the original design architect, who makes his first interpretation, which appears in black and white. With the help of the team, it goes through a modification stage, and the process continues until the structure of the final design emerges, and which results in the board of the design team meeting to make its decision. The process continues until the final outcome is acceptable, and the design is ready for implementation.

Such evaluation is not a mathematical problem for the architect. The word evaluation, whatever it may suggest, comes in the form of recommendations to the architect. He then uses the recommendations to challenge the logic as a design work rather than as a mathematician. By deduction or other means, he brings himself to the stage of answering certain requirements, using answers that are reducible to 'yes', 'no', or 'none for the time being'. The importance of his work therefore relates to the way he analyses the total work and makes pairs of questions, inter-relates aspects in reaching decisions made by himself, and finally

to the way the answers synthesise the whole.

This is what was meant by 'gaining from systems thinking, and problem-solving methodologies for improving architects' communication in the group by man-machine ways of communication', considering the computer as a member of the team, and an interpretive structural modelling, for instance, as the chosen methodology.

4.4. Application of CMOAS and Problems of Communication:

When considering Complex Multiple Objective Architectural Systems (CMOAS), anything among building elements which has a function, such as a window, related to the whole of the building can be considered as a CMOAS. A window must be considered in relation to noise, light, heat, glare, comfort criteria from various viewpoints, cost, quality and other aspects. Although it is a sub-sub-system, optimisation of the interaction between objectives will occur if there is no particular preference or order of priority in its design. In this situation the mathematically based choice gives a doubtful trade-off to the designer whose instrument for making decisions is the drawing rather than the graph of the trade-offs.

Communication then, when dealing with CMOAS, is not defined mathematically. Anything beyond the individual's ability to sort out interactions can be considered as CMOAS. Communication is viewed in terms of language, interpretation and implementation. The language used is

crucial in reaching a proper interpretation. The resulting brief is the first established communication between the original architect and the client, in which the relationship is based on an understanding of the language used, the interpretation involved, and the steps to its implementation. Therefore, when considering a model of work with, e.g. the Interpretive Structural Modelling (ISM), the brief is taken as a problem presented by the client. Using ISM, interpretations are structured individually, or by a chosen design team. The structured model is then the first interpretation taken to the client, from whom more information is gained, in order to improve upon the brief. Of course, it has been stated that "no one could have ever expected Misvandrho and Edwin Lutins to have designed even remotely similar houses for the same client on the same site; as architects their own personal interests were too different" [21]. So in learning how to answer the requirements of the brief, interpretation is important.

Despite the perceived nature of communication, as in quoted remarks that what was important here was not the product but the process, for architecture, the product is important.

Everything we do to improve the process is towards getting a better quality result, so by improving communication, the aim is to improve the product.

4.5. Architect and Artist Compared:

This may be because the architect's responsibility is different from that of the artist. It has been said "the artist deals with issues and solves problems which seem important to him"[21]. However, he is also required to understand and think of the problems which seem important to the users in general. In any event, artists can avoid such considerations whereas architects must take into account the user's requirements.

Moreover, an architect can be definitely regarded as a problem-solver, unlike an artist who is not necessarily so. If it is felt that artists solve problems that they see, then it might even be considered that they create the problems to be solved in the first place. In the architect's situation, he is concerned with a structure which is not normally concealed, unlike the artist's painting, which can be stored anywhere. A building must be in harmony with the environment, to function properly, or have the capacity to fulfil its intended function as a 'closed' system.

As Broadbent (1973) says, "designers unlike artists cannot devote themselves exclusively to problems which are of interest to themselves personally" [12] and the continuation of this though can be applied to students of architecture. Broadbent has also stated that design students should not expect to approach real-world design problems posed by clients in the more introspective and

personally expressive mode of the artist.

The relationships between the architect and the non-
architect form part of the design problems, for which the
theoretical ICU-UCI design framework will be introduced in
greater depth in later chapters to bring badly-structured
problems to a well-structured state, and then to achieve an
interpretation of the problems to reach an understanding
about the proposed outcome.

4.6. The Architect/Client Relationship:

When designing for oneself by establishing one's own brief,
and then putting that brief together while also thinking of
the solution, any type of artistic gesture can of course be
brought into the presentation and considered to be an
appropriate solution. In that case, one is one's own
client, perfectly placed to understand the requirements,
and free from problems or criticisms.

The reality is quite different. In practice, the client,
who is paying for the production of the design, has to be
considered. he has his own ideological base, aims and
objectives, and he requires to establish as closely as
possible, an understanding with his designer. So initially
he may not be in harmony with the architect's ideas, in
spite of being attracted by the architect's high reputation
or reasonable fees.

It has been quoted that it was one thing to design for

yourself, but quite another to design for a real client with real prejudices and biases. The intention therefore was to help to reduce the remoteness of designers from the people they were supposed to serve. "Social science remains largely descriptive while design is necessarily prescriptive, so the psychologists and sociologists have gone on researching, and the designers, designing. And they are yet to re-educate each other into more genuinely collaborative roles. Meanwhile the communication between the creators and users of the environment often remains uncomfortably remote." [21].

Social science, humanities, economics, architectural psychology and urban psychology all want to create as far as possible, a means of improving communications so that the designer is better-informed about what the users want, and the relationship between designer and user becomes closer. In this respect it is strongly believed that, on the basis of interpretation of the brief and through proper channels of communication, an architect can bring himself to a 'complete' understanding with the user.

There still remains a translation of this understanding to a proper three-dimensional system. This is an equally important stage in which the same channel of communication can be used to identify the difficulties involved with the total system. Facts to be considered seriously are that architectural systems always have problems, and complexities will surface at some future date, because the

outcome of the design process is not an optimum solution. The architect never searches for an optimum solution because design is not a purely mathematical matter.

Design decisions are influenced by the architect's preferences, and based on his interpretations, as well as, at best, on understandings arising from the likes, dislikes, necessities, etc. of the users.

What is lacking in architecture and its place in society is trust. Architects may be brought to a standstill as a consequence of being made to take blame which rightly lies with bad policy-making in the first place.

In a totally just and fair world, it may be concluded that no blame should attach to the architects at all, who have demonstrated that cities are built as a result of good team-work.

4.7. The Architect's Usefulness to the Client:

The questions of "How can we find a way of making the architect useful to the client?" [29], and "does the power of choice rightfully belong to the future user?" [29], need also to be addressed. The aim of this research project is to provide theoretical answers to such questions. The point is not necessarily to consider the user's needs in the distant future. When looking at the problem-solving process progressively, every requirement of the future user cannot possibly be covered for the long-

term since the future tends to bring its own changes, and the behaviour of the user can only be a matter of guesswork. The only future to be considered is that in the near-term. Complexities remaining beyond that can be left to the progressive nature of the problem-solving process.

4.8. Consideration of a Framework and Methodology:

In relation to making the architect useful to the client, a framework should be introduced, in which simple but essential predictions like 'this space must be small', 'this space will have more light', could be made without any commitments to the physical form. Therefore the architect benefits from the framework by being placed in a decision-making situation in which he is not forced into making decisions involving the consideration of priorities. After a first run of the framework, a map is established which allows a first look at the order of priorities.

This may be achieved by giving a genuine view of our individualisation and community development in architecture. The framework should give enough possibilities to participants in the design process to make decisions and to present individualistic inputs, and to bring them to the team as producer for the community.

What is important is to understand where and when participatory design can be used, and what kinds of scientific methods should be implemented. We already know that in architecture there have always been attempts at

scientific inquiry into design, and it is evident that such inquiry is lacking in the profession. The problem has been that those attempting to analyse the design activity have functioned as scientists, although design has not followed a purely scientific path. Design is a decision process in which some aspects at least are not obviously relevant to others. It is expected when using ICU-UCI, the relative nature becomes clear and the designer is able to show this to others.

It may not be that the best way of using methodologies is to begin by supposing a complex project and seeing how from beginning to end certain types of problem-solving methods can be applied. In the end it should be possible to apply these methodologies in general to different stages of design. But the project should not be imaginary, the examples used must be real world problems to highlight the basic solutions, which are considered as the interpretation of the brief, communication between architect and non-architect, and the establishment of the architect's requirements.

Considering methodologies of architectural design and engineering as A1, A2, An, and methodologies in systems design and engineering as S1, S2, Sn, a matrix of the two can be envisaged. By looking at stages of the work, a chart can be used to decide whether to design in the traditional architectural way or find a new way, and why a system method should be adopted in architecture. In

traditional architecture, there is not much in the way of design method. The same process is used by all, i.e. learning about the problem, then thinking - which is the key to design, and using the architect's ideas of design, which is itself a process for obtaining the final outcome. The solution - the final design - is unique to his methodology, but the same procedure, more or less, is followed by all practitioners.

Nevertheless it is still possible to see different methods of working. (Fig.11) [49]. Systems methodologies are introduced for areas of complex systems such as military - logistical requirements, and other large-scale production processes, and it is thus possible to learn from them. In construction process, for instance one can benefit from a 'Critical Path' method.

Such comparisons can lead to the root of the problem and to the most appropriate design framework. This is why ICU-UCI is introduced, in which awareness is always maintained of projects in which the role of the architect is less than one hundred percent. Proper attention is also paid to the role of the individual, especially the architect, in making decision.

As far as the implementation of preferences is concerned, while giving individuals the opportunity to express their likes and dislikes, a stance against the preferences of 'the masses' is avoided. After the individual makes his

THE MARKUS/MAVER MAP OF THE DESIGN PROCESS
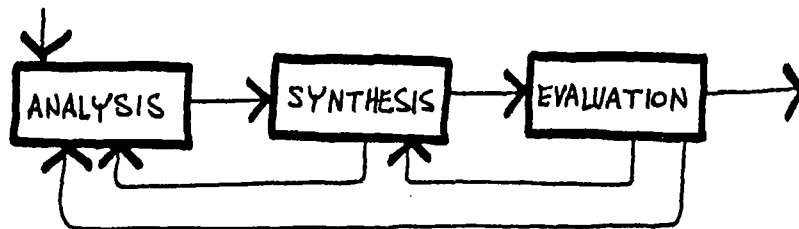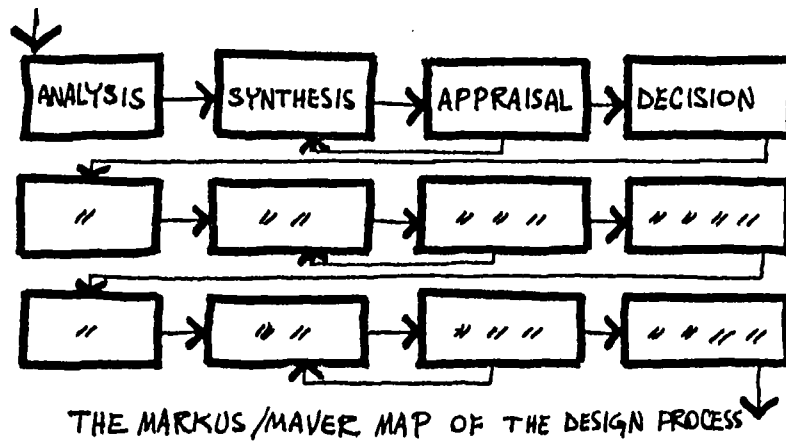
EVEN THE SIMPLEST MAP OF THE DESIGN PROCESS MUST
ALLOW FOR A RETURN LOOP TO ALL PRECEDING FUNCTIONS

Darke's PARTIAL MAP OF THE DESIGN PROCESS,
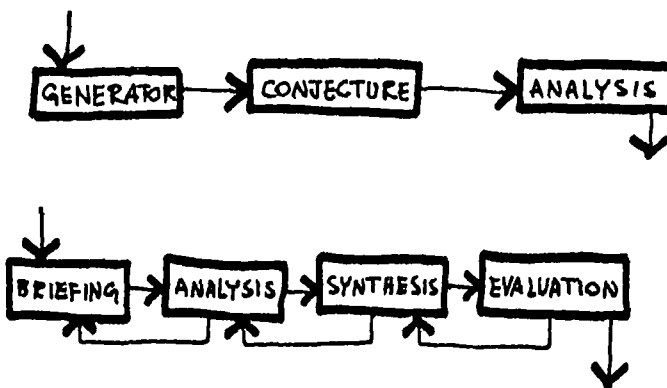
EVEN THE BRIEFING STAGE NEEDS TO BE ACCESSIBLE BY RETURN LOOPS.

Fig.11 DIAGRAMMATIC PRESENTATION OF DESIGN METHODS [40]

map of preferences, he can present them to others, his standpoint will not be hidden from public view, and thereafter corrections can be made. This is all at the stage of evaluation, and it results in an order of priorities, in which 'needs' come first.

In the implementation of design decisions, there must be a clear concept of the end product, forming one of the criteria in the decision-making process.

CHAPTER 5

DESIGN ACTIVITY IN RELATION TO HEMISPHERIC CHARACTERISTICS
OF THE BRAIN

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DESIGN ACTIVITY IN RELATION TO HEMISPHERIC

CHARACTERISTICS OF THE BRAIN

In relation to types of problems and the difficulties one can face in tackling and offering solutions to them, and in which we find some problems difficult and some easy, some impossible to solve, and some straightforward and manageable, Mintzberg (1976) says "Maybe the problem is not that you are stupid or tired, but that you are tackling a problem that taxes the least developed hemisphere of your brain. Recent scientific research shows that the human brain is specialised, the logical, linear functions occurring in the left hemisphere, and the holistic, relational ones occurring in the right."[58]

Throughout the whole process of architecture, two types of work are involved. One refers to planning, and the other to managing. What is managed by the brain is sequential planning to achieve a solution that can be demonstrated. In other words, a solution is managed in the brain. The word manage here can be changed by design or solution; to implement a design we must have the ability to plan stages for fulfilling that design.

The architect's job, then, falls into two categories 'managing' the solution in the brain, and 'planning' the implementation of the solution in the brain. The brain sees this as two seperate types of work, appropriate to the two

seperate hemispheres of the brain. "The functions and capacities of the two hemispheres should both be respected, but that one should not be confused or applied where the other is better suited"[58]. In other words, if the brain becomes more trained in skillful planning, then we cannot expect a creative, intuitive function. Similarly if a person becomes more creative such that he involves himself with much intuitive thinking then his sequential thinking is less developed, unless he becomes trained in the use of the left side of his brain.

In some countries such as England an architect is expected to use both hemispheres of the brain simultaneously. In other words the design architect and executing architect are expected to be one and the same person. This is the criterion by which a person is acknowledged to be an architect. What is missing here is that anybody with planning ability can of course be instructed to produce a solution, and there is no clear method of determining if his solution is a pure outcome of the use of the right hemisphere of his brain. He may have used his experience regarding the sequential approach to a solution, which one achieved by others, using the right hemispheres of their brains.

That is to say that the rules and regulations might force an architect to come up with a design solution that is different from any other, and by virtue of being able to sell it to the public, registering it as a creative

solution. In fact, the nature of the solution is not processed in the right hand, unskilled, 'dark' side of the brain, which the left side should be able to consult, to find out the process involved in creating the solution.

The situation for architects in France and the United States of America is different, in that, as in many other countries, creativity and planning are recognised as separate activities. A design architect differs from an executing architect who may be fond of sequential approaches that are clear to others involved in the implementation of the suggested design solution.

"It seems that the mode of operation of the brain's left hemisphere is linear; it processes information sequentially, one bit after another, in an ordered way. Perhaps the most obvious linear faculty is language. In sharp contrast, the right hemisphere is specialised for simultaneous processing; that is, it operates in a more holistic, relational way. Perhaps its most obvious faculty is comprehension of visual images."[58]

The design architect thus requires to achieve simultaneous processing in decision-making. Many 'self-interactions' need to be sorted out, while 'wholeness' is the objective and the relationships between parts are assessed by the brain of the designer, putting them in a hierarchy and noticing their functional communication through the relations he introduces to them.

The job of the executing architect, whether the same person or not, requires linear thinking whereby the architect is the reductionist, conceiving the whole system in stages, each of which is responsible for specific information for specific parts of the project.

If the findings of neurologists and psychologists are correct, in that the brain has two hemispheres in which "the left hemisphere controls movements on the body's right side and that the right hemisphere controls movements on the left"[58], then each side must be specialised in a fundamental way. This is important information in determining who will make a good design architect as oposed to a good executing architect. This being so, the true nature of architectural education and its practice is evidently at variance with that operating at the present time.

There are some schools that consider that the design architect and executing architect should be two different people. The problem ignored in architecture today is that often a person is capable of training both sides of his brain, thus enabling himself to develop skills in thinking, rather than considering them as a gift he had from birth.

This effect is seen in some common human tasks, which activate one side of the brain while leaving the other largely at rest. For example, learning a mathematical proof

might evoke activity in the left hemisphere of the brain, while a piece of sculpture or the assessment of a political opponent might evoke activity in the right.

The point being made is that it is possible to train a brain to be active in both hemispheres. If this is the philosophy of those architectural schools where the meaning of 'architect' is perceived as 'a person who is capable of designing and executing', then the educational content must enable anyone to be an architect. However, this is not the case.

Of the many students who join architectural schools each year, a small number of them show particular abilities in design. This does mean that the rest do not have design ability. But what they do is obtain solutions out of deriving answers from a 'planning' approach, reproducing something that had been produced before in other circumstances. Owing to the similarity of the problem, they are able to compose an answer by selective use of parts of answers related to each part of the problem. Using the right hemisphere of the brain to organise these partial solutions in a relational way to arrive at an answer to the problem is not the same as approaching the problem in a creative way.

Creativity lies in the way a problem is approached, which entails considering the solution as unique and not yet created. The creative designer will not tolerate a solution

similar to previous solutions - His solution must be unique. The problem then encountered is that few architects have the opportunity or the capacity to go through all the complexities in their minds, in reaching the kind of unexpected and unpredictable solution that has no conscious relationship to any previous one.

In other words, if you are thinking of relating two floors, the physical ways available are a staircase, a lift, or an intermediate device such as a ramp. These elements are known to you by known words. Just as with speech, to create a sentence, you may know how to speak without consciously knowing the grammar of the language, <u>but</u> <u>what</u> <u>you</u> <u>say</u> <u>may</u> <u>not</u> <u>be</u> <u>grammatical.</u>

For a minority of school entrants who approach solutions creatively, the solutions arrived at are like the sentence whose content is not yet known, and needs to be processed until all the interactions, and alternatives regarding all the relations between the elements for the creation of the whole.

The final outcome for that type of designer is visualised when he first contemplates the design. In an architectural institution, however, new students necessarily come under the influence of the institution's philosophy regarding their education.

If a school's educational approach assumes that the design and executing architect are one and the same person, then

the whole educational process can be expected to show distinct support for making both hemispheres of the brain skillful. Unfortunately, the creative side in the architectural school is presumed present in the students by virtue of their entering the school on passing some entrance examination. Their presence in the school thus qualifies them as creative, taking for granted therefore that each student's right hemisphere is trained and skillful, so that all that he then needs to know is the methodological and sequencial approaches to the process of design. Therefore by not gaining practice in becoming skillful in a creative way (since he believes he is already creative) he emphasises the left hemisphere of the brain, benefitting his literary skills and his abilities in linear thinking.

Naturally, when any practitioner receives a brief, he wonders for some time how to begin the work. Some, of course, take this as an embryo thought in the right hemisphere of the brain (if this distinction is correct), and then create an environment for feeding that embryo until they conceive (even if incorrectly) a solution. That moves them from the doodling stage to the point of having a well-drawn design solution.

For others, the initial wondering may be how to actually begin work. They start by choosing the reductionist approach, or by a way which is analagous to knitting. The

first knot is followed by the second, and so on until the product is seen, but they do not have a creative pattern for such knitting. Either they are following established solutions, acquired from literature and recombined to give a total solution, or by beginning analytically and then making the whole.

This frequently happens in an architectural office. The management are mainly those taking care of the linear functions of the office. They cannot comprehend the idea of someone sitting at his back-of-the-office drawing board, thinking. Such thinking cannot be appreciated by them so the designer must translate it through his hands, and onto paper, purporting to show the interaction between the elements in his decision process by appearing to be designing, when in reality he is doodling.

The manager of the office, who may be the senior architect, may then content himself with the notion that the designer is in fact designing, and not wasting office time. The office environment therefore compels you, if you are not trained at school in the right hemispheric approach, (that is being able to think of the whole), to put to paper an element of the design requirement, say a room, and then gather other parts around it, and complete their relationships. So if you are trained correctly at school, your approach to the problem is from the whole to the parts and to the elements. Going from the elements to the whole can be seen in some stages as though you were knitting,

but as mentioned before, the created pattern is in your mind, and you are capable of presenting the whole at first in a fuzzy way, with the constituent parts, and then working from the parts relationships, towards the whole.

The school must be able, therefore, if it considers design and planning as two necessary parts of one profession, to train both hemispheres of the student's brain. Otherwise, as already mentioned, there is a risk that the architectural students are presumed to be creative. They may then reinforce that notion by imitating 'leading architects', and using a lexicon unknown to the public but welcomed by the elite of the profession. They may also get further credit if they are capable of learning the sequential aspects and becoming executing architects.

Sadly, in most of the architectural offices, there is great emphasis on the latter, that is, being good at detailing, producing working drawings, presentation, specification writing and all the executing aspects of the process, while the real problem is embedded in the area of design, where the needs and requirements have been misinterpreted, and there is no way to achieve better communication and thereby reach an understanding.

It boils down to the practitioner having to convince others that he is a creative person. But the ability to impress others should not be based only on verbal ability or on assuming a different appearance.

A profession such as architecture, must therefore have an educational curriculum compiled and tested, not only by architects, but by psychologists, neurologists, planners and managers, to ensure that students receive the appropriate training to achieve two skilled hemispheres of the brain.

It may happen either through ability or choice, that the student rejects training in one hemisphere to the detriment of the other. One must then recognise that such a person will become qualified in either of two ways. This is an invitation to reconsider whether it is actually possible to train both sides of the brain.

"Some people - probably most lawyers, accountants, and planners - have better-developed left-hemispheric thinking processes, while others - artists, sculptors, and perhaps politicians - have better developed right-hemispheric processes."[58]

The keyword is 'developed'. If it is a matter of development, then that suggests that either hemisphere can be developed, and that with training, better development of both sides can be achieved.

Mintzberg (1976) uses a folklore from the middle-east, in fact from Iran. "The story is told about a man named Nasrudin (actually known as Mullah Nasrudin), who was searching for something on the ground. A friend came by and

asked: "What have you lost, Nasrudin?". "My key," said Nasrudin. So, the friend went down on his knees, too, and they both looked for it. After a time the friend asked: "Where exactly did you drop it?" "In my house," answered Nasrudin. "Then why are you looking here, Nasrudin?" "There is more light here than inside my own house,"".[58] Mintzberg adds that this "light" little story is old and worn, yet it has some timeless, mysterious appeal"[58]. Robert Ornstein uses the Nasrudin story to expand on the point he is making, "Specifically he refers to the linear left hemisphere as synonymous with lightness, with thought processes that we know in an explicit sense. We can articulate them. He associates the right hemisphere with darkness, with thought processes that are mysterious to us, at least 'us' in the Western world"[58]. He goes on to emphasise the nature of 'esoteric psycologies' of the East. Mintzberg adds: "In sharp contrast, Western psychology has been concerned almost exclusively with left-hemispheric consciousness, with logical thought."[58] He then continues that Ornstein suggests that: "we might find an important key to human consciousness in the right hemisphere, in what to us in the West is the darkness."[58]

We must learn that "there is a set of thought processes - linear, sequential, analytical - that scientists as well as the rest of us know a lot about. And there is another set - simultaneous, relational, holistic - that we know

little about. More importantly, here we do not "know" what we "know" or, more exactly, our left hemispheres cannot articulate explicitly what our right hemispheres know implicitly"[58]. May be that is the main reason why so many creative architects have gone ignored.

CHAPTER 6

IMPORTANCE OF IMAGINATION: A BEE OR AN ARCHITECT

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Imagination is an essential quality for an architect and is part of his creative role, even when he is involved in group work and making his final product from a collective input. Regarding the fundamentals of the role of an architect, the following quotation shows the importance of how designers should think. "A bee puts to shame many an architect in the construction of her cells but what distinguishes an architect from the best of bees is this, that the architect raises his structure in imagination before he erects it in reality. At the end of every labour process we get a result which already existed in the imagination of the labourer at its beginning".[49]

In this quotation there are a number of points that need explanation. In comparison with what an architect does, a bee is seen as doing sequential and repetitive work, well-planned and well-understood by the bee. But however, precisely this work is done, there is no element of imagination. With the division of labour within the community of bees, those functioning as labourers function always as such and do not imagine themselves becoming for instance, queen bees. The division amongst them enables them to process the kind of work in which they function like a pre-planned (programmed) machine. This is in the sense that they do not have to think of or be able to function in a different position. Nor do they see the

whole product, so each carries on with the task which is
allocated to it, e.g. labourer or queen bee.

Many individual architects who are actual representatives
of the profession (as opposed to 'leading architects') have
to have a developed sense of imagination if they are to
stand their ground. No matter whether the final product is
outstanding or bad, there is a need for imagination
regarding the process of work before the actual project
commences. For any architect, not being seen as a 'bee' is
in effect acknowledging him as an individual, capable of
imagination. He brings a process of work from the creative
faculty of his mind and therefore, the outcome is of more
value than work in which he, despite what his profession
means to him, functions like a bee, using brain without
imagination.

The architect who raises a structure in his imagination is
thinking of the whole product before actually presenting it
to outsiders for their judgement. He is thinking of the
whole and it is therefore <u>in</u> <u>the</u> <u>nature</u> <u>of</u> <u>the</u> <u>profession</u>
<u>to</u> <u>be</u> <u>a</u> <u>systems-thinker</u>. It would be wrong for any
architect to reduce his role from holistic to that of only
reductivist. In other words, when he thinks of the whole
product in a generally vague way, he is in fact imagining
the structure of the whole, which is in fact setting up a
hierarchy between the whole itself and its smallest
possible parts. In such a process, he is also thinking of

aspects of the relationships and communications between parts.

6.1. Imagination before Action:

It is possible that during this process the architect thinks of one part in more detail than others. His imagination then functions in a free-wheeling manner, enabling him to record the outcome in the form of drawings, notes and sketches, and to actually see where the rhythm of thought requries amendment to make the thinking productive. It is regarded as impossible for someone to remain an architect without having the capacity to imagine the final product. Thus, any practitioner is a systems thinker, even minutely, but as a result of his training and external influences he falls into one of three categories, i.e. executing architect, design architect or architect who does both.

In the case of an executing architect, although the result of another thinking (design) architect's product is not his responsibility, he has to be able to imagine from the drawings what he will produce as an executing architect. In his case as well, imagination is an essential ingredient (arising from the activities of the right hemisphere of his brain). As a result of training, he is more skilled in the use of his left hemisphere. For the design architect, the outcome arises from activity in the right side of the brain. He relies more on imagination. The architect who can function in both ways has both sides trained, so

imagination is an unavoidable part of his work.

From the quotation distinguishing an architect from a bee, what is also important is the realisation that before any labour process begins imaginative work takes place in the mind of the labourer. Understanding that this is where the work begins will help in group work of the second generation design method. In this method, suggestions enable the architect to function as a person with the responsibility of designing a product. Ideas exist in his imagination before any labour process. But in that design method, they are not enabling the architect to contribute any more effectively than a bee.

He is expected to ignore his ability and responsibility, and to ignore the fact that he is already formulating the final product in his mind. They want him to pretend that there is no product in his imagination. He is required to listen to others who are functioning like the bee, or contributing by explaining their own requirements. However, this method does not allow the architect to benefit from thier contribution by fulfilling the unchallenged parts of his imagination. Rittal said that they persisted in forcing their demands on the architect, so that he became immobilised by self-criticism. He ended up asking himself who was he to make decisions about other peoples' lives. His professional value is destroyed as a result of a wrong understanding of the role of group work

in the profession, such work appearing as forceful and antagonistic in second-generation design methods.

J.L. Costy (1979), in 'Connectivity, complexity and Catastrophe in Large-Scale Systems' has a quotation from R.P. Feynman who says "what we need is imagination. We have to find a new view of the world". Therefore the solution to architectural problems and public dissatisfaction is not in forcing the architect into becoming a 'bee'. If there is just criticism about the method of production, and if the influences of other sectors are clearly spelt out to the public, then the most valid criticism devolves on policy-makers, economists, and politicians.

Architecture has been one of the most important professions acting in the service of mankind throughout history. Those architects who were capable of great imagination were unfortunately slaves in the hands of kings and cardinals in the past, and are slaves of developers today. Any architectural shortcomings were the result of forces exerted by people who placed their own vested interests above those of the public. They required the architect to build them castle, palaces, and headquarters, and to ignore the need for decent houses and places to live for the rest, who had no power to choose. The architects, for their part, should have given some thought to how the outcome of their work might adversely affect the lives of the masses.

An architect has a responsibility to imagine the outcome of his work. If the outcome makes a society more divided, and if the architect shows particular reference for one part while ignoring the rest, he is not applying his imagination properly with respect to his final product. That is why it has been said that we had to find a new view of the world, seeing the responsibilities of the imagination on a world scale.

The extent of the required imagination is not just in terms of single units or single large-scale buildings in isolation, with no reference to the surrounding environment and its relationship to the whole world. The city of New York provides an example of large-scale buildings. Although in terms of the space it occupies, the skyscraper is small compared to the world, the scope given to this part of the work by architects, political leaders and developers was so important as to lead (or mis-lead) people in contact with this part of the world into believing that what was being done in New York was to be taken as the proper and standard criterion for other cultures. Its dominating characteristics, in some societies, are outcomes of the imaginations of many an architect who created them as dominant examples for other societies, for which those architects were expected to be aware of the consequences from the beginning. If such an outcome expands the gap between privileged and unprivileged sections of a society, then it is part of, and to some extent a full

responsibility of, the architects. In that sense, although the work may have been forced upon enslaved architects by politicians, kings and developers, it was happily accepted by many an architect who enjoyed having their patrons' left-overs while not letting their own minds travel far enough to see the outcome of their work in the contect of the world.

Old architecture raised large buildings such as mosques and churches in the hope of bringing people closer together, but ignored their real needs. By some imaginative process which was perhaps sincere enough it had been thought that in this manner, people might feel that their improvished lives were somehow improved. They might have thought that eventually they would have beautiful, well-built and decorated homes - by the standards of the time - beyond their normal experience. The church and the mosque were expected to be shared by all on equal terms.

In new architecture practitioners are capable of imagining a world in which it is possible to solve the problems resulting from the self-interest of politicians, economists and other 'slaves' to kings and developers. The architects' imagination must enable the public to have a viewpoint in the gap which has been created by the activities of their governors in society. The role of architects can, by the use of imagination and systems thinking, consider matters on a world scale. Their attitude in the first place must be analogous to a person

who sides with the public, while the masses also are directed correctly and sincerely to address the problem and not be swayed by the individual likes and dislikes of the architects.

Any imagination which creates more divisions among people is unacceptable and unforgivable. As Einstein has said, "Imagination is more important than knowledge". He, as a man of knowledge, was going to cause problems and difficulties to humanity. He doubtless had his likes and dislikes, and before 'the bomb' he was an unknown scientist.

There is no need for him to be quoted. It is felt that what he said was a unique and extremely important example of a man with vast understanding who suffered from a lack of proper functioning of the creative faculty of the mind.

6.2. Genius without Imagination:

Before 'the bomb', Einstein achieved a capability like that of a bee, with a left-hemispheric function so developed as to be compared with the bee that puts to shame many an architect. He was a person who excelled in extremely well worked-out sequences of mathematical processes with regard to physics, but who did not have enough imagination to see how his work would affect the whole world. This is not to say that he did not have imagination, but he himself said that he did not realise at the time that his imagination was more important than his knowledge. He allowed his

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knowledge to overshadow and limit his imagination.

It would take a very big stretch of the imagination to conclude that Einstein was a world peace-maker. One could begin, perhaps, by saying his bomb was going to destroy the two cities of Hiroshima and Nagasaki, and as a result some scientists from the United States would pass the information to other scientists around the world. One would then suppose that scientists such as in the Soviet Union would respond to the American bomb by making one of their own. The arms race could then be referred back to Einstein's imagination in the sense that world peace came out of the 'balance of terror' which grew out of Einstein's bomb.

The world is then united, and systems thinking is seen to be essential to politicians, regardless of their ideological behaviour and understanding.

If the imagination of Einstein were of such an order, it can be assumed that he must have imagined alternative and easier ways of achieving world peace. Einstein is not 'on trial' here but the point worth repeating about his observation is that truly <u>imagination</u> <u>is</u> <u>more</u> <u>important</u> <u>than</u> <u>knowledge</u>. Imagination is the beginning of knowledge, and it is the responsibility of the architect to apply his imagination within the context of the world, with the aim of never increasing the discomfort of those who are unable to enjoy proper architecture.

CHAPTER 7

CAN ARCHITECTURE BE OPTIMISED?

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Alexander Rougvie (1987) in his book 'Project Evaluation and Development' mentions system requirements. He defines the system as "any entity, conceptual or physical, which consists of interdependent parts. Each of a system's elements is connected to every other element, directly or indirectly, and no sub-set of elements is unconnected to any other sub-set".

He indicates as a system requirement, that the optimisation of the whole is the requirement. He describes that although the component parts can be not fully optimised, suboptimisation to some degree may be necessary to achieve success in the project as a whole. The definition of the system is correct, and as far as architecture is concerned, his 'systems requirememt' cannot apply to a building (system) in which the aim cannot be optimised.

The system requirement from his point of view is to optimise the product. This is not considered here to be an aim for architectural production. Optimisation can be achieved in, say, lighting performance, acoustics, air conditioning, services, costs and expenditures (i.e. for the parts), but in systems terms, the summation of these optimisations does not result in an optimised whole. From the systemic view-point, the combination of the optimised parts, even if it produces an optimised whole, does not

necessarily mean that the outcome is satisfactory as an architectural product. The converse, that an optimised whole does not mean optimised parts, i.e. sub-optimisation, is also true.

The architectural product is not based solely on objective matters. It is not merely required to satisfy the measurable and calculable responses of clients, users, architects and all non-architects involved. It is a process which gains an outcome, moving from 'unclear' activities of mind-brain relationships, to a well-established and sequenced planning procedure which actually brings a designer's or group participant's design outcome to a stage of execution then to final product.

It is thus evident that individual intuitive contributions which exist in an architectural product are an aspect which cannot be optimised. Optimisation in relation to perception and sensation is unattainable in the architectural product. Performance of services within an architectural system should be optimised, but not the design process and/or product.

Design is not about optimisation, but it may pass through such a stage to introduce other aspects. That is not, however, the direction in which an architectural production should proceed. If it is fully realised that the type of building concerned cannot be dealt with by traditional methods, the building demands a holistic systems approach.

Even if certain areas are to be approached with the goal of optimisation, the final outcome retains complexities that remain unknown.

Whatever level of optimisation is achieved, whether in the individual elements or in the whole, the societal system and the users can introduce complexities to a completed building or cause a re-evaluation of the function of the architectural system to render optimisation obsolete. For example, a criterion for comfort may be based on the easy availability of energy resources, from which a figure is established for the level of comfort in a building. Subsequently, there is an increase in the price of energy, which necessitates a redefinition of the criterion for comfort, and as a result the originally defined 'optimum solution' has to be changed.

This is not to say that optimisation should not be sought in certain areas, where objective assessment lends itself to an optimum solution. This can be done even in the traditional concept of designing, in which case it is then not a systems requirement, so much as a need. The success of the total project remains unclear because the behaviour of the society is not defined with certainty. Discussion of optimisation of architectural systems is a totally wrong approach, especially in aiming for systems requirements and in optimising the whole.

The converse, from an optimum whole leading to a sub-

optimised part is also an incorrect approach, since right from the beginning it must be understood that an architectural product is not about having an optimal solution. The kind of solution sought is one which, within a certain period of time, can bring satisfaction to users who are concerned with the presence of the product in their environment. The fact that they have a fore-knowledge of future complexities can be accommodated in a Progressive Architectural Processing Method (PAPM), in which the stress is on 'Processing' during the life-time of the building.

On the traditional theme, "the traditional model of the construction process in the U.K. has been built upon a number of simple assumptions about the nature of the client bodies and the way they choose to have their buildings produced."[89] This is to a considerable degree the case in any country. "Even now ('since World War II'), the traditional system cannot be applied in all types of buildings. That is seen due to increased level of inflation and high interests rates, the increased exposure of construction clients to the experience of developing in countries outside the UK, (particularly the USA), and finally the changes in the attitudes of the participants who serve the clients, i.e. the designers and contractors"[89], the traditional method can no longer be used in all types of buildings.

This is not to say that optimisation methods can bring satisfaction to the client. Considering the client as

investor, his idea of an optimum solution is not simply profit from an investment. In many cases he regards the building as a prestige project, so talk of an optimum solution is meaningless unless it is wished to derive other meanings which provide satisfaction for the client, user, or non-architects.

In that case the word optimisation, is not derived mathematically. Rather reliance is being placed more on explanation, and introducing a lexicon different from a mathematical one. Use of the simple meaning of optimisation to achieve some trade-off means that architecture as a whole cannot ever talk of the optimisation of the whole because it is not achievable, and is irrelevant from the point of view of subjective ingredients of either the client or the user or the designer.

The reality is that the complexity of the construction process and present-day circumstances rather than the failure of the traditional method compel the adoption of a systems approach. When the designer comes to the final stage of designing and takes pen to paper, he is more or less within the area of traditional design. He may not follow the traditional way of construction. In the case of the production of the three-dimensional design, all the relevant actions with regard to optimisation are utilised, and traditional ways are disregarded, unless the building is small and simple enough to be manageable by traditional

methods of construction.

This does not mean that the outcome is satisfactory if each stage and part aims for an optimising solution. For construction where planning activity and sequential steps are called for, optimisation will help. The total system in production does not have optimisation as the holistic aim either in the construction process, from its beginning to end, or in the actual system being created.

For a construction process which does not concern pre-construction processes, optimisation can bring about a better outcome. In the pre-construction design stage in which the holistic system about to be created is being defined, the aim should be to have a clear understanding of what is involved, and a clear acceptance of the fact that total satisfaction from a building is never to be expected.

It has to be understood that the relationship between user and building is that of one between two systems, and the result is the interaction between them. At one point they can be considered open, whereas at another they can be considered as closed.

It has been said that "the environment in which the system operates can be considered for our purposes as those elements, not being part of the system itself which can produce an effect on the system."[89]

If an optimum solution is aimed for in either an open or

closed system, where closed systems are "those in which there is no contact or exchange between the system and its environment"[89], and an open system "contrasts with a closed system by its ability to be influenced by changes in the environment"[89], we come to the conclusion that the optimum whole can be and/or in fact is meaningless.

If a building is taken as a closed system, which is in fact impossible since the exterior of the building is in the environment, human beings as judges of the functions of this optimum solution are being excluded, as are their perceptions and sensations as users. Consequently optimisation is not complete.

If we include users as within the closed system and not in contact with the environment, then they themselves become a factor which affects the assumed optimum. The outcome of the two is not optimally satisfactory. Any building which is in itself an environment which has an exchange with people, attempts at optimum solutions are totally inappropriate. But there is no harm in working towards optimisation.

A description of the client's requirements and his questions on the completed scheme have to be closely scrutinised. That means that the brief should be interpreted in a systemic and systematic way to establish an understanding between producer and non-producer. In any circumstances, an architectural production is an open

system, even if a closed system is formed by incarcerating the users in the building and not letting them have an exchange with the external environment. This is because it is the user who looks at the function, and judges whether or not it is susceptible to the other influences. The human as user of any environment has an effect on the system, and his judgement is influenced by his position with respect to the building. He may also influence other people who are evaluating the functionality of the building.

CHAPTER 8

BACKGROUND FOR THE DEVELOPMENT OF THE THEORY

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8.1. Poetic Words and a Heroic Vision:

In October 1969, an architect who was the new head of the Faculty of Fine Arts at Teheran University made an interesting and thoughtful speech to new students. His first sentence was a rather poetic one, for which a translation might be "You are the pick of the flower-basket of new architecture". This kindly and awe-inspiring remark was a symbolic 'brief' for the faculty's new orientation and would have various contrasting effects on the development of his anxious and professionally naive listeners.

The listeners were beginning a six-year full time course in architecture, but as a result of having passed the important entrance examination had already begun to imagine themselves as the architects of the future. They were to spend at least the next six years growing in an environment in which "the new masters preached a venture into the unexplored"[74]. The culture they were to absorb would purposefully develop in their minds a vision for believing in the role of the architect first and foremost as a hero and other more mundane professional matters would be regarded as secondary.

Whatever the new head of the faculty might have intended by his opening remarks, he planted a vision in the minds

of the young student-architects which would be cultivated and nurtured through the influence of their education environment. Their view of architecture and their role as architects would be fashioned within this heroic vision.

Perhaps it was not too surprising that such a vision should be adopted by students, regarding their new role as architects with responsibilities in architectural problem-solving. The architectural culture in the Teheran school was largely imported from the West, where architectural historians and the educational environment rewarded successful masters and pioneers of new architectural styles with words more appropriate to war heroes, perhaps as a consequence of two world wars.

Any student might be expected to be seduced by such language. For example, the United Kingdom's eminent architectural historian, Professor N. Pevsner wrote when surveying the new style in architecture which appeared after the first world war: "it had been established by a number of men of great courage and determination and of outstanding imagination and inventiveness. They had achieved a revolution greater than any since the renaissance had replaced Gothic forms and principles five hundred years before, and their daring appears almost greater than that of Brunelleschi and Alberti"[74].

However encouraging such stirring language might have been for the new-comers, especially during the first year of

their course, they would sooner or later, (and the sooner the better), have to realise that poetic words and heroic vision alone do not provide a functional and productive language for a profession such as architecture, in which the complexities of bringing together art, science and technique are fundamental in achieving the desired end result.

Consequently a more scientific language and a group-orientated vision is needed, the absence of which is a strong contributory factor to the contemporary crisis facing architects in the 'heroic' mould. The need to marry art and technique has been realised for some time. Pevsner also says: "Today in major architectural jobs the engineer must be named side-by-side with the architect, and his contribution sometimes is architecturally more stimulating than the architect's."[74]

"Every profession needs a heroic vision to inspire the practitioners, who will mostly be engaged in routine, so that they strive and reach out for something more than routine accomplishment. But this should not be at the expense of the customer and the public. All architecture is necessarily a public statement, but the hero architect often rides rough-shod over public sensitivities as he strives for the ideal to satisfy his ego." M'Pherson.

In that inaugural year at the Fine Arts Faculty, a new educational system was going to be tried as a result of a

democratic change-over from the old system, particularly in
the disipline of architecture in Teheran University. This
change-over was the result of some years of struggle
between two mixed groups of academic staff and students.
One group belonged to the 'old school', presenting
architecture as an outcome of an individual's performance.
In general the tendency was towards art and artistic
presentation of the design as though the profession were a
one-man show, with fame as the ultimate goal and the true
indication of proper, conscientious and successful
professional conduct.

For many of those students in Iran as well as in any other
country, illustrative architectural design magazines
(Domus, Architecture d'Aujourd'hui, etc.) were to a certain
extent a learning source featuring leading architects
(living or deceased) such as Walter Gropius, Le Corbusier,
Mies van de Rohe and Frank Lloyd Wright. There was very
little room for research, and a PhD for an architect was
considered an indication of useless activity in the
profession and a recipe for exclusion from the professional
world. The academic world was the only alternative.

The 'old school' regarded academia as an unreal world, a
place for theory only, for school-orientated projects. The
market was the real practical world, the world where
business-orientated projects were produced. They
misunderstood the fundamental nature of architectural
activity in which theory and practice reflected, and were

combined to meet, the needs and necessities of the real world.

This was a direct result of the situation in leading countries during the late fifties and early sixties for students beginning their architectural education. "In the early sixties, however, form was king in architectural thought and most architectural theory focused without question on aspects of form. Architects seldom thought of symbolism in architecture then, and social issues came to dominate only in the second half of that decade" (Venturi, 1977) [101].

All architects and students were influenced by the importance of this idea, to the extent that they hoped to achieve form and become famous, attract public attention and become 'kings', symbolically at least, in their immediate educational and professional environment. As E. Saarinen frankly reveals, "The only architecture which interests me is architecture as a fine art. That is what I want to pursue. I hope some of my buildings will have lasting truths. I admit frankly I would like a place in architectural history" [41].

Among all the supersensualists for whom a major goal was, according to Charles Jencks, as limited as "to achieve a full colour layout in one of the more fashionable 'glossies' such as Domus, Vogue or Studio International"[41], almost all have paid minimal heed to

the value criteria of the masses. For these architects, tools and criteria for evaluating worth were 'sensation' and 'perception', rather than any other measure or scale. Their scaling criterion was an 'unacknowleged epigram'[41], such as 'it's so beautiful, it's killing me' (and/or) 'it's so luscious I could eat it' [41].

They preferred not to have the ability to understand society as a whole. For them the users were 'the elite', whose happiness came before that of the masses. Indeed the most convincing of them, Hans Hollein says: "Architecture is not the satisfaction of the needs of the mediocre, is not an environment for the petty happiness of the masses... architecture is an affair for the elite"[41]

Of course the supersensualists were not the only group of designers who ignored the dictum: "the power of choice rightfully belongs to the future user (in general)"[29].

8.2. One Extreme to Another:

However, at one extreme of the then chaotic spectrum of architects were those who were 'wild and free' and "at an appropriate moment during the process of imagination, they have allowed their imagination to run free, and on the whole they have tended to work by analogy" [12], which in general is not of course forbidden. The fact which must not be ignored is that in a bad design it is the user who bears the risk of the warping of his life on account of the wrong use of an analogy.

At the other end of the spectrum were those who since the late fifties, as Friedman (1970) said "have been working on a theory which would free the client from the 'patronage' of the architect and at the same time, have been looking for a way to make the architect useful to the client"[29]. They had the ability to apply systems thinking in architecture. They were to put the architect, client, user and other agents and involved people together. They were not in favour of only dealing with them separately, so they understood that "any system that does not give the right of choice to those who must bear the consequences of a bad choice is an immoral system'[29].

"'Synthesis', or putting things together, is the key to systems thinking, just as analysis, or taking them apart, was the key to machine-age thinking"[73]. For these individuals too, synthesis and analysis were complementary processes in which "analysis focuses on structure; it reveals how things work; synthesis focuses on function; it reveals why things operate as they do"[73].

8.3. Community Architecture and the Gulf Between 'WE' and 'US':

The twentieth century which 'is a century of masses and it is a century of science' [73] has a profusion of examples of the power of choice having been misused by some of the leading members of particularly influential societies. The masses have been presented with an illusion of choice and

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freedom. If the belief is sincerely held regarding Winston
Churchill's statement: "we shape our houses and our houses
shape us"[43], that is to say, that as Jones (1984) said
designing was a way of improving relations between objects
and people, and it was important that this relationship was
two-way, then one must be able to clarify the 'we' who
shape our houses and the 'us' who's shape is the outcome of
the shape of their houses. One may gather, erroneously,
that those comprising 'we' are the same as those comprising
'us' in an equation. This is not so and has never been the
case in building industry in general.

There may be good examples of what is referred to in the UK
as 'community architecture', in which the 'we' who shape
the houses are the actual users and in which the
architectural team, that is almost all members of the 'we'
and 'us', are indeed the same people in an equation. As
such, community architecture is advocated by Mr Hackney,
who was president of RIBA during 1989. His hope is to
reduce the environmental problem of inner cities by
community architecture, in the face of a U.K. housing
market which, until the Spring of 1989, experienced a rapid
and sustained rise in property prices.

Community architecture at its best is about increasing the
quality of life. It is an outcome of those who in general
have good-will towards society. Rapidly rising house prices
indicate changes in the value-criteria from qualitative to
quantitative, and are in direct conflict with community

architecture in the U.K. Where society as a wider system
is in conflict with the low-level sub-system of community
architecture, there cannot be a real solution to the
problem on the scale required.

This means that although it is true that our houses shape
us, it is not always true that 'we' - the users or their
true representative - shape our houses. A good example of
this was when Le Corbusier, "the Picasso of Architecture,
brilliant, of inexhaustible inventiveness, incalculable and
irresponsible"[73] came forward in 1922 with a fantastic
project for a city of three million inhabitants to be
housed according to a rigid grid plan and to work in a city
centre of twenty-four cross-shaped skyscrapers.

Millions of people found themselves unable to relate to the
way their houses were shaped, and were forced to accept the
value criteria of the 'leaders and pioneers'. They
therefore were gradually being shaped by their houses,
which cost them on average fifteen years of their working
lives to pay for. If one adds to this story of 'successful'
masses, that of the unlucky masses who in their millions
wander in various parts of the world in search of even
primitive shelter, then one realises that built
environment produced extreme (but solvable) problems of all
kinds of complexity in which the role of architects,
however important as form-givers, can be, and is, limited
by the structure and function of a national societal system

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in <u>particular,</u> <u>and</u> <u>an</u> <u>international,</u> <u>wider</u> <u>societal</u> <u>system</u>
<u>in</u> <u>general.</u>

Having said that, an individual architect may survive the
misleading influences of a particular societal system to go
on to pursue his own ideas to good effect, if he is able to
change his approach such that he produces buildings which
benefit the masses. In conclusion, the responsibility of
the architect is more than that exemplified by Henry Moore
who said on his eightieth birthday: "as an artist I did not
set out to make the public understand but to find problems
for myself of space and form, and to explore them."[42].

8.4. A Change of Direction Since the 1960's:

"In the mid 1960's architecture was in a fairly critical
state. Few new buildings really pleased users and the
architectural profession as a whole was viewed with
considerable suspicion by the society it was supposed to be
serving."[12] In Iran, it was as a result of these
influences from abroad that a call for change was made. A
serious split between academic staff and students resulted
in a change of policy in the Faculty of Fine Arts of
Teheran University. It was at this time that first-years
were referred to as "the pick of the flower basket".

The point about the followers of the old educational system
in the Faculty of Fine Arts was such that research and
study were regarded as not necessary for a talented
architect, and that one should be ashamed of appearing not

to be 'talented'. These were about to change if the 'new' group could implement the new policy in which hopefully 'one must force the frozen circumstances to dance by singing to them their own melody' if one aimed to 'reduce the environmental problem.'

Followers of the new educational system in the faculty appeared to be aware of the need to industrialise fabrication and construction processes, to work as a group, and to stress that it was essential for the outcome to be based on research and development.

Comparing these needs with the situation in leading industrial countries demonstrated a profound similarity. In those countries, from the end of World War II to the end of the 1960s, heavy construction projects became larger and more challenging with each passing year. Industrial projects grew at an unprecedented rate, culminating in such enterprises as billion dollar nuclear power plants. Housing and commercial construction grew extensively in line with economic growth. In the construction industry the growth of electronic data processing (EDP) resulted in widespread use of several new management tools including Programme Evaluation and Review Techniques (PERT), Critical Path Method scheduling (CPM), Management Information Systems (MIS), Project Management Systems (PMS), and many other computer-based inter-related programs based on a common data bank, heralding a new era in construction efficiency and performance.[8]

They mostly arose in the west in the period after World War
II and into the sixties, they reached Iran and similar
countries between about 1970 and 1980. In Iran, one may
argue that although one did "force the frozen circumstances
to dance", they did not do so by "singing to them their own
melody", but depended on the rise in oil prices from 1973
onwards. The result is that virtually no -one achieved the
aim to "reduce the environmental problem", or "herald a new
era in construction efficiency and performance".

Rejection of the old system at Teheran University was a
united attempt at solving the architectural and
environmental problem through the belief that the root of
the difficulty lay in the structure of architectural
education and its attitudes towards the profession.
However, as problems were realised to be more complex and
difficult, as problem situations were seen to require
knowledge and information from many disciplies, and as
teams of people from diverse backgrounds, values, and
perspectives were found to be indispensable and were
brought together to assist in obtaining creative solutions
to problems, it became increasingly clear that new ways to
structure and facilitate such group efforts were needed.

The wisdom and justification for rejecting the old system
became obvious and the new attitudes came to embrace the
idea that "to regard thinking as a skill rather than as a
gift"[73] was the first step towards doing something to

improve that skill in which the nature of the thinking will

be the important key consideration to establish a solution.

CHAPTER 9

EMERGENCE OF THE THEORY FOR ICU-UCI DESIGN FRAMEWORK BASED ON INTERPRETATIONS OF SYSTEMS THINKING

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9.1. Problem of Expansion:

Expansion is a factor of human problem and difficulties. It is understood that there is a difference between expansion and progress.

Progress is the way of life in which we tackle problems, solve difficulties and lessen complexities. We do not intend to create complexities. But thinking only of expansion brings the interpretation that there is no guarantee against the side effects which can bring problems and difficulties to human beings.

The world we refer to as a 'mysterious world' is intelligible as well as complex to the point of sometimes preventing one from arriving at a minimal solution regarding the interactions of the elements involved in the world as a system.

The system is understood to consist of a set of elements connected together, resulting in a whole which can be understood. There is a way to understand the wholeness of the world by a particular way of thinking about the world i.e. systems thinking. To have a better understanding requires thought about the word 'thinking' and the different kinds of thinking.

9.2. What Precisely is Thinking?

Einstein (1949) questions "What precisely is thinking?".
Then he continues "When at the reception of sense,
impressions, memory, picture, image, this is not yet
thinking and when such pictures form a series each member
of which calls forth another this too is not yet thinking.
When however a certain picture turns up in many such series
then precisely through such return it becomes an ordering
element for such series, such an element becomes an
instrument, a concept. I think that the transition from
free association or dreaming to thinking is characterised
by the more or less dominating role which the concept plays
in it".[16]

A conclusion would be that "systems thinking then makes
conscious use of the particular concept of wholeness
captured in the word 'system', to order our thoughts.
Systems practice then implies using the product of this
thinking to initiate and guide actions we take in the
world."[16]

The key words in here are "conscious" and "wholeness". It
is the responsibility of architectural schools to base
their educational policy on offering this capability to
think of the wholeness and as a result, to clarify the
distinction between conscientious architects and the rest.

This does not oppose the idea of an architect practicing
his creativity. It does not stop him being creative but it

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leads him to how his creativity should be presented in the world and for whose sake, and in fact extends the responsibilities involved with this profession.

9.3. The Limit of the Individual's Function in the Production of Wholeness:

Extending responsibility does not mean and should not result in preventing the architect from producing anything with respect to his expertise as referred to in the second generation of design methods in which it says that at the end he becomes a person not having any right to design anything for anybody or in fact make a decision for any product which can be used by people; he has to facilitate himself in such a way as to formalise their creativity.

This is not how systems thinking is understood. Systems thinking enables the architect, while considering the wholeness also to be conscious of how to limit himself and find his right place in the complexity of the production process, in a way similar to the branches of a tree.

In other words if you are the smallest branch of a large tree, your place is correctly linked to the other branches and then to the trunk, and branches and trunk together represent the structure of the tree. In that respect your consciousness is in relation to the whole of the tree but your function is clearly limited to the area where you are in the complete production.

9.4. Thinking, Goal and Practice:

To deal with different kinds of thinking, if one concentrates on the world thinking and then changes the adjective from 'systems' to, say, 'architectural', 'musical', 'commercial', 'medical', 'military', 'peace', 'war', 'unity', 'happy' thinking and so on it can be seen that what is being discussed is the kind of activity in which one has a responsibility to fulfil a certain goal by that way of thinking.

If the aim is happiness, there should be no elements of sadness in the thinking if such elements bring unhappiness. If they do, 'happy thinking' becomes meaningless. If we think of peace, we cannot include war-like elements because those elements in the final stages when connected to each other will produce war functions and actions. To practise that kind of thinking cannot bring peace, therefore any kind of thinking should bring its own goal-oriented elements if the aim is to achieve a practical outcome from such thinking.

For systems thinking to be able to contribute, an understanding of the definition of a system must be acquired. As explained before, a system is a collection of connected elements which represent a new larger element. That new element has a uniquely different role and characteristic. It is as if we are talking about combinations and arrangements of elements. We are not

aggregating them. We are in fact producing something new.

If chlorine and sodium under certain condition make the salt sodium chloride, the characteristic of sodium chloride is completely different from chlorine and sodium, neither of which is edible, while salt is a nutritionally essential new compound produced from those two elements.

9.5. World as a Complex System::

Understanding the system of the world incurs a responsibility to solve the complexities created either by nature or by the mis-management and mis-conduct of the people who have deliberately developed their thinking in counter-progressive ways. 'Progress', as understood here, involves the creation of another set of complexities and difficulties, and has the intention of setting a clear order of priorities.

We live in a world which is complex but with enormous capabilities to solve its complexities. Although the world functions as a system, it also includes many sub-systems which are not in support of each other and which counteract the harmonious co-existence of the whole. The communications we have today enable us to have full responsibility for practising systems thinking, rather than insular thinking with regard to sub-sub-systems and the satisfying of only many minorities.

9.6. Interpretation of Systems Thinking in Relation to Universal Human Rights:

Although an individual practitioner's role is of course limited to his work environment in particular, and to national boundaries in general, the stance which can be taken by an individual in response to understanding the world as a system gives him continuous responsibility to practise systems thinking at any moment, in any way or at any stage possible. This means taking full responsibility for the complex world outside ourselves and for the most important factor, i.e. the welfare of humanity in the context of such areas as universal human rights.

Systems thinking enables one to understand that to conscientious human beings, it is not acceptable to give fewer rights to a person in one part of the world than to another, for instance, living in the utmost comfort. Systems thinking makes architects responsible for looking at the world not as a place for their likes and dislikes but as a place for them to provide the needs and necessities in a just order of priority.

In the order of priorities, although national boundaries will limit his performance, the architect is clearly aware that he should not support unfairness in order to enjoy fame or for the sake of enjoying journeys of adventure into the 'dark side' of his brain.

9.7. Systems Thinking, Responsibilities and Human Abilities:

Of course, if the division of the human brain into left and right hemispheres with their separate functions is fully established by scientists as the basis for individual performance, that is to say, those who are active in the right hemisphere of the brain are capable of management and creativity and those active in the left side of their brain are capable of sequential planning, then it might be concluded that human beings are of two kinds - leaders and planners.

The leader is capable of managing, the planner capable of analysis, but however correct this theory may be, the responsibility goes to both of them to be aware in their thinking of the danger of misleading, or creating analyses which are not based on an order of priorities.

The architect who functions in this world as a manager, as a planner, as a designer, and as an executor, and who covers the whole process of architectural production from beginning to end, acknowledging different levels of responsibilities in his work environment, must be aware of playing a key role in the production of the sub-systems of the wider 'world-system'.

Such architects should at least be able to begin with systems thinking. This may be the only way of taking care of the whole i.e. the complex world outside. If the world outside were reduced in scale, systems thinking could

indicate the degree of responsibility involved, enabling the thinker at least to place his practice within the context of his immediate environment.

9.8. Practice of Systems Thinking within the Immediate Environment:

In that environment there are others who are part of that sub-system who in fact act as modifiers, as influencers, users, of that sub-system.

The architect's thinking may bring about a design outcome that leads to the production of an alienated creation. When the public sees such a development, which fails to improve their lives, they will not participate in any efforts to solve the remaining complexities resulting from the new situation, and they will show little interest in keeping the system in working order. Such consequences as vandalism then become a part of the problem, although, of course, the roots of the problem of vandalism go beyond the architect's responsibility.

Any development whose aims do not include progress for that particular sub-system cannot expect to be rescued by the public. To acquire such public goodwill is one result of systems thinking, by which other participants of the particular societal system are involved, especially those immediately concerned in creating the development.
Public participation does not limit the architects thinking, but in fact it should and will provide better

information enabling him to produce, not only for them, but for himself as well, assuming he can understand the problem and offer a solution.

9.9. The Effects of Different Types of Thinking in the Production of the Final Architectural Product:

Different types of thinking in architectural production will produce differing end results. As mentioned before, if we become skilful in our type of thinking, then our consciousness about systems, or business, or art, or any other subject in society, can lead thought into the practical application of knowledge.

Therefore, in the field of architecture, it is the responsibility of the architectural schools, if they want a certain type of thinking to be implemented in their society, to make that kind of thinking fundamental and basic to the school's aims. The result could be a different educational atmosphere based on systems thinking, commercial thinking, artistic thinking, etc.

Considering the profession of architecture, any kind of thinking brings its own sources of reading for the students, and its own way of tutoring. For example, an architectural school with an artistic orientation emphasises that aspect, but since it is our type of thinking that is being discussed (even if other aspects of architecture are fulfilled by other experts), art is still the base of the thinking.

The state of architecture in Britain today can be gauged by the prevailing market conditions. There is a shortage of architects and people who are needed in the construction industry, which means that things have to be done to tight time schedules. Since speed is involved, the degree of attention paid to responsibility becomes relaxed, and commercial aspects automatically take priority. The whole profession and people involved form a majority with a certain uniform type of thinking and the minority cries out in the hope of stopping them from making mistakes. The whole of society is affected by their commercial way of thinking. This thinking is usually opposed to systems thinking, in which the 'wholeness' is considered, and care is exercised in the relationship between the elements, as a sub-sub-system, with the total element as the wider system. The word 'element' is used here because any element, although having a small part in the system, in itself has the structure which can be seen as a system itself.

The actual effect of commercial thinking depends on the area, according to political allegiance, which in turn governs its relationship with the building trade.

For instance, consider a Conservative-controlled council. A builder may apply for planning permission for a building, and the council is very flexible and gives the 'go ahead' to his commercially motivated plan. The builder will then abandon any ideas of a relationship between his product and 'wholeness'. In other words, commercial considerations and

commercial thinking that enable the builder to gain

financially from his investment impel the council to let

him proceed, and they may even encourage him to go ahead

with his plan and do nothing about the wholeness, i.e. in

the environment.

This amount of flexibility and licence in planning will be

more prevalent in a 'Conservative borough than in one which

is 'Labour-controlled', with requirements beyond purely

commercial ones.

Architects in general are aware that boroughs under Labour

control are known to be more resistant towards projects

based on commercial thinking alone, whereas Conservative

groups exercise flexibility and licence with regard to

purely commercial thinking.

9.10. The influence of Government Policy on the Type of Thinking in the Educational Environment of Architecture:

There is no doubt that the policy of each government and,

therefore the type of thinking prevalent in a society

affects the educational atmosphere of any discipline,

depending of course on the nature of the discipline.

Educational courses in architecture can be influenced to a

greater degree than those e.g. in chemistry, if the basis

of thinking changes with a change of government. If for

instance a society's basic thinking is to increase the

degree of private sector ownership and make a society more

commercially orientated, the effect on planning and

architecture will be seen in a more tangible way than in the field of chemistry.

It goes back to the nature of the educational discipline. Architecture is a kind of discipline which covers many others. It is a type of profession which is inter-disciplinary in itself. Thus if a society turns in a commercialised direction, the effect on architectural production is very obvious, as is the effect on academic architecture. Of course, there are critics of the prevailing situation, but the mainstream of an architectural school will have no choice but to go along with society, mainly because most of the time the educational establishment is financed by the government which is the main institution to set providing or influencing their criteria.

Therefore, even though an architectural school may base its educational direction on systems thinking that particular school may inevitably, over a certain period, be influenced against its wishes, to follow a government policy which is opposed to the school's thinking.

However, discussion within the educational atmosphere always leaves room for comparison between different types of thinking. This does not mean that for instance if some things are based on systems thinking they are guaranteed a better outcome than those on a commercial basis. Particularly with regard to systems thinking, it is felt

that generally speaking, any type of thinking can produce an outstanding outcome, not withstanding the criteria laid down therein.

9.11. Relationship Between Type of Thinking, Needs and Requirements

Throughout the history of architecture there are different types of building covering almost every kind of thinking, based on artistic, commercial and social thinking, and even, one could say, systems thinking. Any kind of thinking finally produces an outcome and without preferring one kind of thinking over another, a thorough examination has to be made to find out which type of thinking can be of greatest service to society and which type of thinking is in fact essential and appropriate to that particular society at a particular time.

Artistic thinking may be attempted, but a society concerned with commercial thinking would not accept it and consequently the results would not be popular, which does not imply an average or mediocre product, but simply something which the majority does not expect at that particular time. This has always been the case.

Always when the social circumstances are oriented in one direction and the majority accept the changes from one system to another, there are those who resist change, or who advocate an even better type of thinking, but when society thinks otherwise, the dissenters do not enjoy the

result of their thinking or are not able to be of service
at that particular time. In another period perhaps, their
work would be recognised, but to think as they do such
people need to be very patient and should not think in the
short term.

9.12. Relationship Between Educational Atmosphere, Contemporary Needs and Feasible Future:

In this respect we can refer to two types of leaders of
thought. Those who are actually leading contemporary
society and those who are leading the educational policy
for the society. There will also be people who think of
the contemporary social circumstances as a period of mis-
match between what is necessary for society and what is
practiced.

These people are in their own way leaders, of 'research',
and in the circumstances can be seen as being in opposition
to the prevailing norms. The success of their product can
be regarded as uncertain. But this does not mean an
educational atmosphere should be based on contemporary
needs, which is only one factor which must be considered.
The others are the foreseeable future, which must be
considered by the policy makers, and the needs and
necessities, as they see them. An educational atmosphere
must be created based on these three factors, namely
contemporary society, needs and necessities and a
foreseeable future.

Such an atmosphere might be different from that of a

society operating by what is contemporary to it, but its responsibility means more than merely accepting contemporary society, it has to be given the opportunity to discover problems and to tackle them. Of course it may not be possible to implement answers to the problems, but it is the responsibility of the educationalists to seek out solutions and create circumstances in which their solutions can be implemented.

On this basis, it can be stated that due to the extent of development and progress in the field of communication, we are living in circumstances where we can make ourselves aware of what is really going on in the world, without merely relying on television and radio services which may directly or indirectly be under the control of the government.

Governments place a high priority on aiming for a future based on the contemporary social circumstances which arise from its own policy which it considers answer the needs and necessities of society.

9.13. Systems Thinking for Academia:

For any educational atmosphere, it is felt that there is no further case for not considering systems thinking. As with the dramatic progress in the field of communications, society and academia have the opportunity to adopt systems thinking and always to consider the wholeness of the society and produce a certain kind of graduate trained in

systems thinking.

Of course contemporary society will have its own influence when a person is practising what he has learned, and he should somehow manage to implement his own thinking while also satisfying contemporary social requirements and convincing others that he is working to their criteria. This may involve seeing other kinds of thinking within systems thinking. It goes back to the meaning of system, which is a discipline, and the discussion about all disciplines, and somehow a way should be found when implementing this kind of thinking to satisfy society.

Society consists of different types of people, with different ways of thinking and it is unrealistic to imagine that all the people will simultaneously think along the same lines. Commercial thinking will not satisfy a person who has artistic, systems, mathematical or scientific thinking. Scientific thinking also will not suit someone with commercial or artistic thinking. However, systems thinking, if the meaning is correctly understood, can facilitate everyone's kind of thinking to produce a whole. This wholeness has a democratic aspect in its ability to represent their thinking. The democratic outcome is not just the summing of their various votes. It is a democracy which offers not only such benefits, but allows the gathering of opinions and benefits from the amalgamation of them. It is a kind of product which is based on those

opinions. It is like referring to the chemical combination of sodium and chlorine as mentioned before. These materials are individually poisonous, but in combination they are salt which is essential to life.

Therefore the thinking of society that attends to needs and necessities and other contemporary circumstances, together with those for the foreseeable future, and brings them together, can produce an outcome which can answer to most points of view in such a way as to be useful in the final product.

The responsibility of the educational system is therefore to create this ability in students, otherwise as is the case in some schools, the educational atmosphere in architecture produces people with strongly opposing views who can only write, if their way of thinking is destroyed. By doing that some of them obviously become alienated to their profession and their own particular circumstances.

Such a school might be the Architectural Association. Instead of creating a type of thinking which can facilitate the creativity of others, it opens the way for all kinds of thinking in a disintegrated way. The Architectural Association has more than ten educational units, each of which has a different type of project with different aims and responsibilities. The resulting architects will follow different directions in the world and some of them may know nothing about conscientiousness, merely looking to their

own needs, likes and dislikes.

Schools should be able to create a unique and united work environment which might include all types of students from various social classes whose aims are to fulfil the requirements of the social class in "a bottom up hierarchy". That social class does not mean an 'average'. It is in fact the essential requirement of society. It is difficult to see such a direction for instance in a school such as the Architectural Association, which is one of the leading schools in the western world, as well as the oldest and largest school of architecture in the U.K. The school presents itself like an open market in which all kinds of tutorials for dealing with all kinds of interests can be found. In other words it does not appear to be a responsible school, nor does it act in accord with its motto: "build with truth and design with beauty".

The 'truth' in fact does not emerge from the existence of various units of educational workshops within the school; 'design with beauty' can of course be discerned because every individual might have a different level of creativity and concept of what is regarded as beautiful. But again, the truth of the society should be seen from a systems thinking point of view.

However the school appears to set no criteria for the truth and anybody with any kind of interest may practice it, be it through nostalgic artistic thinking, modernistic

thinking or whatever. The school does not have a
responsible way of thinking, which can cover all kinds of
thinking in an amalgamated form.

The motto: "Build with truth" does not appear to be
fulfilled by the school. This is because communication
allows thought on a global scale. The students of the
Architectural Association, have various backgrounds and
come from different parts of the world. Consequently they
are a source of information, introducing the needs of their
own societies. In addition, other medias are there to
enable the school to gear its policy in the way as to
satisfy such responsibility and become an international
school, but what the school does is to separate these
interests. It functions like a pharmacy providing
different medicines for different people. Different
medicines can be found in different units which therefore
offer different projects. This is considered to be wrong.

An educational policy based on this different information
means producing a type of student whose aim is to serve the
society. The school's responsibility, if it upholds the
truth is to have targets and goals for various social
classes which the educational atmosphere should serve, in
order to bring progress to the society.

There is no merit in producing luxurious architecture as
favoured by certain developers, and certain privileged

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people in a society, while ignoring the reality that millions have no place to live, and no architect is functioning to help them. The function of architects here is not necessarily to design a house, but should demonstrate that the school has such a responsibility and understanding of 'truth' in the world.

It can be said that one of the truths in the world is the existence of various classes in society. To follow that truth, the architect should serve any, or all, of these classes, but the truth being considered is not merely everything one can see. There is another criteria by which various truths and their priorities are determined, which is how we evaluate human rights.

These have to be seen in global terms so that all are served. This might not be the case two hundred years ago, because communication did not allow us to have full knowledge of a person who is living for instance in a small town in Africa or Australia. Today it is possible to determine criteria which gives more balance and unified evaluation of human rights.

That is the basis upon which the truth and the way of thinking of the architectural school should be founded, otherwise it will continue to create architects who are either in the service of the upper classes, or majority who want to imitate that way of life. Of course there are also some who by way of their own perceptions develop systems-

based thinking in spite of what the school is offering, and become different types of architects. But as long as this difference in the functions of the architects persists, some inordinate successes and failures will occur among them.

Those who fail most of the time refuse to support developers who ignore the needs of the majority.

9.14. Relationship between Systems Thinking and Scientific Thinking:

As Popper (1957) points out "the best we can do is write history which is consistent with a particular point of view. We ought if we can to state that point of view plainly. What follows then is sketch of the development of science which enables us to understand the nature of systems thinking as being complimentary to scientific thinking. The assumed problem is that of understanding the nature of systems thinking and explaining why the systems movement, conscious of itself as such, emerged in the middle of this century"[16].

To consider systems thinking as complimentary to scientific thinking, we should look at the latter and its functions. It leads us on to analytical thinking. Analysis enables things to be taken apart from each other which allows examination of each part and consequently a reduction of the problem in each part. **The danger of relying on scientific thinking is that analytical thinking deals on the basis of answering the requirements of the parts.**

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From that basis of thinking has resulted the world of today, where different countries, with their own problems, compete with each other. Those that can influence other countries to satisfy their own requirements end up ensuring that less influential societies achieve relatively less progress, and unfairness in the total world is perpetuated, i.e. some areas of the world are successful and benefit from poverty in other parts.

The contribution made by systems thinking in this case brings these parts together again, and gives meaning to the wholeness. Where supposed 'wholeness' appears to accept things not seen to be connected to each other, then that wholeness is not functioning properly, and the result is its own destruction. Consequently those parts which have no problems initially also suffer from the outcome.

Thus the way in which systems thinking complements scientific thinking is in allowing scientific thinking to use analysis to demonstrate problem areas. Solutions must then be given while considering the wholeness of the global problem. The distribution of the remedy becomes important, and the expertise in global terms becomes important. But this must be made clear that a naive approach to systems thinking will flash a green light to new imperialism and a vigilant approach accelerate an international movement towards and early internationalisation.

The implementation world-wide of systems thinking would be a great achievement. On that basis, although the world is seen as so complex, progress towards a total solution could be made. What ensures that such progress continues is the use of the successful parts to gain an understanding of the responsibility of preserving the wholeness of the world.

Such thinking, when established in a growing proportion of the world, as is apparently happening, will obviously have an effect on the field of education, and those areas that will benefit most quickly are establishments such as architectural schools.

It has to be borne in mind that the prevailing environment has a greater influence on the educational atmosphere than the global environment in the matter of direction and intention. A purely commercial environment strives to ensure that every step of progress is geared to stimulating people into earning more money, leaving little room for humanistic values. Everything according to its monetary value. Such an environment has more effect on the direction of a school than does a universal programme such as new political thinking in which world leadership - if such a term may be used - may be aiming to solve problems by negotiation rather than by force.

9.15. Responsibility of Educational Members:
Commercial thinking can affect the educational atmosphere in the short term, but as mentioned before, an educational

atmosphere and the supporting members of an educational establishment have a responsibility to look further than the immediate contemporary environment and society. It has to think of the feasible future and consider ways of influencing existing circumstances by looking at the needs and necessities of the foreseeable future, and at those of the society who are not able to enter the commercial sphere.

Systems thinking is thus complimentary to scientific thinking when the latter has made the elements obvious, and the element or elements not capable of functioning properly within the wholeness of the present time become evident. Then a remedy is established and while putting things back together again to restore the wholeness, the scale and applicability of the solution to the entire world can be gauged.

This last point is extremely important with reference to the responsibly minded architect, in that by introducing systems thinking, we do not want to bring the architect to the stage where his activity in drawing, design and decision-making stops, but if he attempts to consider the global problem and the masses who are in dire need, he ends up not contributing anything because he does not see a tangible solution in the foreseeable future. That is not the desired result because systems thinking is not intended to make him ineffectual. The intention is to enable him to benefit from a role complimentary to scientific thinking,

such that if he cannot solve the global problem, he is nevertheless able to find a solution to the problem of one part as a sub-system. The nature of this solution should not further increase the expectations of those who are already in an advantageous position.

9.16. Systems Thinking to make the Responsible Architect:

In the interests of producing responsibly-minded architects, this type of thinking is introduced to the school. Of course, there has to be a considerable degree of other ways of thinking, and examples of their consequent successes and failures, to convince the student of the importance of the new 'systems-thinking', which by definition can cover other types of thinking.

The order of priorities within systems-thinking, of course, should always follow the answer to the question and the solution to the problem of the wholeness. If for some reason a particular architect becomes unable to solve the problem, or contribute to the global solution, he needs to become aware of the inappropriate functions, and that he is including something which is not in accordance with systems thinking. He requires also to be able to consciously decide how to implement his way of thinking to direct the product toward a time in the future, from where in retrospect he can justly say that his idea was the only way possible for him in his search for a solution to the global problems.

9.17. Importance of Communications:

"If systems thinking and the systems approach are serious, if they are more than a temporary fashionable piece of claptrap, and I believe they are, then it is necessary to establish what exactly systems thinking is, and what it means to adopt a systems approach to the problem"[16]

Of course, as stated earlier, systems approach and thinking are serious ideas due to the importance of communication which does not limit thinking to a purely analytical type. It allows thinking about the relationships and connections among an assemblage of things. It is therefore necessary to consider systems thinking and to implement a systems approach.

It is not considered to be 'temporary, fashionable and a piece of claptrap'. It need not be regarded as 'fashionable' simply because social circumstances change so that such thinking can no longer be implemented. First of all, so long as the wholeness problem exists, there is a need for such thinking. This was true hundred of years ago, in spite of people regarding systems as a subject which emerged in the last thirty to forty years.

In fact, the discipline of systems thinking emerged over the last forty years or so, but there were people who promoted systemic thinking several hundreds years before. The Iranian poet and philosopher Saadi has a poem displayed in the lobby of the United Nations building. It refers to

a human being as a member connected to others representing a wholeness, and it refers to the smallest element of this wholeness as of the same material as the universe. It refers to the situation where if one of the elements is in pain from the effect of bad circumstances, the other elements should not be able to accept the suffering.

What the poet means is that in a system, if one element does not function in a healthy way, it has an effect on other parts. Why should a human being who is capable of understanding this close his eyes and ignore the pain and agony of others. If he does close his eyes to such suffering, no longer can that person be considered as a human being.

A direct translation will help reduce the need for a detailed explanation of the poem, according to Edward B. Eastwick translation of the whole book of Saadi known as [25]: All Adam's race are members of one frame,

Since all, at first, from the same essence came.

When by hard fortune one limb is oppressed

The other members lose their wonted rest:

If thou feel'st not for others' misery,

A son of Adam is no name for thee.

It is clear, nevertheless, that systems thinking enables and advises the human to think of the wholeness, and to consider his own place in the society, as a serving member. This was stated years ago by philosophers and those who

were sensitive to the universe and the existence of the human being.

9.18 Self-Centralism:

Today there should be a rejection of any actions originating from the present world and modern which render society incapable of implementing such thinking, and providing solutions to present-day problems.

Any human advocating projecting a self-centred attitude should also be dissuaded from his views. In this category therefore, an architect or student of architecture who has been taught to put his likes and dislikes, and his desire for fame above the wishes of the masses and the requirements of the needy, cannot be regarded as a responsible human. This is so self-evident that it should be one of the criteria in the education of architects.

The problems facing human beings do not lie in the creation of interesting combinations of technological elements. Such achievements have been registered by people at every level. A looks at the technology of, say, a radio, or a watch enlarged to the scale of a complex high-rise building, reveals all kinds of interesting combinations which human beings have already conceived. This does not mean that architects must use e.g. these small functional things as models for large structures of interest to developers, or to persuade company owners to acquire grand and impressive headquarters buildings while ignoring the

need to direct the architects to other areas such as the housing problems that exist all over the world.

9.19. Systems Thinking Architect as Problem Solver:

Referring to the architect as problem solver, must be in the context of system thinking ability, rather than merely solving the problems of a developer's requirements. The architect must evaluate his own requirements first in a conscientious application of systems thinking. Even if circumstance do not allow him openly to declare his standpoint, there is a chance that the final product may show that he was trying to say something, a semiotic explanation, which was of a global character, related to the needs of the majority, and an effort to achieve a solution to the wholeness problem. In that sense he can be said was at least to have been trying to function conscientiously.

'New Directions in British Architecture' (1986) quotes Richard Rogers as follows: In 1976 he (R. Rogers) told the RIBA 'We stand at a watershed in world history. The issue being the validity and acceptability to the majority of the world's inhabitants, of the present social and economic system, which allows two-thirds of the world's population to suffer from malnutrition and homelessness'. Rogers went further, refusing to confine himself to ritualised expressions of well-meaning concern: 'The question is' he continued, 'whether a new order is viable based on our ability to carry out a social revolution which

in the short term will threaten our present living standards, for the forces of the market-place that have traditionally been kind to us, are blind and merciless to the majority who are weak. If this is Utopian day-dreaming, and we reject the idea of a new social and economic order, based on limiting the total hold of the few, manipulating everything in their own interest, then we must accept the aftermath, which is starvation, destruction and death.'

Rogers followed these remarks with some harsh word about the way in which, as he saw it, the large architectural practices were taking all the work, and those such as James Stirling's, and presumably his own were being starved of opportunities because of their tendency to disturb the status quo. It was tragic that, in spite of the best of intentions, architects inevitably strengthened the existing system whilst paying lip service to society's needs, for in the end earning their living in the service of the present system. The sole aim of the successful architect lay in increasing the financial return for his paymasters, the client, thereby in turn enhancing his own prospects of wealth, power, and further commissions. Meanwhile his own mind was closed to the non-paying public. How could such people consider themselves to be autonomous professionals working for the good of the people?'.

In fact Rogers, as one of Britain's most successful and internationally renowned architects, makes reference to the

responsibility that architects should exercise with regard to the wholeness, while admitting that in his position he services the demands of the client. Then where the semiotic of his work lies, and who can explain the semiotic of his work, for instance in the Lloyds Insurance building is an essential matter which needs to be discussed with him.

The interpretation is taken to be that the Semitic involved Lloyd's Insurance building, is a matter that makes clear that Rogers is in favour of luring out hidden aspects and inside out having functional pleasant inside after a shock or surprise by the outside appearances, a kind of revolutionary thinking of his responsibility to the wholeness.

Checkland says: "Eventually I believe that systems thinking and analytical thinking will come to be thought of as the twin components of scientific thinking, but this stage of our intellectual history has not yet been reached".

This is felt to be a natural approach, in general, in architectural design. In other words, when one receives and understands a brief regarding the design and production of a building, one automatically thinks of the building as a whole entity which is supposed to serve all components or which consists of several components required to co-exist such as to give meaning to the function of the whole.

On the other hand, the whole is, nevertheless, capable of, an ill-defined function, if some of the components are not

capable of functioning properly. For instance, in the case
of a hospital building, during a study of the components
of the function, brings a familiarity of their functions.
Their combination then comes to represent 'hospital'. The
components have been arranged to create an organisation,
which, it is considered, is functional enough to answer the
brief.

There is a continuous process of going from the whole to a
consideration of the components and returning to the whole.
In considering the wholeness of the building, systems
thinking is being utilised. Analytical thinking is being
applied when the components of the building are being
considered.

This back-and-forth process is a natural process in
problem-solving for architects (as opposed to some of the
other professional participants). The word 'natural' is
with reference to the nature of the subject rather than
that of the problem solver, the architect, who is obliged
to think in this way with no obligation towards any
particular view-point. It is the characteristic of the
profession. To be productive, the designer is forced to
reduce the wholeness analytically, into parts,
simultaneously always bearing in mind, albeit in a vague
way, the amalgamation of the parts, in some sort of
organised shape, i.e. the building as a whole.

Of course, it is possible to have a building resulting from

an accidental combination of the parts, but the aim is nevertheless to achieve a satisfactory form. Always, there are parts which require additional attention in the mind of the designer, to bring wholeness to the product. How far, the connection of these parts contributes to the wholeness of the building, [depends upon the possibilities, and] the abilities of the designer. Nevertheless, the mind of the designer, is able to imagine the total organisation that needs to be achieved.

In architecture, reductionism and vitalism are seen or can be seen simultaneously. The process from the whole to the parts, and then from the parts back to the whole is the natural way of conducting the process. That is why architecture always has to consider the whole, and the wholeness of the final product, and to have the best possible connection between the parts, as discovered by the architect in the analytical stages.

So even before the science of biology, it was the case in architecture to have systems and analytical thinking as twin components of the thought leading to the final product.

Checkland (1981) seems to support the view that architectural thinking contained scientific thinking within itself irrespective of the fact that the appearance and presentation of the work involved uses a language which mainly shows itself as an outcome of artistic thinking.

According to Checkand, "Biologists in fact have been among the pioneers in establishing ways of thinking in terms of wholes", [16]. Here it has to be admitted that even before biologists, it was architects who thought of the whole, so it seems the earlier pioneers in systems thinking, were architects.

They did not use however the term 'systems thinking' or 'systems' for architecture since there is the additional 'artistic ingredient' which makes one 'system', i.e. a building, in the first instance preferred to another. Out of two architectural systems, the one with more beauty can satisfy people more quickly than another. So in 'better' architecture what is involved is not just a better systems function but one that includes an artistically pleasing element.

Architecture is much older than biology and architects were active in history much earlier than biologists. The reason for emphasising this aspect is to suggest to scientists that they think about the deeper meaning of architecture, and to find out more about the 'ingredients' involved in it.

9.20. What is the Deep Meaning of Architectural Complexity?

"The modern science of biology emerged from the Aristotelian view that living things (and, indeed, for Aristotle, inanimate objects as well) functioned to fulfil

their innate purpose". This applies to architecture since, although a building may have several functions, and parts may have different and independent functions, it is the total innate purpose that is the aim if it is ever to be evaluated as a functional and satisfactory whole. Unless this stage is achieved, the work of the architect will be subject to criticism.

If a building cannot fulfil its innate purpose then there must have been difficulties in the mind of the architect in pursuit of achieving the wholeness as well as the function of the parts. In working towards the fulfilment of the innate purpose for this inanimate object, which in a sense is nevertheless a 'living' system, people cannot be excluded from the building. Thus the innate purpose in the mind of the architect should be obvious to the user.

9.20.1. Innate Purpose in Architecture:

"No professional experimental scientist would now deny the evidence that living systems in all their mechanisms obey the established laws of physics and chemistry. No professional scientist seriously invokes entelchy.". [16] It is also true of architecture, which also obeys the laws of physics and chemistry, as does the whole existence of a building although of course other things are involved.

Checkland also says: "But this does not mean that reductionism has carried the day; it does not mean that biological phenomena are nothing but physics and

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chemistry."[16]. This is correct in architecture as well because first of all architecture is not only about materials and their combination. Combination may only follow the laws of physics and the chemistry of the materials, but there are other things that come from the 'dark' side of the human mind, regarding the consideration of other people's needs and necessities, as well as the likes and dislikes of the designer. They all are ingredients which are involved and amalgamated in and with the chemistry and physics of the materials when they are organised into a whole.

If we follow Checkland further, he says: " Biology is now established as an autonomous science which is not reducible to chemistry and physics. Establishing this has established systems thinking".[16] For many years, when people referred to successful architecture, they talked first about how it appealed to them with respect to the environment. If they found a building pleasing, they admired it. If they found it unsatisfactory, they criticised it. It is not the chemistry of the materials nor the physics of the structure that they are talking about. It is something within and outside of those two. Therefore every time people referred to architecture, they were talking about something which, although reducible to chemistry and physics, had additional attributes which upon reduction, were no longer observable. Therefore the language used to demonstrate the outcome of the physics and

chemistry involved in the product of architecture, long ago, had been an example of how an architectural production was explained. That was therefore an unestablished form of talking about systems thinking.

9.20.2. The Egg and Entelchy of an Architectural System:

"For vitalists the development of the whole organism from a single egg must mean that in each developing organism resides a mysterious spirit-like 'enteleche' which somehow directs and controls the growth of the whole." [16]

In architecture, the 'egg' is the whole which is in the architects mind in a very vague form. All other informations he receives, and all other environmental effects cast upon his way of life, have a direct influence on the growth of the egg. Therefore, although the egg is the wholeness, the way it proceeds to the final form is related to the external information and resources available to form it.

The mysterious spirit-like 'enteleche' is something from the architect's 'black box'.[43] Even this black box, in controlling the egg to its wholeness, and directing the way it grows, is affected by the external forces upon the functioning of the whole mind, and consequently upon the whole black box (i.e. the right hemisphere of the brain). Therefore the 'egg' of the whole building is influenced by the real world, in the same way that the real world formed the cognitive ability of the architect.

An architect, when designing after receiving all the information relevant to all the requirements, and after finding out the available resources, is feeding the egg and making possible its growth within his mind. During the entire mental decision-making process, sometimes pen can be put to paper and illustrate the growth of the egg. This is either in an organised form of drawing, or merely doodling. The point is that time influences the growth of this egg. This is an essential factor. If this growth is not to be totally influenced by external forces beyond our control, the architect must train himself to concentrate on the wholeness. The arguments put forward earlier regarding the pioneering aspect of systems thinking in architecture were about those practitioners who placed the profession under their control and reduced the influence of external forces upon the growth of the egg. Such control was required because they were able to imagine the growth of the egg, and they were able to accommodate all the possibilities in such a way as to fulfil the innate purpose, i.e. to serve sense and bring out the intentions of the human mind.

The innate purpose, either as sincerity towards an understanding of the required function, or as the amalgamation of personal likes or dislikes, was a sound motive for the architect to determine the growth of the egg. This control used their type of thinking, which is the important 'systems thinking' factor believed to have been used at that time. If commercial thinking as opposed

to systems thinking prevailed, the outcome would certainly not have been the same.

9.21. Holistic Thinking: - Architecture:

"Holistic thinking in biology which began in the second half of the nineteenth century, has continued throughout the twentieth century. Its modern form is still the discussion of the autonomy of biology."[16]. In architecture holistic thinking did not date from the nineteenth century. Consciously or unconsciously, it goes back centuries, to where in fact an architect began to erect a building. Consider a shelter. It consists of materials and the manner by which they inter-relate, giving them a meaning as a shelter, so that the wholeness is the aim. While thinking of the total production, the architect is advised, or learns from experience, what parts and components are needed to support holistic thought in the simplest form for the shelter.

Architecture is therefore a profession in which its producer i.e. the architect, and his team, knowingly practice systems thinking or are unwittingly implementing such thinking. They are however in a position in which they must end with a total product which itself requires at least a holistic thinking or systems thinking in order for the production to be understood.

Of course a part like a door, a window or a floor may

independently have its own meaning. But when they appear in a certain relationship to other elements in the form of a building, then the degree of their functionality and their feasibility is in relation to the total whole or to the immediate parts which can be formed in a sub-sub-system of the total whole.

So an understanding of the degree of importance of such parts in a total product requires the application of holistic thinking to the problem of understanding the whole. Having said that, approached from the analytical angle, that is dealing only with the parts, it is also possible to bring the part or the element of the total building to a satisfactory functionality. But again its worth or value can be judged only when a holistic view is held.

A pain in the eye invites thinking of a remedy for the eye. But the eye and its value is in relation to the total nervous system and to the total body. A dead body will not require a healthy eye. Taking the eye as a part, and after applying a remedy to the body, it should have all its connections with all the immediate parts surrounding it to make up the sub-sub-system of the total system, enabling the eye to be considered as one part with the body as a total system.

This means that while thinking holistically, solutions can be sought for the parts in an analytical way. But taking

back the parts into the total system, whether consciously or not, is with respect to a process of synthesis which regards the whole system.

To recapitulate, systems thinking goes back to the beginnings of the human race.

CHAPTER 10

THE GENERATION OF A THEORITICAL BACKGROUND FOR A DESIGN

FRAMEWORK, AS ICU-UCI

CHAPTER 10

THE GENERATION OF A THEORETICAL BACKGROUND FOR A DESIGN FRAMEWORK, AS ICU-UCI

10.1. ICU-UCI Design Framework:

The design framework being developed, already identified as 'ICU-UCI', can be thought of as two situations. ICU means: 'I am trying to find out more about your way of thinking or your requirements', or 'I am trying to bring light to all the dark aspects of the brief which I will receive from you as a client. When I succeed I will be able to claim that I indeed 'saw you'; ('CU'). It means therefore that I then have established an understanding beyond mere interpretation of your requirements, so I now clearly know what your requirements are.'

The second part of the situation, 'UCI', means: I have enabled you to see what is going on in my decision processes, i.e. how I am involved in producing an outcome, for example, from the brief given by you. If I succeed, i.e. if I enable you to see me with a proper means of communication, then the probability of a mistake or a disagreement over the final product will be greatly reduced.

This framework in fact enables every individual who has any architectural interpretation, or who becomes sensitive about implementation of the brief given by certain groups as clients or users, to examine their requirements and to

establish an understanding from interpretations of the things they want from the relevant designer or architect.

'ICU' stands for Interpretation, Communication and Understanding.

The 'ICU-UCI' abbreviation is self-evidently two parts with the same ingredients. The first part places role of architect as designer. The second covers the role of the clients or users and other participants in bringing feed-back into the process. The main objective is to enable the individual designer to have a method of recording the stages of moving from the interpretation of an often ill-structured problem to that of understanding it by way of self-interpretation.

Initially, interpretation of the brief is made through a chosen communication model and an understanding is established and presented to others as the designer's interpretation of the brief, which is in the end a design product. 'ICU-UCI' enables the establishment of a path from 'I' to 'U', that is, from interpretation to an understanding, which is literally in black and white, so that it can be presented to anyone concerned with the product.

Now the 'ICU' map becomes evidence for any participants to examine and for them to understand the designer's interpretation. They have to go through the same process

of communication to record their interpretation. If their 'ICU' map matches the designer's, the framework of 'ICU-UCI' for that stage is complete.

The designer is now one step closer to agreeing on the final product. He can claim that he 'saw' them and they 'saw' him. If the maps did not match, a basis would be formed for further discussion and for the parties to question each other in the search for the appropriate answer. At this stage the participants' interpretation, which is based on the designer's understanding, creates some questions. For the designer this sets off another round of mapping his interpretation of their understanding, going back to the same channels of communication. Finally he establishes a map on which both sides, or the group, agree. The communication method is, of course, a man-machine way of communicating.

The machine in this case is the computer which acts as a scientist capable of analysing things, clarifying the problem, and establishing and converting an ill-structured problem into a well-structured one. The user of this mode of communication i.e. the computer and relevant software, is in fact acting like an artist and organiser who is synthesising the structure of the whole in the way he requires. In other words the computer is doing machine-age work, which is analysis, i.e. taking things apart, and the architect is doing systems thinking, which is about synthesis, i.e. putting things together. (Fig.12)

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PUTTING THINGS TOGETHER :

SYNTHESIS

SYSTEMS THINKING

FUNCTION : WHY THINGS OPERATE AS THEY DO

COMPLEMENTARY PROCESSES

HOW THINGS WORK : STRUCTURE

TAKING THINGS APART :

ANALYSIS

MACHINE - AGE THINKING
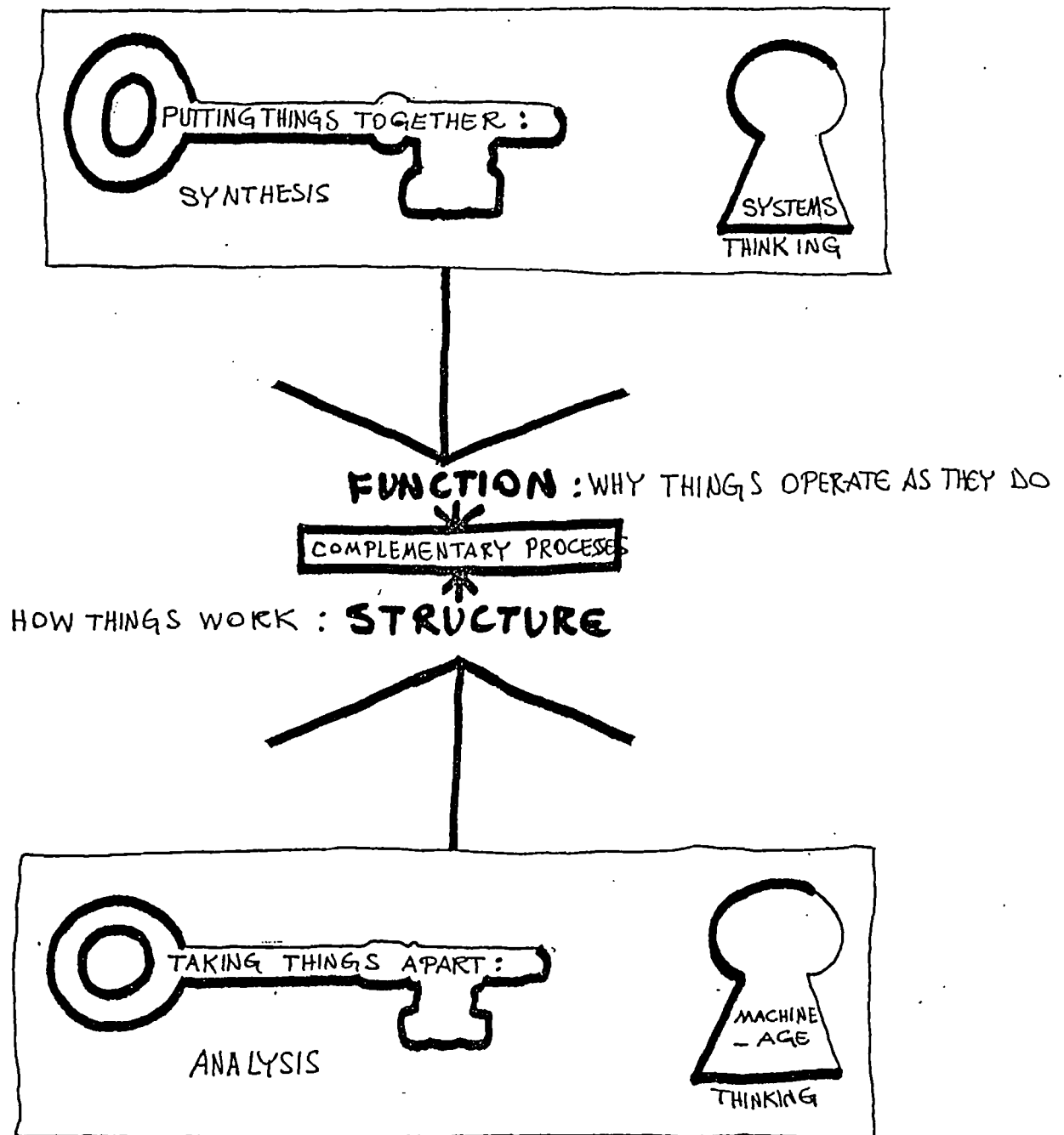
Fig. 12 COMPLIMENTARY PROCESS: SYNTHESIS AND ANALYSIS .

By analysis a structure is established. That is how things work. By synthesising we talk about the function; why things operate as they do. Every time you see a pair of elements you think about a relationship between them and how they should function. In the total process you are actually thinking of the systems function, that is to say, a system is in fact a function.

This communication enables the client, users, future users, assumed users and the architect or anybody who has a part to play in the whole design process, to answer the questions put by the computer about the relationship between a pair of elements in the system. The first step is to reduce the decisions to three states. It may be deduced that a pair of elements can help each other, or they relate to each other, or one helps to achieve the other, or one has a connection with the other, or any other phrase that can establish a final outcome. The relationship can be anything but the answer will be one of the three states of decisions.

A 'none' decision is really a 'no relationship' or 'no decision yet made', but that does not mean that the indecision will always remain. After seeing the structured map, the communication with the machine, a definite opinion will be formed about the pair of elements, otherwise other people involved in the whole design process will enter the

communication about it.

The man-machine stage of communication therefore helps all group members to establish an understanding of the designer's interpretations, which is then brought to all participants for their judgement. From there another interpretation is established, introducing another structured map by the same channel of communication.

A typical example may involve the sequence of events after the process has begun with the original architect, following the stages of inception, feasibility studies and outline proposal, all presented in the form of a briefing. As an illustration it may come as a model of the work which reflects the whole design process. (Fig.7). This application of ICU-UCI looks only at the briefing and design stages, in which the original architect processes a formation of a design solution.

In the design stage the original architect comes into communication with the computer to establish a structured map of communication. Other people can do the same and thus have their own maps. Imagine them all seated in a hall or meeting place where no-one knows anyone else's decisions, but the particular software is running simultaneously in all their machines. The democratic results of their decisions can be obtained immediately without needing to interrupt the process for discussions with clients and other participants. The participants can

sit in one room and answer the questions that are relevant to themselves, and at the end they can examine and discuss their outcomes and learn from them what is not unanimously agreed by all participants. (In fact this is what it is hoped to be for future development; an area for further research.)

It must be mentioned that ICU-UCI is not a framework for groups but for the individual who is specifically regarded as being the architect. It is believed to be a helpful framework for the designer who must sort out self-interactions while making decisions. For group work there are consensus methodologies which are established, and have been examined, and which can be implemented in some stages of design by architects and those responsible for architectural production. The ICU-UCI framework is, however, a secure way of helping the design architect in particular. Even in the process of architectural production, those areas that are subject to the managerial decision process have their own methodologies and way of management, in which second generation of design methods have been found successful. It is therefore obvious that ICU-UCI is not a framework for the total process of architectural production.

Of course interpretation, and a need to establish the required understanding can be done either by the individual or by the group. The emphasis here is on the individual designer who, by using ICU-UCI, can help himself to

overcome the handicap of a short-term memory and make proper use of external memory aids such as notes and written information related to the job.

He can in fact benefit from the long-term memory of ICU-UCI by re-structuring his own interpretation of needs and necessities. At the same time the method of interpretation allows him to incorporate elements of his own likes and dislikes.

Re-examination of the established structure, which is a map often produced by a computer, enables him to review his decision process later, or immediately on production of the map, to find where he disagrees with decisions he made at earlier stages. Corrections can then be made.

This enables the architect when coming to discuss the work with non-architects such as the client, users and legislators, to have available in a sequential way, the matters involved in the creation of the wholeness for production of which he is also responsible. Of course this responsibility is at the design stage of the production.

10.2. Design Methods - First, Second and Third Generations:

Karl Popper has been quoted as saying that if you propose a theory you must work against it to see if you can kill it. If your theory survives, you must leave it to society to accept or reject it. If they can refute it, your theory is dead. If they cannot, then it is established. This gave

the basis for talking about a third generation design method. Popper's views can also be misused by people in architecture. Supposing a designer comes up with a final design, assuming that it has passed his test insofar as it was a theory he worked against and failed to kill. If there is no mechanism in society to work against the project, it may be regarded as established and accepted. It may even be highly favoured as an example of first generation design.

Without proper examination by society or for that matter, the architect himself, he presents a theory in the form of an architectural system, and assumes that the project has passed the tests and has a right to exist as an established theory. This amounts to propaganda with an element of dishonesty, since he already knows that firstly, he as an individual relying on his memory is not capable of examining complex interactions between the relationships, connections and arrangements of all the elements, objectives and other matters involved in the design of the project. Secondly, he knows that society does not necessarily apply the process of examination used in science, as architecture involves considerable artistic appreciation, which contains much interpretation that in turn needs established levels of understanding.

There are definitions for 'first' and 'second generation' design methodologies and all other activities are referred to as 'third' generation, which is not an established

methodology. Figure 13 and 14 are respectively concise and comprehensive diagramatic presentation of the background, first and second generation design methods. There is no particular concern about accommodating the proposed design framework in any of these three areas, but it will probably come under a combination of 'first' and 'second'.

In referring to first-generation design methods writers as saying that knowledge should be regarded as the domain of experts, in the ICU-UCI framework the expert is not given the right to make the decisions to the extent to dictate to others "how they should live". Rather it is suggested that the expert retains the right to make decisions for himself, and to give others access to his decision process so that the design reviewers can decide whether or not his decisions are acceptable.

Second-generation design methods on the other hand assume a symmetry of ignorance. 'Symmetry of ignorance' is the most important of the seven criteria for recognising second-generation design methods, which assumes that all people contributing to the design of a product have equal rights in the decision-making process. All are assumed to be laymen, so any experts have less say. When contributing to choices and stating preferences, all have the same weight. The other six criteria according to Tom Heath (1984) are:

THE EXISTENTIALISTS ↛ THE BEHAVIOURISTS

THE BEHAVIOURISTS ⇔ LATTER-DAY FUNCTIONALISTS

Fig.13

↳ OBSERVE HUMAN BEHAVIOUR BY EMPIRICAL METHODS

↳ QUANTIFY IT

LEADING TO A
FIRST-GENERATION
OF DESIGN METHODS

↳ SET UP MODELS OF
MAN/ENVIRONMENT
INTERACTIONS
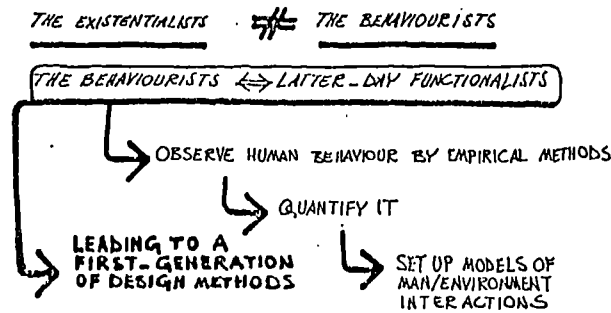
« FIRST GENERATION DESIGN METHOD »

TO TAKE A FRESH VIEW OF DESIGN PROBLEMS ➡ EMERGENCE OF

A POWERFUL APPROACH TO DESIGN IN EARLY 1970s ➡ DESIGN

METHOD BASED ON : **ANALYSIS , QUANTIFICATION, COMPUTER**

AID , ETC. ➡ "FIRST-GENERATION" DESIGN METHOD,

AS CALLED BY HORST RITTEL (1972) ➡ TO CATALOGUE ITS

ACHIEVEMENTS, IN TERMS OF BUILDINGS BUILT , ...MOST OF ITS ADVOCATES

FIND THEMSELVES IN DIFFICULTIES ➡ PERMEATION OF SO MUCH

DESIGN THEORY ➡ CAME TO EXISTANCE THE ATTITUDE ¦ "EXPERT-

KNOWS-BEST" ➡ EXAMPLE : **DISNEY WORLD** (FLORIDA),

PLANNED WITH METICULOUS PRECISION ➡ "THE WORKERS" AND "THE PAYING

CONSUMERS ARE CONTROLLED AS DISNEY WANTED ➡ REPRESENTED

THE MOST COMPREHENSIVE APPLICATION OF QUEUING THEORY ANYWHERE

IN THE WORLD ➡ WANTS TO TELL PEOPLE HOW THEY "SHOULD" LIVE :

IT REPRESENTS THE MOST COMPLETE REALIZATION
OF FIRST-GENERATION DESIGN METHODS APPLIED
TO THE BUILT ENVIRONMENT ...

Horst Rittel, some 10 years after the first major publications said : FIRST-GENERATION
APPROACH SEEMED TO HAVE DIED ...THE WHOLE THING WAS A TERRIBLE MISTAKE.

Fig.14

THE EXISTENTIALISTS ⟺ A MARXIST-EXISTENTIALIST VIEW

INDIVIDUAL'S RESPONSE TO HIS ENVIRONMENT → FEELING AND FREE TO MANIPULATE IT AS HE FELT NECESSARY

RICHER AND MORE PROFOUND WAYS OF BEING "HUMAN" ← REQUIRE READING IN ACTIVIST CIRCLES ← DREW HEAVILY ON THE LITERATURE

DEEP INDIRECT, UNPLEASANT EFFECT ON THE PIONEERS OF DESIGN METHOD

INTERESTED PARTIES BROUGHT, AND KEPT, TOGETHER, SOMETIMES FOR WEEKS IF NECESSARY, UNTIL THEY HAVE TRASHED OUT A SOLUTION AMONG THEMSELVES

ADVOCACY PLANNING (DAVIDOFF, 1965)

CITEZEN-PARTICIPATION (BURKE, 1968)

CHARETTE (SHELTON, 1971)

TO SEE INCREASINGLY DESIGNERS WHO DON'T WANT TO MAKE DESIGN DECISIONS, WHO BELIVE, AT MOST, THAT THEIR TASK IS TO ENCOURAGE OTHER PEOPLE TO DETERMINE WHAT THEY THEMSELVES WANT

LEADING TO A SECOND GENERATION OF DESIGN METHODS

⟪SECOND GENERATION DESIGN METHODS⟫

AS SUGGESTED BY HORST RITTEL (1972) ⟶ PREMISES OF SECOND GENERATION OF DESIGN METHODS ⟶ THE ASSUMPTION THAT THE EXPERTISE IS DISTRIBUTED ...ALL OVER THE PARTICIPANTS ...NOBODY HAS ANY JUSTIFICATION IN CLAIMING HIS KNOWLEDGE TO BE SUPERIOR TO ANYONE ELSE'S ⟶ THIS IS CALLED "SYMMETRY OF IGNORANCE" ⟶ THE ARGUMENTATIVE STRUCTURE OF PLANNING PROCESS ⟶ ACT OF DESIGNING ⟶ MAKING UP ONE'S MIND IN FAVOUR OF OR AGAINST VARIOUS POSITIONS ON EACH ISSUE ⟶ HEALING SEPARATION BETWEEN THE EXPERT AND THE CLIENT ⟶ LOOKED MORE IMPRESSIVE THAN FIRST GENERATION ⟶ BUT PARTICIPATION WORKS IN AT LEAST THE DELAY ⟶ BUT THERE IS ALWAYS A FRAMEWORK SET UP BY AN EXPERT (e.g. ARCHITECT) ⟶ THE RESULTANT BUILDINGS HAS A RANDOM APPEARANCE EXPRESSES THE IDEAL OF PARTICIPATION ⟶ AT BEST THEY MAY IDENTIFY A "HIGHEST COMMON FACTOR" OF USER NEEDS ⟶ BUT ONCE A CONJECTURES AND REFUTATIONS APPROACH WERE ADOPTED THEN THERE IS NO SYMMETRY OF IGNORANCE ...

" Rittel's second generation of DESIGN METHODS IS NOW GIVING WAY TO A THIRD WHICH TAKES A POPPERIAN VIEW OF DESIGNING WHILST (1963) RECOGNIZING THAT WITHIN IT THERE ARE PEOPLE, EXPERTS, WHOSE JOB IT IS TO MAKE THE DESIGN CONJECTURES ... " BROADBENT

ACCORDING TO POPPER : WORTHY PHENOMENA FOUND ⟶ COMMITED HIMSELF TO THEM ⟶ START CONJECTURES ⟶ COLLECT DATA TO SUPPORT IT ⟶ DO NOT JUSTIFY, TEST RIGOROUSLY ⟶ DISPROVE IF YOU CAN ⟶ ENCOURAGE OTHERS TO DO THE SAME, IF SURVIVE ⟶ HOLD THEM

1. "the argumentative nature of the planning process";

2. "no limited action can be worthwhile because society is totally corrupt; only revolution can solve any particular problem";

3. "the arguments used, should be as 'transparent' as possible";

4. is "the principle of objectification.. the process of design must not only be transparent, it must be recorded, given propositional form made part of Popper's 'third world'";

5. "is that the delegation of judgement to the professional designer should be minimised";

6. to have "an intractive rather than a reactive model of the design process".

To make both of the two generations work, the ICU-UCI design framework is introduced, bringing the interpretation stage to the understanding stage, which eliminates any mis-readings, mis-testing, or mis-examination of aspects involved with the production of an architectural system. Therefore on this account Popper's view in architecture is found unacceptable because it can be a misleading vehicle for a commercial thinking architect.

When second-generation design methodologists assume the symmetry of ignorance, it is understood that, in fact, they are saying experts need not have formal training. If one is sensitive enough to the issue being tackled, then one can be considered as an expert for having an opinion and

affecting the final product. This applies in architectural production where social factors are important. If a building is designed with so many technical aspects referred to engineers that the layman cannot contribute, then he is not invited to make a contribution. In the case of air-conditioning for example, the layman cannot go far beyond asking for it to be made as safe or as comfortable as possible. He may be able to ask for cost effectiveness or efficiency, but may not be able to go any further, which shows that the expert's contribution is essential.

The term 'symmetry of ignorance' is assumed when the project refers to social matters for which you do not have to be an expert by formal training to make a contribution, the basis of which is knowledge and vigilance towards the matter in question. In considering the political implications of the first and second generation methodologies, it becomes immediately apparent that if experts are regarded as knowing best, they are receiving a licence to do whatever they like the world over.

However, adherence to the systems idea that human resources should be allocated towards the solution of the global whole, means that the experts cannot be given such carte blanche. Any expert's knowledge in social matters can be challenged by society's criteria, so those in the group from the wider society will have the same knowledge. They cannot be ignorant participants attending as witnesses, which was one reason why second generation design did not

work. Another reason was the lack of realisation that if there is no proper thought to the wholeness being created, individual contributions can lead to the creation of in effect, an 'impossible animal', having the legs of say an elephant, head of a horse, back of a camel and so on. Therefore the whole must be considered, and then the individual contributions amalgamated using the abilities of an architect-designer.

10.3. Problem Solvers and the Ingredients of ICU-UCI

The human brain consists of right and left hemispheres. If it can be asserted that 'convergent' people i.e. those with the ability to plan, have trained their left hemispheres, and 'divergent' types, i.e. those with managing ability, have trained their right ones, then problem-solving involves 'planners' and 'managers'. The former make ill-structured problems well-structured, whereas the latter implement the solutions.

Architectural problem-solving methods can be described in a spectrum ranging from an individual's 'traditional method' to a selected number of new systems based on problem-solving methodologies. Since the process of architectural production consists of various stages such as design and construction. Application of different problem-solving methodologies requires a proper knowledge regarding the characteristics of these methods within their own particular spectrum.

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Generally, the beginning of problem-solving is in thinking, and then accordingly, in the making of a decision. This is the most commonly known fact, and indeed the oldest way of processing the solution of a problem. This applies to any individual who is capable of thinking, decision-making, and applying a method based on his interpretation of the problem and the real world, as well as his understanding of the solution and its consequences.

He does this with the possibilities available to him in the real world. Since the process of thinking and decision-making involves self-interactions, therefore a better solution will be achieved if interpretation and understanding can be facilitated by 'better' ways of communication. When the problem is simple and the number of interactions manageable by the individual, then the issue of efficiency in terms of time and the precision of the answer, i.e. the solutions, can be achieved without the use of established methods or man-machine ways of communication. It is then possible to have solutions such as relating to a small building, relying on individual problem-solving, based only on thinking, i.e. manageable, self-interaction decision-making. For complex problems the number of interactions and the need for better registration of interpretations and understandings requires a more scientific process of problem-solving, e.g. system-based methodologies.

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An examination must thus be made of what is involved in different approaches. If for example we have a rational approach, then by examination we will have 'the processes of rigorous analysis'. An empirical approach requires explanation, and a process of imagination is involved. The rational approach may require people who are 'convergers' whereas the empirical approach requires 'divergers'.

As far as creativity is concerned, Broadbent (1973) quotes Paul Valery as having considerable insight in suggesting that a truly creative act needs both.

To achieve productive designing we should combine the result of creative thinking with critical thinking. If a person has a critical personality, as well as a creative one he can be productive in thinking and producing. Valery (1973) envisages the kind of dialogue between two personalities, one creative and the other critical. If the act of designing were to be productive, we have to find some way of combining, or rather alternating two quite distinct kinds of thinking. Two people would be involved, one making up combinations, the other one choices, and if that were so, we would need some means of ensuring that each could contribute what he did best.

A converger can benefit from the mathematics and logic present in the technique of solving problems.

Broadbent has said that the Cartesian method, in fact, is a precise formulation of convergence. Architectural design

is a form of problem-solving in which the aim is not to focus on the process of re-structuring so much as on the solution. It is a mistake to consider the problem and its explanation as the point of focus from which the solution will come later as an inevitable outcome.

Lawson (1980), in referring to problem-solving strategies, sees scientists as problem-focused, and architects as solution-focused. The interesting aspect of Lawson's results was in his analysis of the differences in problem-solving strategies between the two groups. He discovered that in general, scientists were selecting blocks in procedures which were aimed at uncovering the structure of problems (i.e. the 'hidden rule'), whereas the architects aimed at generating a sequence of attempts at high-scoring solutions until one proved acceptable. Broadbent saw Lawson as calling these two different problem-solving strategies 'problem-focused' (scientists) and 'solution-focused' (architects). The implication was that designers' methods were quite different from those of scientists.

A serious point to be mentioned is that any systems methodology in which the language is so mathematical that it is incomprehensible to designers, will be of no benefit to them. When tackling a problem, the architect must have a design framework and methodology which communicates effectively from the designers point of view.

Atkins has suggested that a better understanding of

intuitive design would not only enable appropriate design methods and machine design procedures to be formulated, but that it would inform normal design practice and improve design education.

During problem-solving a few arguments (e.g. needs, necessities, likes, dislikes), are provided from the brief as input, to give a structure of the relationships between them with a symbolic presentation as an outcome. The framework should enable the exploration of the way each argument applies and should allow more information to be included in the process of discovering the inputs required at each stage of the design production.

The result is a hierarchy of the requirements and needs, showing not the importance of levels, but the degree to which a level has more undiscovered arguments or information in it.

P.K. M'Pherson states: "An objective higher in the hierarchy does not imply that it is more important than lower objectives. The higher objectives are generalisations of the value-meaning of the group of objectives that subtend them. The higher the objective in the tree the more abstract and idealistic it is."[63]

For example, a designer who has a brief gets involved in the project, both in and out of the office, which means his mind is busy in a creative capacity, processing many small

decisions to arrive at a wholeness. For that wholeness to be more in tune with what others understand and require, it must pass certain stages of examination to see whether his interpretation is valid and creates an understanding.

That, in fact, is the way interpretation is viewed, which is understanding, with the difference that it is unchallenged. It has not been examined. It hasn't got an assessment mark. Another person may derive a different understanding. If for the same subject the interpretations of two people agree, they have an understanding about the subject. The more people agree, the greater the understanding. A lot of interpretations get lost in the decision-making process by not being registered.

10.4. Understanding and Interpretation:

It is considered that there should be one, unambiguous meaning to be derived from the word 'understanding, representing the stage at which something is evident. If a correct process of realisation occurs in the mind, the result will be the same in anyone's mind, given the same input information. For example, one plus one will equal two in the mind of anyone who can calculate figures. If two people have different types of thinking then the summation of some numbers does not necessarily mean merely their total. With systems thinking two persons will come up with the total, plus something else, which might be different from person to person, and becomes a matter for interpretation. But up to the stage of recognising the

existence of such extra entities, one is in a phase of understanding, which can be presented in black and white. Interpretation can be similarly presented but may not be seen as factual by others unless they learn how they managed to arrive at the 'black and white' stage via the interpreter's point of view.

When such learning between two people is complete, the stage of understanding can be claimed to be established. The difference therefore between understanding and interpretation, is:

1.   the understanding is factual, and

2.   the interpretation is personal.

To turn the 'personal' into the 'factual' a process of teaching and learning with other persons involved is required, which will then result in a consensus of understanding.

An easy way to explain interpretation is to use a television advertisement as an example. Usually the designer of the advertisement allows for only two possible kinds of interpretation. One is for the viewing public, and the other is for legal reasons. That is to say, using still pictures and film presentation, the wording of a short advertisement gives explanations and descriptions and makes promises about the subject of the advertisement, at the end of which a final statement summarises the message. For instance, consider an advertisement for 'Listerine',

which is a breath freshner and germicide for micro-
organisms that cause bad odour in the mouth. The final
sentence, "It takes your breath away", implies that if you
are not careful with it, it is powerful enough to kill you.
The expression is idiomatic. It represents surprise or,
literally, the meaning of "exhileration" which is to lose
your breath in surprise, excitement, thrill, etc. But with
the help of the film and its sequences shown within one
minute, the last sentence gives one the impression that it
kills bad breath, and leaves the user with a fresh and
happy feeling. The designer here reduces the possible
interpretations to two. One encourages the viewer to buy
and the second is a defence alibi if anything injurious
happens to someone using their material. Interpretation is
thus seen as the stages of understanding. When reduced to
only one type of interpretation, a fact is established
which represents understanding. When that stage has not
been reached, and a spectrum of different meanings is
available, the consequence is a likelihood of
uncoordinated, non-united actions. Each person with a
different interpretation will react in a different way.

When a brief is introduced to a design team consisting of
people ranging from the layman to the expert, their
interpretation of the functions, needs and necessitates,
aesthetic aspects, cost and expenditure, maintenance and
materials, quality and quantity, will all be different. As
long as the resulting understandings are not in an agreed

form, they are a result of individual interpretation.

The framework of ICU-UCI brings the vast number of
interpretations into one which is agreed among all
participants. It delivers the understanding by way of
communication, which however, if applied directly to all
group members simultaneously, would result in chaos. Any
item for discussion among the members would create a type
of agreement not fully comprehensible to all, unlike the
greatly enhanced outcome when each individual is allowed
adequate time for such interaction.

Before the team involves itself with communication, each
member can communicate with a machine to reduce the number
of his or her interpretations of any pair of elements
involved in the design production of a total system, to
reach a point of decision, which is the individual's final
understanding at that stage. The communication method
allows this interpretation or stage of understanding to be
registered for further examination by the individual and by
the members of the team. The individual can review his or
her own stages of understanding from his interpretation
indefinitely, subject only to time constraints, until he is
satisfied that there are no other interpretations available
to him while, say, he is considering the connection,
relationship and combination of two elements of a total
system.

The structuring of the relationships in black and white

signals the stage of having an understanding of one's interpretations. If the same happens with other members of the team, it is quite possible to be faced with different answers to the question of how two elements relate. The answers reduce to the elements having a relationship or a state of undecidedness.

All of them are now considerably easier to discuss. When there is disagreement with the expert view, the explanation and learning processes begin. In the learning process, the information about the reason for such an interpretation or decision is revealed. Nobody is forced into changing a decision at such a session. In other words, the learning process extends the cognitive background of the decision-maker, to return at a later date with a different decision, or a clearer point of view in defending the earlier decision.

If he can defend his decision, then he is about to change the point of view of others. On the other hand, if he accepts their view he has moved a stage forward. If he fails to move forward he is in the 'undecided' state, where nobody was able to give an understanding of his interpretation, or bring his interpretation to a stage of understanding. In that case the task of exchanging information and learning will continue.

Here a democratic outcome, as has been said before, is not simply the counting of positive answers against negative

one. The point is that this is a means for an expert to understand a non-expert's view, and for the non-expert to learn what the expert probably thinks is a better view than those of the others.

The ICU-UCI framework gives full rights to the users, and at the same time adequate rights to the practitioner, which in this respect is the architect. As stated previously in the example of the violinist who must be allowed to choose his instrument and play, the architect needs similar rights before embarking on creating a building.

In the first generation design methods what is done after getting the agreement of the client is the production of a design for which there is a difference of understanding between the first agreement and the plans and elevations, etc., that are being presented. If the client is not able to read the plans, elevations and sections, then his final judgement can only be after he actually sees the building, which is, of course, too late if the building is not as he required.

A model could have been provided before the actual decision to build and can be helpful, but most of the time it only shows the outside. Although model makers can produce high-standard models whose interiors can be viewed using special cameras, an expert eye is still required to understand if a model is capable of answering the requirements.

The professionals in a design team may find a model very

helpful, but laymen would only consider the appearance, which depends on the materials available in the model market, and which are radically different from those in a real building. The model has to show, for example, which parts are concrete, using say, a particular kind of paper or spray colour, and scale is also an important consideration. Even then, the environment has to be considered. A high quality model always helps to achieve a better understanding.

But there are other things which are important before a model is viewed to see if the designer has the kind of thinking which generally agrees with that of the client with regard to the problems, aims and objectives as well as to see if he is practising his thinking correctly. These are important considerations. If they are fulfilled his e.g. model will enable you to participate better i.e. to come to a better understanding whenever the model is appropriate to the designer's requirements.

10.4.1. What is ISM? Communication:

ISM is a problem-solving methodology which can be selected for use with the ICU-UCI design framework. ISM is a powerful new mthodology which has its roots in the past. Warfield (1984) has said that the ISM process was an outgrowth of an historical sequence of developments that might have been thought to have begun with the idea of syllogism, developed as a way for deductive logic by

Aristotle (ca 384-322 BC).

A problem in decision-making, in which our decisions are questioned by those who have to live with the consequences of them, presents in itself a problem which needs to be solved. If the number of elements involved goes beyond the ability of an individual to remember and handle the related information conveniently and effectively, then a state of complexity exists. This concerns the unpredictability and probabilities involved, the consequences of our decisions, and the users' reaction to them.

To facilitate our decisions regarding the relationships of the elements, the priorities, etc., we need to structure them in a manner presentable to others. ISM can help to do this structuring. Olsen (1973) said that Interpretive Structural Modelling was a computer-assisted interactive learning process whereby complex issue or problems might be organised.

This ultimately puts the designer in a better position to deal with the problem. It requires a clear statement, and a clear decision regarding the relationship of the elements to each other, as far as the designer's involvement in interpreting the relationships. When an example of the work is a small project, he might be able to work out on his hands the interactions by relying on his memory. But as the number of elements and size and complexity of the work increase, management of the information requires the

use of a machine, i.e. a computer.

The software (ISM) uses logical language, seeing the problem as a simple series of 'yes' or 'no' answers, which helps the architect to organise his mind and to limit a 'wild-and-free' use of his imagination. As we enjoy free use of the imagination, we here introduce a manner of work in which the architect is very free but can make logical decisions about the whole, and synthesise the elements to be fed to the computer in a detailed and analytical way.

This means that if the complex architectural system is given as a brief of about fifty pages, identifying about one hundred objectives and a thousand elements needed to achieve its production, then lists of objectives and elements can be stored in the computer. The computer presents pairs of elements, and queries requiring 'yes' or 'no' answers e.g. objective M helps to achieve objective N, is room T connected to room S. In this respect the computer performs analytical work for the architect.

It poses questions about the structure, and the designer with an interpretation of the future whole is free to state his decisions about the questions. He is therefore dealing with the complexity and synthesising the structure, and giving answers while having the function in mind. He is also thinking vaguely of the whole, and answering with regard to his interpretation of the work. After this, he will have a structure which is one of many required to

create the whole. The first person to learn whether what he sees is legal, logical and acceptable is the design architect himself. He can make his first corrections without needing to think of the whole, which otherwise could limit his progress and ability to solve the problems freely and responsibly.

It would not put him in any position in which he would say "This is not important enough to deal with now", regarding his decision about the connections or relationships and arrangements of the elements. The structured map of interpretations then goes to the client. The advice to the client is to carry out the same procedure on his own for constructing the same map for himself, as a basis for comparison with the one from the architect.

This comparison begins the first stage of learning, leading to an understanding. Learning brings about all the necessary modifications and corrections which help to avoid problematical situations in the future. This process continues until both sides consider that the lexicom between them remains unique and established, i.e. they understand each other. They then have a proven arrangement, and there will be nothing hidden in the goals, aims, relations, needs and necessities and so on.

Whatever was intuitive for them before now becomes clearly interpreted in the same way. ISM software, that is logical language program or any such program which requires 'yes'

or 'no' responses to questions, can therefore be used. The reason for that is clear. Computer-aided design has been available in the field of architecture for over 10 years, but is still little used, since today's architect finds it in a way difficult to learn, and dislikes using computer keyboards. This is a consequence of his education, and means he has to recruit the services of other technicians for jobs needing Computer-aided Design (CAD). The architect also does not enjoy designing with a computer 'mouse' instead of a pencil and pen. It may be enjoyable for experimental work but he can only function properly when a digital pen is used to register his traditional means of communication in the design-decision process by computer, at every level of architectural design work.

An important question is, 'why bother with CAD?' The profession has its own way of communication in which CAD can be regarded as no more than an aid. But language and interpretation in communication is a difficult matter. When there is much to interpret, the only way to reduce the problem with a computer without resorting to extensive keyboard input, is through a program such as ISM, allowing the registration of interpretations and communications, which is the most important aspect of the production process in architectural systems.

10.5. Towards Consensus and the ICU-UCI:

When interpretations are registered in some way, a map can be obtained of the background knowledge and cognitive

understanding regarding the problem. When more information is obtained through communication with others and from the literature, then one can return to see if the interpretations e.g. from the brief are correct. By so doing, increased knowledge is gained about the interpretation, and the possibility of miscalculation is minimised.

The point is that if the architect can come to an understanding with the user and others, there will be no need for him to conduct or attend tutorial sessions that are a typical requirement of second generation design methodologies.

There may be some architects who, regarding themselves as experts, want no involvement with non-architects. There may also be non-architects who claim the right to make all the decisions, to the total exclusion of architects, who are thus ignored in the symmetry of ignorance among members of a team.

These approaches are not felt to be feasible. The most effective attitude is to accept, and give responsibility to, the architect as a responsible person for the creation of the product, and then to enable him through some suitable framework to examine his interpretation and reach an understanding first with himself, then to present that understanding to others. They too, have the right to exercise the same procedure, or use other methods, and

having produced a written, structured map, have a sound basis for learning, and for processing the work to achieve a consensus of agreement.

This concept is felt to be rather ill-conceived as an approach to problem-solving. Responsibility should be given to those who have had and/or willing to have practice throughout their careers. If their experience is inadequate, that must be rectified. As has been mentioned in the case of architectural education, systems thinking enables schools to approach the problems more effectively. Placing systems thinking against commercial thinking highlights the differences between the two. With commercial thinking the aim is a beneficial outcome of an investment. Systems thinking is about the hierarchical relationships among the parts of the whole project, and recognises that every element in the total complex has its own role as a little system in itself - a sub-system. It is not possible therefore to accept a criterion which satisfies some parts of the system while ignoring others or ignoring the total.

An appreciation of that kind of responsibility, coupled with a professionally conscientious commitment, eliminates any tendency to arrogance towards the public, i.e. the users. The symmetry of ignorance is felt to be simply a message of dissatisfaction with the architect's dominant role. In tackling architectural problems, another approach

is to make the public aware of the role of the leading architect which sometimes happens to be 'mis-leading architect', for we must accept that no-one should be a dominating leader of others. The only leadership is in the process of learning the experiences, and their methods of work, for there are no unique methods. It is known that there are many cognition processes that go into a design decision, and it is hoped that ICU-UCI will take some of them from the 'black-box' - 'dark' part of the architect's mind - into a more transparent box as it were.

It has been suggested that problem-solving is a matter of planning, and condition correcting a matter of implementation. A great deal of planning or problem-solving consists of re-defining the goals which are to be implemented in condition-correcting.

10.6. Questions Raised During Preparation of the ICU-UCI:

In preparing an introduction for the generation of this design framework the following questions were considered.

1. Why differentiate between framework and method?
2. Why generate a design framework?
3. How to respect an Architect's rights and freedom?

10.6.1. Why Differentiate Between Framework and Method?

One might assume that the generation of a design framework equals the generation of a design method. Although in the final analysis one leads to the other, the reason is that the method has not yet been evolved. Checkland [1981] when

referring to his own research project said that after ten
years of applying his method to different areas, he was
still learning how it worked and how it could be improved.
It is too soon to present the proposed framework as a
design method and, for the same reason, too soon to ask
other people to refer to it as such. Therefore it is a
design framework and with use and experience will one day
become the background resource by which it can be
introduced as an established method.

10.6.2. Why Generate a Design Framework?

It was already concluded that it is almost impossible to
imagine architects as being united, but the architects'
performance and the bias in society can be generally seen
in two ways. In one sense, architects, whatever their
background and regardless of their social class, try to be
supportive of the masses. In another sense there are
individualistic fame-seeking architects or those who want
to become architects in the heroic mould, which is how they
wish to function. Perhaps this slightly over-states the
case, but it indicates the prevailing atmosphere in modern
and/or contemporary architectural circles.

One group tells you how you should live. It designs, and
you are required to accept its special arrangement, upon
which your own way of life depends. You are forced to
accept the group's particular attitude. The other group
says people must be considered, and allowed to say how they

want to live to the extent of ignoring expert knowledge and let people have an equal say in design and in making choices.

It is claimed that there are examples of people's participation to the exclusion of expert knowledge which has resulted in buildings of failed participatory design.

Can the whole be compromised for the sake of participation? A production team comprises designers, engineers, other experts, users and clients. These participants will not have the same background knowledge and sensitivity to solve the problem, and their contributions will not be equal. Therefore there has to be a way of finding out how much, for instance, the user can contribute and how far experts can be urged to modify their own likes and dislikes to meet the needs and necessities of the users.

In the second generation of design method all the participants were asked what they liked and what they wanted. If one said, for instance, I want a red wall, one said I want a green floor and one said a blue door, each was allowed to make a contribution while the architect was not able to see the whole product. In other words the whole product was compromised for the sake of the elements submitted by the participants because they were contributing, whereas no one was responsible for the final whole. The one who had to combine them simply facilitated the joining of all the elements to produce a whole, which in fact is not what any expert can expect of a proper

system.

Generation of a design framework such as ICU-UCI can improve second generation methods, which thus need not be dismissed, and support first generation methods without bowing to the designer. This dictatorship over other people's lives is a key to third generation design methods and is an extremely important conclusion for this project. So, the important element for the third generation is to bring understanding, interpretation and a way of proper communication.

10.6.3. How to Respect an Architect's Rights and Freedom?

This requires systems thinking which is regarded as synthesis, as opposed to analysis, i.e. structural modelling of the individual's architectural interpretations. Although this is possible by using, e.g. the ISM package but the one which is felt to be more appropriate needs to be programmed to be three-dimensional (interpretive structural modelling) usable in all the stages of the design. In other words one full package which can be used for a future development. For the present an ISM can be referred to as the one which has been practised on for some time.

The reason for this framework is to protect architecture from the possibility of losing its autonomy. Consider architecture as a profession like that of a violinist in music. In order to hear a violinist performing he must be

allowed to pick up his instrument and play. One way of judging that he is not playing well is that he loses the attention and interest of his audience.

An architect however must be stopped from producing an unsatisfactory building which can cause problems for users in any society. However, the rights of the users must not become so dominant that the architect loses freedom of expression in his profession. Systems thinking must enhance conscientiousness in any architect while he is being educated in architecture. He has to think of a greater whole, a wider system, which is what systems thinking enables him to achieve, even when he is tackling a problem at local level. In other words he will not be expected to do things out of his or his employer's personal preferences.

He places a higher priority on those things that are part of the needs and necessities of the greatest number of people. He is an architect whose thinking is based on a world vision, an internationalist way of thinking. An architect of this type should not be impeded in practising his profession as a result of pressure from the future users of his creation.

The ICU-UCI framework allows the architect, while practising his profession, to present his ideas for others to examine and decide whether or not he is practising correctly.

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To recapitulate, the ICU-UCI acronym represents two phases. The first, 'I see you' meaning 'I can read you and all the dark sides of your brain by way of actually judging on the map your structure, based on your decisions'. That is enough to judge whether the trail of thought is as it should be, and if so, you also have freedom to use your creativity. Otherwise non-architects will stop the person from giving free rein to his imagination. The second part of the acronym - UCI - is the same process in the reverse direction, (with a poetic license, since 'you see I' strictly speaking might only be acceptable as a phrase in say, rural Norfolk, equating to 'you see me').

Suppose 'Tofigh' is the designer and 'Philip' is the one who is going to criticise him or work with him by offering constructive criticism. Then when Tofigh wants to ascertain Philip's requirements, he brings his results on a map and offers them to Philip who corrects them and argues about the things he does not agree with. Tofigh is thus able to 'see' Philip, i.e. each is able to 'see' the other, and Tofigh's interpretation of Philip's requirements, through an effective means of communication becomes, in black and white, his understanding of the requirements.

Then comes Philip's judgment, where he makes an interpretation of Tofigh's understanding, and through the same channel of communication creates another area of interpretation for Tofigh. The process is repeated between

interpretation and understanding, until both sides reach one understanding which forms a sound basis for making further decisions, leading to a structure.

10.7. What is the Remaining Complexity in the Design of Architectural Systems?

The design of a system, whether it is of technological or social nature, can be viewed as a problem-solving process. Architecture as a product is a wider system which contains both technological and social aspects. The problem perhaps is the interaction of the two, and probably the interaction of more aspects. Even if the technological problems are solved, the solution for the social aspects cannot be final. The complexity that remains is a matter that can be tackled at the appropriate moment. The design of an architectural system therefore is an amalgamation of social, technological and environmetnal issues and the problems associated with each.

The architect of the present day has different functions, so the responsibilities of schools of architecture are different now from those of the past. An institution may retain criteria that were set half a century or even a century ago, in that an architect is considered as one who can, for example, build a house. This understanding is not adequate today.

Some present-day architects may not even know what current building materials look like, or what they are. They read

about them, know their specifications, and have an idea of
their texture, resistance and so on, and are expected to be
knowledgeable about all of them. This assumption is wrong.
If the public is unaware of this situation, then they do
not know what is involved in the making of a piece of
architecture.

In general, the unjust nature of the criticism of the work
of the architect was a primary motive for the creation of
the ICU-UCI framework. The aim in the project from the
start was to give the design architet a chance to improve
communication between him and the team, and with others
involved in the design process.

For the production of each stage of the whole project there
exist consensus methodologies from which project
facilitators can benefit, and with which the whole project
can be run. The architect needs a design framework from
which he can sort out his own self-interaction problems,
which is where ICU-UCI comes in.

There is no need for an imaginary project discussing ICU-
UCI. The ingredients of ICU-UCI, i.e. interpretation,
understanding and communication, can always be explained
and were already discussed with short examples, placing the
emphasis on persuading others to see the key problem in the
architect's relationship with others, which is the way in
which the interpretation process happens.

Problems are created by wrong or crude interpretations.

When we process our interpretations of a brief we should be able to structure them clearly, and to be able to ask ourselves at a later date if we agree with them, or ask others if they can accept them as the basis for further graphical work.

If the individual can come to some understanding, as for instance through self-criticism, arriving at one version of all the differing interpretations, the result is presentable to others by means of a communication method e.g. such as previously mentioned Interpretive Structural Modelling (ISM).

10.8. Role of Future Designer and Third Generation Design Groups:

The question has been posed regarding whether or not we are now entering a post-industrial society, and whether we are now in need of a post-industrial design process. The suggested conclusion is that our views of the future role of designers are inevitably linked to the kind of direction in which we wish society to go. The important question of who should be guiding the direction taken by designers in society raises broadly, three issues. In the first, a conservative role is envisaged for the designer, centreed around the continued dominance of the professional institutions. In such a role the designer remains unconnected with either clients or builders and is following a design process consistent with first generation methods. In them he is more under the dominance of his

employer, who is under the dominance of professional institutions. For instance if he is to satisfy RIBA (the professional institution of the United Kingdom), then those working for him have to satisfy RIBA's criteria, even when such criteria go against the interests of the users, clients or those who are to implement the work. The designer produces stages of the work and may know nothing of the executing part of the work or of complaints about it by users.

The second type of role is different in that it is more within the second generation of design methods. It has been said that the opposite to the conservative approach is actively to seek changes to society which would result in the end of professionalism as we know it. Such a revolutionary approach would lead a designer to associate directly with user groups.

This is not seen as revolutionary, or capable of suppressing the imagination of an architect. If it is assumed that a group of users does not include an architect then there should be a recognition of the fact that they do not have the same level of experience in the use of the imagination. Some of them may well be very imaginative, so they can make a substantial contribution and the symmetry of ignorance assumption in this type of work, with a disregard for professionalism, is unrealistic.

Any unrealistic approach is not based on revolution. It

might be considered as an angry, defensive, or provoked response, but not as revolutionary, in which there is no valid explanation that such an approach will result in a better outcome if change aims to bring improvement. In the second generation of design methods the designer is not an expert and deliberately forsakes his position of independence and power. He no longer sees himself as a leader but more as a campaigner and spokesman, the kind of roles in which it is quite possible for a designer to function.

The role of spokesman requires every decision and requirement to be approached in a strictly sequential, analytical and justified way. A designer who is an effective spokesman has the ability to use his intuition analytically.

Depending on his motivation he can also function as a leader and campaigner. The point is that where arguments embrace social issues any profession must be abandoned or adapted in favour of a campaign. During revolutionary periods in any society, such feelings develop among professionals concerned with the public interest and they may utilise their imaginative experience to co-ordinate their feelings in a powerful way, quite separate from the general public response.

It can be said that the fact that society included such

people was already known by those who first realised that there had to be a change in the process of production. This does not mean that the former designer now spokesman, reverts to designing. He is functioning in a different way to provide different circumstances in which the order and value criteria of the society may favour change. As a designer, in which much is expected from his trained intuition, he is not required to be a spokesman or campaigner. If a designer becomes a campaigner and spokesman and convinces politicians and policy-makers to function to the benefit of the general public, then the social circumstances that influence his profession are such that his conscientious support for the world is not reflected in an increased number of buildings.

His world is then a kind of world resulting in a wider field of imagination, and the recognition of a new whole. In that sense he is a designer who is processing the elements of his speech in the 'right side' of his brain, to create the relational, connectional and organisational existence of the imagination that existed and was created in his statements towards a change for the better.

The third issue raised is a middle path lying between the two extremes of 'conservative' and 'revolutionary' is much more difficult to identify and can only be expressed in vague terms. In this role the designer remains a professionally qualified specialist but tries to involve the users of his design in his thinking process. These

more participatory approaches to design may include a whole range of relatively new techniques from public enquiries through role play and simulation, to computer-aided design procedures. All these techniques embody an attempt on the part of the designer to identify the crucial aspects of the problem, make them explicit, and to suggest alternative courses of action for comment by non-designing participants. Designers following this approach are likely to have abandoned the traditional idea that the individual designer is dominant in the process, but they may still believe that they have specialised decision-making skills to offer.

This is an area where third design generation methods should be considered, entailing a process in which the designer respects his role and asks society to recognise the specialist knowledge he can provide to solve its problems. He is willing, under these circumstances, to stand with the users and let them contribute as much as possible, enabling him to achieve a better outcome. All these are admirable objectives and reasonable requirements, the implementation of which requires researchers in design to introduce methods and frameworks designed to find out if they can be made to work.

The framework being developed in this research fits into this category, in which the designer has a right to his own role with a means of communication enabling him to

understand others, and others to understand him. Third-generation design methods are not an established category but account for anything outside first-generation and second-generation with both designer and public playing their natural roles. The coalition of expert and non-expert leads to a democratic outcome not in the sense of counting 'yesses' and 'noes', but by way of amalgamating in an understandable way the contributions of the participants towards the creation of a whole which functions satisfactorily for a specific period of its life.

This does not mean that the future of that whole will be free from complexities in its own future. The design process is different from the office management process, which in turn is different from that of design management. With reference to human brain activity, the individual carries out the work in the 'dark' part of the brain. Office management is something a competant manager can work out. There is no need to be an architect for that. Finally, the design management process can be done by a designer or architect in a coalition team or when functioning as a facilitator.

These three groups are quite separate and must not be confused with one another. We deal mainly with the design process, not the architectural office management process, and not only with the design management process.

A person working in the ICU-UCI framework is faced with

having to make decisions about the connections between two elements, and making interpretations of their relationships and arrangements. No matter how many such decisions, he should always be thinking of the whole. On this account he can merely introduce the framework. He cannot take an imaginary project - for which a result has already been produced, without having a real-life society by which to judge the outcome. Examination of an issue by society has particular sensitivity because it will be the user of the product. Therefore the presentation of this framework represents an original and valid exercise with respect to what is considered to be the root of the problem, namely the gap between interpretation and understanding. It is also valid because the framework moves towards closing the gap, offering a solution to the problem. The complexity of architectural production in non-social areas can also be dealt with in the same way between the architect and other experts. Every time it is used, the framework brings interpretation closer to the stage of understanding which is the most that can be achieved. The remaining complexities must be dealt with as they arise.

10.9. Conclusion:

There is always variation in the percentage of work load and responsibility that devolves upon the architect. However, what is left nowadays is approximately thirty-five percent of the total project, which indicates that any blame from society should not fall on the architect alone.

There seems to be a general mis-understanding of the design process and a need for clarification of the complexities of following a design process that results in a building as its end product. If such clarification becomes recognised by those judging architecture, there will be further clarification of the architect's responsibility, leading to the establishment of a design board responsible for the outcome, appearing before the name of the architect.

It would be the responsibility of the board to place the architect's work in the process of judgement, assessment and evaluation to achieve a democratic outcome. Another problem in design is how to demonstrate an understanding of the problem and the method of arriving at a democratic outcome in the early stages.

An important stage is that of trying to understand the brief given by the user/clients. The brief is information from which an architect finds out what the client or user's requirements are, in order to discover a solution to them. The brief can be prepared by the client himself, or in conjunction with the architect, or with other people such as users, architectural policy makers, planners and others. Many of the problems actually arise at the briefing stage.

The brief is a list which includes many hidden 'do's and donts', 'wanteds and unwanteds', 'likes and dislikes'. and requirements and specifications. So there is a first stage in which a brief is created by someone who, in this case,

is not the original architect, but the design architect. For the original architect to be involved in the designing of the project, he should first receive the brief. If we assume that the client can be anything from a layman to a specialist again the language between them and consequently the interpretations of the meansings involved in the finding and defining the needs and necessities, likes and dislikes, etc., are another problem area. Whatever the methodology to be used by these people in formulating the brief, when it reaches the original architect it is suggested that he deal with it logically as well as holistically.

Usually after receiving the brief, the architect and/or designer 'lives with it' for some time. He tries to understand it by reading it, classifying it to differing levels of generalisations, importance and priorities. He also works out on paper its formulation and grouping. He registers in this manner his interpretation of the brief to reach a stage of definite understanding.

Whatever he does, he must live with the brief for some time to discover, remember, and register in his mind in a transparently presentable way, his understanding of the objectives which are as yet unknown to himself and others. Even when a detailed brief with all the requirements is provided, there is still a need to examine his interpretation to establish an understanding. This is the situation in which the interpretation of both sides appears

in harmony, and understanding is achieved.

The client here is regarded as the present or future users
or their representative, as well as the actual investors,
policy-makers, planners and all others who are concerned
with the final product.

Regarding the coordination of the activities of all the
involved people, a design framework is needed to help the
architect by reducing his problem of communication, and for
presenting his thoughts and decision processes. To help
him, the framework suggests that he break it down to as
many elements as possible, and into as many objectives as
possible, and as much as he can see and interpret.
Reliance should not be placed on memory for solving the
interactions, or on the ability to memorise them and
therefore decide the order of priorities in this stage of
the work, with the rest being assumed. Areas not important
to the designer would be equally unimportant to others. It
would be better to use another method of remembering and
registering the importance for the relations of these
elements and interpretations of the brief i.e. ICU-UCI.

CHAPTER 11: AN OPERATIONAL FRAMEWORK FOR ICU-UCI

11.1. Introduction

This chapter is designed to explain the steps involved in the operation of an operational framework for 'ICU-UCI' in which the letters I, C and U stand, respectively, for Interpretation, Communication and Understanding.

As mentioned before, the importance of the framework is in relation to the first and second generations design methods. In the first, the expert (in this case the design architect as anexpert) plays a dominant role stating how one should live. In the second generation design method, although the rights of the users are recognised, the role of non-experts seems to be deliberately exaggerated to the extent of assuming a 'symmetry of ignorance' between non-architect and architect, which in reality is non-existent.

The importance of imagination in architecture and impossibility of total optimisation in architectural systems are firmly concluded to be further fundamental bases for ICU-UCI generation.

With regard to further development of 'ICU-UCI', it is also concluded that a progressive, evolutionary implementation of the framework requires a real-world project and a real-work

environment in which the design architect will be motivated either by being paid for his work or participating in useful competition. When such situation is provided in the process of implementation of the framework, the individual designer will be able to provide an interpretative model of his decisions and evaluations in the form of worksheets and maps from his self-interactions during the interpretation processes of the brief and non-architect response to his decisions, regarding the design of a complex multiple objective architectural system, CMOAS. The end result for the design architect will be two-fold. On the one hand, a closed understanding will be established with the language, thought and requirements of the non-architects, eliminating so-called architect dominance. On the other hand will be a democratically produced architecture without ignoring the rights of the architect during the process of synthesising his decisions.

11.2 What is the experiment:

The experiment is to put into practice and test the ICU-UCI design framework in relation to a CMOAS by using SWAP methodology.

The provided CMOAS in the following chapter is of considerable complexity coded as LBR. This architectural scheme, which is in the public domain undergoes scrutiny and

evaluation by at least four sets of protagonists:

1. The Developer initiating the project, seeking buil-
    ding consent and eventual profit;
2. The Architect designing the scheme to meet the
    client's requirements within the constraints of the
    planning and building regulations, and to make
    an appropriate architectural "statement";
3. The Local Government authorities with responsibility
    for planning consent;
4. The Local Community with its aspirations and
    opinions as to the kind of built environment that is
    desirable.

The operational model, based on the author's (as a design
architect) I (interpretations), C (communications) and U
(understandings) has been constructed, by using computer-
aided Systemic Worth Assessment Procedure (SWAP)
methodology.

For the demonstration a simulation team of Design Architect
and Methodology expert has been formed. To act as
Developer, the Architect, the Local Government authorities
and the Local Community the author using his experience as
an architect with the LBR project team, generated the many
kinds of input, each as a step on a round of ICU within the

ICU-UCI framework, necessary to launch a SWAP exercise. The experiment was not meant to provide an authoritative assessment of the LBR scheme. The aim was to demonstrate that ICU-UCI design framework by using existing and/or developing operational methodologies can become an essential method in the design and evaluation of every CMOAS (complex multiple objective architectural systems).

11.3 A Summary of the ICU-UCI:

Chapter 9 covered the emergence of the theory for ICU-UCI design framework based on interpretations of systems thinking, and Chapter 10 covered the generation of a theoretical background for the ICU-UCI.

A summary would be that the ICU-UCI can be thought of as two situations. ICU means: 'I am trying to find out more about your way of thinking or your requirements', or 'I am trying to bring light to all the dark aspects of the brief which I as a design architect will receive from you as a client'. The design architect can consider his employer, i.e. the architect firm, its client, the public and legislators as HIS clients. That is to say he should produce a design not to be in conflict with the objectives of the four parties unless he is instructed to do so. When I, as design architect, succeed I will be able to claim that I indeed -'saw you' ('OU').It means therefore that I then have

established an understanding beyond more interpretation of your requirements, so I now clearly know what the requirements are.'

The second part of the situation, 'UCI', means: I have enabled you, i.e. my client, to see what is going on in my decision processes, i.e. how I am involved in producing an outcome, for example, from the brief given by you, i.e. information collected from my principal architect, his client, local authority and the public about their needs, and objectives. If I succeed, i.e. if I enable you to see me with a proper means of communication, then the probability of a mistake or a disagreement over the final product will be greatly reduced.

'ICU-UCI' enables the establishment of a path from 'I' to 'U', that is, from interpretation to an understanding, which is literally in black and white. It must be mentioned that ICU-UCI is not a framework for groups but for the individual who is specifically regarded as being the design architect. When a problem is a CMOAS the designer who must sort out self-interactions while making decisions, should at the same time have a method of interpretation to allow him to incorporate elements of his own likes and dislikes, for which either of ISM or SWAP methodologies can be used.

11.4: A Summary of ISM?

ISM is an Interpretative Structural Modeling Methodology
which is discussed in Chapter 10, Section 4.1. A summary
would be that ISM is a powerful problem-solving methodology,
developed as a way for deductive logic, to facilitate our
decisions regarding the relationships of the elements, the
priorities, etc., in a structured manner presentable to
others. It is a computer-assisted interactive learning
process whereby complex issues or problems might be
organised. ISM ultimately helps to put the designer in a
better position to deal with the problem. Figure 16 shows
the steps needed to be taken in ISM.

Although with the ICU-UCI both and either of ISM and SWAP
methodologies can be used, but due to the better
availability of SWAP methodology expert, in the following
ICU-UCI experiment in Chapter 12, SWAP is found to be most
satisfactory for the CMOAS exercise of the LBR.

1.5: What is SWAP:

SWAP is an abbreviation for systematic worth assessment
procedure. It is a methodology which provides a framework
that enables the individual decision-maker, e.g. a systems
thinking design architect, to construct a complex
multivariable criterion that meets his perception of the

assessment problem, and allows him to include all the value attributes that ought to be considered as part of the assessment, whether the attributes are hard and countable or soft and only assessable .... The decision-maker, here the design architect, has to end up conducting the assessment in utility space. But if the decision-maker admits that there is more to the problem than direct revenues and costs, then he is already thinking about the overall assessment in terms of a multivariable value space. Utility space gives the decision-maker a framework in which to resolve multicriteria problems with both hard and soft elements, and which is well-defined, easily visualized, and safe. Utility provides a universal "currency" for values. Further extracted reference to SWAP is that it is claimed that the SWAP methodology provides a safe framework for professional decisions and assessments that have to take both tangible and intangible factors seriously into account. Moreover, it gives a highly structured focus to the important new class of trade-offs between tangible business values and intangible values such as arise in architectural system design, engineering design, industrial design and information systems, and also in conflicts between business and environmental, equity and ethical considerations. Further reference to SWAP is in Appendix 4.

1.6: More about CMOAS: CMOAS is an abbreviation for COMPLEX

MULTIPLE OBJECTIVE ARCHITECTURAL SYSTEMS in which C stands

for complexity; MO stands for it being multiple objective

and AS stands for architectural systems.

In the previous chapters Complexity and CMOAS have been

discussed in various stages. In this chapter it is felt

necessary to summarise as follows: The conclusion so far is

that any building can be known as an architectural system.

In every day communication the words 'complexity' and

'complex' are used without qualification, limit, hesitation,

or regard for their precise meanings. The reason lies in

the nature of the layman's emotional reaction to a static

structure or the way in which the dynamic behaviour of a

'thing' acts upon him as a stimulus. The character of his

response varies according to his experience, background

knowledge and ability to analyse intuitively, particularly

in relation to the 'thing'. Considering a variation in the

response, he may, out of habit, use the words 'complexity'

and 'complex' when in reality he means 'difficulty' and

'difficult'. This leads to the fact that the design of any

building can subjectively become a complex problem to the

designer, but objectively it might be only a difficult

problem.

'Complexity' and 'complex' are loaded words in the lexicon

of systems theory for which accurate definitions are

required for their use within a system, to achieve complete-
ness, connectivity, to preserve character and to resolve or
avoid conflicts.

The first point is that, in a CMOAS, a 'CMO' (complex
multiple objective) relation can always be analysed into
pairs of relata, while an 'AS' (architectural system) cannot
be thus analysed. The second point is the 'AS' is not a
complex relation, unless it is meant to be.

There is always remaining 'complexity' in any architectural
system which refers to the states in which the result of the
outcomes of the long term and total relationship between an
'AS' and the users' response and behaviour is considered to
be unpredictable, counterintuitive, or complicated, or the
like.

If an architectural system is big, complexity is expected to
arise and is extended to include the social expectations.
If a unit of an 'AS', e.g. a small flat, cannot satisfy the
user, then complexity is evident. If the number of elements
involved in the design of an architectural system goes
beyond the ability of an individual to remember and handle
the related information conveniently and effectively, then a
state of complexity exists. Since the unpredictability and
probabilities involved, the consequences of our decisions,
and the users' reaction to them leads to the fact that

complexity exists in all buildings and the function of a
design framework has to aim to eliminate that.

When the required architectural system is big, the number of
different functions associated with it suggests that it is a
difficult building to construct which involves contributions
from many different experts in which a design architect is
expected to play the important role.

The summary is that:

An architectural system is a CMOAS when and/or if it:
a) involves many sub-systems in which they require to appear
   as a whole a larger 'AS'.
b) requires a larger quantity of data which is expected from
   the experts and laymen including client, architect,
   public and legislator.
c) spans many disciplines and professions.
d) is a large scale architectural system.
e) can have political consequences.
f) based on the solutions from larger number of ideas and
   alternatives out-come of interactions.

g) success or failure of the future of it is not predictable
   in full due to the response of future users.
And an architectural system can become a Complex Archi-
tectural System when and/or if:

a) it is beyond the design architect's ability to sort out

interactions.

b) it is unknown and/or unique problem for the design
   architect.

c) it is a means of investment rather than a goal of
   investment.

d) there is no written brief for a large scale development.

e) there is conflict between client's and legislator's
   objectives.

f) there is possibility of a change in the pattern of type
   and political vote of local population.

g) there is no expert knowledgeable about the total problem
   area.

11.7: How the test is conducted:

The test is conducted by considering a CMOAS project known
as LBR, which were designed under the following conditions:

a) without regard to its complexity, so it was over
   simplified.

b) without regard to the interactions between the objectives
   of client, architect, public and legislator, so it had no
   structured model of priorities and the weights of
   objectives importance.

c) without regard to criteria for judgement other than
   client/architect agreement, so it had no consensus agree-
   ment over criteria for the project assessment.

d) without regard to constraints, rules and regulations set

by legislators and required by public, so it had no utility function value for its oppositions.

e) without regard to any methodological aids that can support the thinking process of the design architect, so it had no sequential progress towards consensus agreement other than the one might have been obtained as a result of trial and error policy with Popperian like design method.

The selected CMOAS is a mixed large scale architectural development scheme of over one million square feet buildings, in North Kensington, London. It is referred to as LBR and submitted for full planning permission in summer 1989.

By using the SWAP methodology, the outcome result will show why the scheme has not received its planning permission and what further consideration from design architect will be required to set the boundaries for his design outcome. This would be a proof of progress towards the final outcome design within the framework of ICU-UCI.

In this test of LBR CMOAS relevant information which was collected in over 16 months, during the author's communications as design architect within the LBR design team as well as architects communications with client, Local authority, public and other related organisations, has care-

fully been studied by the author. This, in fact, formed

stages of ICU-UCI without any use of computer. Some of this

information was in the form of the submitted drawings to

Local Government Planning Authorities, and some literature

from district plan of Royal Borough of Kensington and

Chelsea, and the rest from the available information which

was given during the project development and some from rele-

vant technical texts, statements, background information and

reports.

Having done that, a summary of LBR CMOAS were formed and a

short list of 111 objectives were identified.

Objectives of client and architect appeared to be on the

same side and legislators' and public's objectives on the

other side. From the both sides some of the objectives

appeared to be in support of each other and some in conflict

with one another, i.e. the Developer and Architect formed

the same perspective and the Local Authority and Public

formed another perspective.

Further analyses were carried out and this time 12 objec-

tives for each interested parties were given higher

priorities and presented separately by giving each list

order number of importance. That is to say that, for

example, objective no. 2 is more important to achieve than

objective no. 5 in any list of the 4 x 12 objective lists.

Up to this stage the design architect, within the ICU-UCI
design framework can find himself capable of doing the
analysis without so much difficulties for sorting out the
interactions of the objectives. Although some further
analysis could still be carried out but it is preferred that
either ISM or SWAP methodologies are used to find out the
mismatch between the objectives in the submitted scheme of
summer 1989 for planning permission and to demonstrate by
way of using computer, why the scheme has not yet been
granted a planning permission.

For the demonstration of an operational model the author
and his supervisor formed a team, similar to the one
mentioned in Chapter 10, section 6.3, to simulate a
decision-maker, a design architect, a methodology expert and
design architect team to fulfil various levels of ICU to
provide necessary information and decisions for the SWAP
exercise. These results which were ICUs within the
framework of ICU-UCI is found in this "Test" extremely
satisfactory and final which it provides information for
further ICU-UCI running if the consensus need to be
established to provide, for the design architect, a
successful move from 'I' to 'U' enabling the new design of
this CMOAS to be successful.

11.8 Relationship Between CMOAS/ICU-UCI and ISM/SWAP:

In the process of producing an architectural system (see figure 7 page 59a) it is necessary to remind that the whole organisation of the production is not the responsibility of the design architect. The designer who benefits from ICU-UCI framework is not obliged to use the process with a group. The following flowchart of CMOAS/ICU-UCI is to show where exactly the role of a Systems Thinking Design Architect begins and how the cycles of his ICUs produce UCIs, leading to a CMOAS design solution for submission to planning authorities. It shows where he can use ISM or SWAP to establish with confidence that his ICUs are to produce an overall worth of CMOAS of over 0.50 within SWAP way of evaluation. The flowchart also shows the process of design-production before and after the role of the designer begins and ends.

With respect to the current distribution of an architect's time at work (see figure 8, page 59b) ICU-UCI framework is and can be operational even up to the detail design stage. That is to say, between 13 to 62% of the design production work. Although in a well-established architectural office every stage may be followed according to the flowchart of CMOAS/ICU-UCI plan of work (fig. 15), the same may not apply in a small office with say, one architect and one assistant. But when a design architect involves himself with a problem and searches for a solution, the ICU-UCI process can be more or less the same for all systems thinking design architects.

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If such a designer, after conceiving a problem, is expected to apply thought, then he should use some kind of methodology to come to a solution. That methodology is either the way he designs, or is one borrowed from another mathematical discipline, etc. It all depends on (1) the scale of the job, (2) the ability of the architect to understand the use of the methodology, and (3) the time available for him to see whether he can apply all the available technology and all means to achieve the most desirable solution.

When a possible solution is found, the question 'can this design/ICU be improved' is posed. If the answer is 'no', then that is the end of that stage, i.e. the outcome is final. If the answer is 'yes', then the solution has to be improved and the question repeated until the answer is 'no'. But if the answer is 'do not know', then the designer needs to use a methodology such as SWAP (see fig. 17) to enable him to establish overall worth for his decisions. The value number obtained in this way will help to clarify a decision.

From the selected designer (see fig. 15) receiving a briefing to doing all the research getting background information and analysing and choosing all the relevant information, there is a point at which he pauses and designs with a new cognitive map of himself. At that stage his past experience, education, state of health and knowledge of the brief in hand and of the characteristics of users, are brought to bear, all of which will guide him into drawing the lines which represent a solution.

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That is the creative part of the work. Creativity depends very much on motivation and the designer's ability to concentrate. It has been claimed that ICU-UCI provides both concentration and motivation. Concentration is provided by considering at every step of design and decision-making only pairs of elements relationship, and motivation is provided by the possibility of being free of complexity while synthesising the elements of a complex multiple objective architectural system (CMOAS). Such motivation provides the drive to think of new ideas.

The flowcharts (fig. 15,16,17) which include all the stages needed to move from a "START" to an "END", up to the stage of DETAIL DESIGN (see fig. 7) show the relationship between CMOAS/ICU-UCI and ISM/SWAP. The use of the flowcharts demand a clear understanding of the true nature of the design problem, role of systems thinking design architect and the application of the methodologies. They show all the necessary steps needed to be taken by the problem owner, problem solver, solution creator and solution evaluator.

Figure 15, the flowchart of CMOAS/ICU-UCI, in which from the start, i.e., the stage of "PRESENT STATE" to the stage of "BRIEFING", the process is a group activity in which the problem owner, i.e. the client, plays the key role in making decisions. If during this part of the work, ISM/SWAP is used the "SELECTED DESIGNER", i.e. solution creator, need not be involved. It is, in fact, a combination of activities by the team of problem owners, problem solvers and solution evaluators. It is to

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provide necessary background information to find out if the project is a CMOAS. At this part, when ISM/SWAP is used, it can not be considered as part of ICU-UCI. It is an independent consideration in which either flowchart of ISM (Fig. 16) or flowchart of SWAP (Fig. 17) need to be followed up.

From the stage of "BRIEFING" to the stage of "SELECTED DESIGNER" (Fig. 15) the problem solver, i.e. the architect's office, establish whether the project is a CMOAS, can use ISM with regard to CMOAS criteria to overcome the problem of decision-making for selection of the solution creator. If the project is found to be a CMOAS, then the solution creator will be a Systems Thinking Design Architect. If he also finds the project as a CMOAS, then he will be in the situation of ICU-UCI activities, which involve analysis, synthesis and communications. He will use ISM for priority ordering and objectives synthesising, etc. When he finds himself unable to interpret the overall worth of his ICUs he will use SWAP to base his decision on the numerical value given to his interpretations by himself. Of course, the number will only help to see the degree of mismatch or harmony of overall worth of SWAP is a guide for better understanding only. In other words, the number by further communications between the designer and "OTHERS", he will have new interpretations which can effect the numerical value of the overall worth of the CMOAS when using SWAP.

In this part of the flowchart of CMOAS/ICU-UCI most of the design cycle or spiral will be established due to the feedback from communication of the designer with others. Each cycle represents one round of ICU-UCI and will benefit from either ISM or SWAP. When the project continued to the stage of submission for planning permission to planning authorities, the system thinking design architect must believe that his creative solution has overall worth of over 0.50 within the framework of the Systemic Worth Assessment Procedure.

From that stage of submission to planning authorities, the process of ICU-UCI of the designer will almost be stopped. But the solution evaluators, i.e. the planning authorities, by using SWAP methodology can establish their own overall worth of the submitted CMOAS. For their purpose, although ISM can also be found useful, but since they would prefer to factualize their evaluations, the SWAP methodology will certainly and obviously benefit the better. It also can be useful for further communication with the architect's office. In other words, if planning permission is not granted by the planning authorities due to their overall worth of the CMOAS of less than 0.51, for the CMOAS under consideration, then the designer can appeal to the authorities to compare his overall worth of the CMOAS of over 0.50 with their overall worth of less than 0.51. This will lead to the final part of the CMOAS/ICU-UCI flowchart in which the stage of "APPEAL BASED ON SWAP OVERALL WORTH OF THE DESIGNER'S AND THE AUTHORITIES" begins to operate. At this stage ICU-UCI will be again become more active in the hope to close the gap

between the overall worth of the two sides, i.e. the planning authorities and the designer.

One key aspect, is to realize that the flowchart shows that ICU-UCI is only used and referred to by the designer. Although every outcome of ICU-UCI will be seen as a design cycle for "OTHERS", but for the designer who never returns to "square one" the cycles represent a spiral progress.

During ICU-UCI cycles, neither the principal architects nor "others" can have any control over the designer. He is very free and responsible in every communication with "OTHERS" to lead his own "I" to "U" and from "U" to "I". This will help him for a better creative outcome. There is no doubt that successful design management will have useful contributions to the effectiveness of the framework. But irrespective of the design management, the progress for the designer is provided by the fact that each time he communicates a stage, he will progress towards better understanding (U). In other words, with every design decision, there is an evaluation process for him. That is why when his overall worth for the submitted CMOAS to planning authorities becomes over 0.50 he can confidently assume that he has an evaluated solution capable of satisfying over 50% of the "OTHERS".

Although the time factor is a very important consideration that modifies the scale of communication to constrain it to a feasible level, it must be understood when a project is a CMOAS it

requires that *enough time be given to each of the four parties*
involved with the operation of the flowchart of CMOAS/ICU-UCI to
produce a satisfactory outcome, i.e. problem owner, problem
solver, solution creator and solution evaluator.

CHAPTER 12: THE APPLICATION OF THE ICU-UCI FRAMEWORK TO A REAL CASE OF ARCHITECTURAL COMPLEXITY - A CMOAS

Chapter 12: The Application of the ICU-UCI Framework to a
        Real Case of Architectural Complexity - a
        CMOAS

12.1: The Selected CMOAS : Code name L.B.R.

LBR is the proposal for the regeneration of a large site in
North Kensington, London W10.

Information on the planning application to Kensington and
Chelsea Council shows:

A. The Site

a) The total net area of the site is 4.212 ha, and gross
   area (taking into account half the size not exceeding 6m
   maximum of two road frontages), 4.440 ha.

b) The current land use is industrial (a range of Use
   Class B i.e. commercial, with ancilliary offices), with
   non-residential existing plot ratio of approximately 1:1.

c) There are two listed buildings on the site;

       (i) Grade 2: Car Factory Offices

       (ii) Grade 2: Former Car Factory for

d) The site surroundings are varied. On the West is the

Estate, a densely laid out residential project of five and

six storey blocks in a regimental pattern. To the east off

is a housing association scheme of 3 storey buildings.

Factory Offices (Grade 2) is three storeys high. Buildings

to the South of the site accommodate a variety of uses, and range from two to five storeys in height. At the head of the West side and adjacent to the site is a church with its church hall, used for events such as discos.

e) The site slopes up from the south side by approximately three metres to the foot of the railway embankment.

f) In its heyday the site employed around 500 people but recently permanent staffing levels have fluctuated between 300 and 500.

B. The Planning Context: The District Plan Criteria

a) The present use allocation is industrial/commercial.

b) The site is not in the North Kensington Conservation Area.

c) The site is within an Area of Opportunity. The District Plan seeks the opportunity of creating leisure and recreation uses, offices for local services and housing on redevelopment.

d) The guidance plot is given as 2.0:1.

e) Provision of new areas of open space is accepted as planning gain; as is the creation of a wider footpath along the main road to the south of the site.

f) The site is outside the areas defined as sensitive view line zones.

g) Development adjacent to railway uses are held to militate against family housing.

h) The need to retain the exterior and interior of listed

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buildings is emphasised.

C. The Proposal: Accommodation

a) The application provides the following accommodation.

Business	(B1)	71,240	(766,800 sq.ft.)
Restaurants, Snack bars Cafes and outlets for sale of intoxicating liquids on the premises	(A3)	1,725	(18,570 sq.ft.)
Shops	(A1)	448	(4,800 sq.ft.)
Financial & Professional services	(A2)	6,470	(69,600 sq.ft.)
Leisure	(D2)	4,583	(49,300 sq.ft.)
Residential	(C3)	10,020	(107,600 sq.ft.)
Trust/Community Use	(D1)	1,091	(11,700 sq.ft.)

Total: sq.m.   95,577 (1,028,370 sq.ft.)

b) This gives a plot ratio of 2.27:1 for all uses, and 2.0:1

for non-residential uses based on the net site area.

c) In addition there are non plot ratio uses:

Service and refuse collection:

3 service bays on sites accommodating delivery

vehicles.

Service Circulation thoroughfares to all buildings at

basement.

Service perimeter roads.

Car parking on two levels giving 2000 parking spaces

(or one for each 47.8 sq.m. gross of developed area).

Public open space 0.205 ha.

Private open space accessible to the public 1.75 ha.

in courts and gardens.

d) The residential accommodation provides:

   30 No 1 bed. flats of 56 sq.m. each average

   47 No 2 bed. flats of 90 sq.m. each average

   2 No 3 bed. flats of 110 sq.m. each average

   2 No 4 bed. flats of 154 sq.m. each average

   20 No Studios

D. The Proposal: Description

a) The main element consists of nearly 75,000 sq.m. of new business use. This is laid out to meet market demands for a variety of lease areas ranging up from 100 sq.m.

b) Development is around a series of internal courts and quadrants. Building heights ranging from three storeys at on the south side, six storeys in the generality of the scheme to seven storeys in the two residential buildings. Top floors are in mansard roofs and set back. Between the quadrants is a 23 storey 73m high (98m high to spire top) residential tower.

c) Car parking and service levels are built in two storeys under the whole site area, the new ground floor area being raised 1m to provide natural ventilation to the top car park level. Below ground service bays and corridors lead directly to each building access cores. The car park is zoned into compartments which will be allocated to the various building uses. A section of the car park will be set aside for day to day visitors. About 2000 number car parking spaces are provided in total.

d) The development will be served by a variety of small ancilliary uses, shops, banks, restaurants, etc. It is proposed to locate these around the covered large court at the centre of the project.

e) Residential use is concentrated in the tower and two other blocks overlooking the main gardens. In addition the workshops at penthouse level in the quadrant shaped block will be fitted out with sleeping areas, bathrooms and kitchenettes and are to be leased as ateliers. There are 101 residential units in total.

f) The office block for the car company, (now a listed building), erected in 1903-4 in Edwardian baroque style is to be retained and used in its original state, exterior and interior, partly for offices and partly for community use, creche and museum.

g) The car factory shed itself (also a listed building) is to be demolished.

h) As important as the buildings are the gardens and squares they circumscribe. A new public park zone (0.205 ha.) is created adjacent to the housing estate on the west side. The other internal courts and gardens are spaces accessible to the public but controlled and maintained by the building owners.

i) Emergency service and casual access is provided for at new ground level. Fire fighting vehicles and ambulances can reach all sections of the buildings. Taxis, motor-bikes and chauffeur driven vehicles have a clearly

defined, but limited route at ground level.

j) A new leisure building, incorporating swimming pools, surge pool, diving pool, saunas, gym and health club will be provided to service the development and a wide customer support from the general community.

k) The developer will provide, as part of the community uses, a day creche for the care of young children for the use of those employed in the various businesses that will occupy the new buildings.

E. Impact on Traffic

At the moment traffic generation mainly consists of large lorries and articulated trucks using the site on a 24 hour basis. Although there will be more traffic around, it will be cars rather than mainly lorries. The site is relatively accessible by road, albeit subject to peak hour congestion. Public transport services in the vicinity are reasonable, though the bus service suffers from the effects of traffic congestion in the peak. The road network cannot sustain peak operation evenly throughout each peak hour and some localised delays could occur. The proposed development could result in a significant change in travel patterns in North Kensington. Almost all available peak hour junction capacity would be utilised. However, the majority would be dependent on public transport services for their access to the site.

F. Planning Benefits

a) The scheme regenerates a large section of North Ken-
   sington currently run down and provides a mixture of new
   uses that will generally improve the environment.

b) In particular, employment opportunities across a range of
   salaries/wages will result. It is estimated that more
   than 4000 jobs will ultimately be created, apart from the
   short term construction requirement in this area with 50%
   long term unemployment. Thus not only will there be
   extra employment opportunities, but the type and range of
   jobs will be expanded and will reflect the new market
   needs.

c) A total of 5.1 acres of new public and private open space
   and gardens will be created with formal landscaping,
   fountains and sculptures.

d) Service traffic and pedestrians will be separated over
   the whole site.

e) A listed building will be brought back into full use, and
   the modifications to the original fabric removed.

f) The footpath to the main road on the south side will be
   widened.

g) If required, the developer will agree a contribution
   towards the improvement of the main road and/or the
   junction.

h) The developer would be prepared to underwrite the
   provision of a bus service to such destinations as
   Paddington Station and Kensington High Street.

12.2: Short Listing of Objectives and Constraints:

This covers stages of analysis and self-interactions of design architect's decision and thought process with respect to the brief, within the framework of ICU-UCI to provide essential material for the use of e.g. SWAP to assess the design architect's interpretations regarding the needs and necessities, aims and objectives, constraints and problems in the design of this CMOAS.

Assessment of the LBR scheme and related information required to assume that the SWAP methodology with the help of a methodology expert and/or facilitator can be an operational assessment methodology of sufficient power to be part of non-mathematical and non-technical framework of ICU-UCI, to help the design architect to move from 'I' to 'U'. Although the process in the establishment of ICU-UCI would be to have an absolutely non mathematical methodology enabling a layman to systems science, whether as a Developer, Architect, Public and/or Legislator, to benefit from the framework but until such a day arrives, the role of methodology expert will be an essential help to the design architect in the design of a CMOAS. For that reason this simulation assumes a design team consisting of a design architect and methodology expert. In general, the role of the latter is to facilitate and the role of the former is to interpret and reinterpret as a design architect to demonstrate his 'IGU' from at least four sides, i.e. the

Developer side, the Architect side, the Local Government side and the Local Community side.

The following two short lists are as a result of the design architect's 'ICU's within the framework of ICU-UCI in the process producing repeatedly ICU to generate UCI and UCI to generate ICU.

12.2.1: A Short List of 51 Client's and Architect's aims and objectives for the LBR CMOAS:

1. To provide circumstances to result in the increase of the developer's share values.

2. To provide a total building scheme with a plot ratio well above the required 2.0:1.0.

3. To base the plot ratio on the calculation of total floor area over the gross site area rather than the net.

4. To provide about 2000 basement car parking spaces instead of the advised 1200 by the planning officers.

5. To provide over and about One Square Million feet mixed accommodation, i.e. over 95,000 sq.m.

6. To provide above or about 75% business accommodation (B1 use) for the total floor area.

7. To provide above or about 10% of total floor area for commercial and professional services (A1, A2, A3 uses).

8. To provide about 10% of total floor area for Residential use (C3 use).

9. To provide about 1% of total floor area for Community use (D1 use).

10. To provide about 4% of total floor area for Leisure accommodation (D2 use).

11. To provide public open space of about 2000 sq.m., i.e. 4.5% approx. of gross site area.

12. To provide private open space accessible to the public of about 175,000 sq.m., i.e. 40% approx. of gross site area.

13. To profit from 1989's economic climate of stock exchange market by a quick submission for planning permission.

14. To provide 100-105 flats of residential use.

15. To provide for a variety of business lease areas ranging up from 100 sq.m.

16. To provide in the generality six storeys of the buildings.

17. To provide lowest residential of 7 storeys and highest of 23 storeys tower block.

18. To exclude residential tower areas form the calculation of plot ratio to lower the outcome.

19. To raise by 1m. new ground floor to provide natural possibility for carpark ventilation.

20. To demolish the grade II listed car factory building of 1903-4.

21. To retain the grade II listed Edwardian baroque style of the car factory offices.

22. To provide emergency service and casual access at new

ground levels for various vehicles.

23. To provide a day creche for the care of young children whose parents are employed in the new buildings.

24. To provide structure with less columns to have more lettable area.

25. To provide only 20% of gross floor area for cores and services to increase lettable area.

26. To provide car parking spaces (of 250 x 500cm per car) bigger than council standard of 240 x 480cm.

27. To follow car parking grid of 8m x 8m for buildings planning and structural grids.

28. To provide buildings width in the generality between 16m - 17m.

29. To provide about 12m distance for buildings from the housing states on the west side of the site.

30. To provide a roundabout in the junction of the main road and the other road to help the traffic.

31. To widen to double the size of the road on the west side to help the traffic.

32. To provide vehicle access from the west side of the site.

33. To provide one vehicle access from the main road in the south next to the private road on the east side.

34. To avoid having a written brief.

35. To provide a scheme to be able to become an exclusive and/or private environment.

36. To have continuous one large building rather than

individual buildings.

37. To provide continuous elevation based on Georgian style except for Tower.

38. To provide 5:1 dimentional ratio for square based plan Tower.

39. To design about 25 metre high spire top for the Tower.

40. To provide a glass corridor on the axis of the car factory office building's main entrance to the building at the end of the site.

41. To receive planning permission.

42. To base the whole design on an interpretation of "B1" classification in the attempt to have simplicity.

43. To follow the client's satisfaction to secure the fees of about £2,000,000 for the stage of submission and additional information.

44. To follow the client's instructions as outcomes from communications with it.

45. To consider the project not as a "CMOAS".

46. To design this project with regard to the experience gained by the architect firm from designing the previous large scale building.

47. To design in a style to satisfy the criteria for advocated nostalgic architecture.

48. To provide an environment to increase and influence the standard, economy and population of the area.

49. To provide a rich environment within a poor area.

50. To provide nice presentation drawings, model and

brochures.

51. To provide best business oriented publicity and PR activity.

12.2.2: A Short List of 60 Environmental Constraints, Public's Objectives and Legislator's Requirements for the LBR CMOAS:

1. To maintain and enhance the status of the Borough as an attractive place in which to live and work.

2. To maintain existing levels of population and housing density in the greater part of the Kensington & Chelsea Borough.

3. To review and formally alter the District Plan when events make this necessary.

4. To provide the Kensington & Chelsea Council's satisfaction.

5. To maintain a general presumption against the demolition of listed buildings.

6. To encourage, strongly, the maintenance and active use of listed buildings.

7. To protect buildings of Local ..., landmarks and features, not necessarily of outstanding architectural interest, as well as all those in the Borough which are listed.

8. To provide an environment which can satisfy the needs of modern life, whilst maintaining its quality, and to allow

change in a sensitive way so that the economic and social well-being of the Borough is enhanced.

9. To consider the acceptance of property owners wishes to demolish and redevelop their property subject, of course, to reasonable compliance with the Initial Development Plan and other planning requirements.

10. To consider relationship between the costs of repair, maintenance and adaptation to an appropriate new use compared with the cost of a new building.

11. To maintain lower plot ratios than those permitted in the past.

12. To maintain maximum permitted of normally 2:1 plot ratio.

13. To maintain a plot ratio lower than 2:1 in areas which desire their character from a low intensity of buildings.

14. To maintain car parking accommodation provided in accordance with the Council's car parking standards of 240 x 480cm.

15. To provide criticism and comments as part of the public consultation process.

16. To provide Design Brief for overall development.

17. To provide logic for land use and buildings layout.

18. To require options for residential location in the site.

19. To provide logical justification for site access, circulation and security.

20. To provide type of residential affordable by the local

people.

21. To require justification that the LBR does not mean to become an exclusive place.

22. To require logical justification that the LBR does not mean to and could not change the voting pattern, e.g. from Labour to Conservative.

23. To provide clear demonstration that the leisure facility can be affordable by local community.

24. To provide clear demonstration that the design will help to absorb the car traffic quickly and release with a time lag calculated to ease the expected traffic problems.

25. To provide clear demonstration that the scheme does not encourage the public to go by car.

26. To provide logical justification for having the tower as residential affordable and acceptable by local people.

27. To provide evidence that the types of employment will benefit the local population.

28. To provide evidence that 2000 car parking spaces will not be beyond the capacity of main road increasing risk of accident for local schools' population.

29. To provide local amenities within the site.

30. To provide as much green space as possible.

31. To require more community use accommodation than present small area in part of the car factory's office building.

32. To avoid the similarity between the LBR and the architect's previous large scale scheme as a crude and

unconvincing example of implementation of its detailing.

33. To avoid the monolithic form of architecture.

34. To avoid the linked concept, if possible, in the present scheme.

35. To provide a design which uses a number of different buildings located in the landscape.

36. To avoid over simplistic approach to the design of building's layout, height and architecture.

37. To benefit from the site which could offer unlimited opportunities in terms of architectural language, building heights and layouts.

38. To avoid the rigid approach to architectural language.

39. To avoid the rigid approach to the height of the buildings.

40. To avoid the rigid approach to the layout of the buildings.

41. To demolish third-rate factory building, listed grade II, for the economic regeneration of the area.

42. To exclude, if possible, the Tower from the whole site.

43. To exclude the Tower from the crescent.

44. To demonstrate conclusively that a tower is essential to the economic success of the scheme.

45. To reject the design of the present tower's crude offering.

46. To avoid any design similar to the present top of the tower.

47. To provide opportunity and more time to properly consider the proposals for this very large scheme.

48. To provide energy conscious design, solar gain and services efficiency.

49. To provide ancilliary accommodation - plant rooms and duct riser space.

50. To provide logical justification for the numbers, location, size and layout of the cores.

51. To provide access for the maintenance of the external fabric.

52. To provide logical justification for refuse collection.

53. To reduce considerably B1 use.

54. To increase residential area.

55. To provide bicycle parking on ground level and basement.

56. To provide bus mid-terminal in the site from the main road in the south side.

57. To provide full ventilation system for carpark to deal with exhaust fumes.

58. To provide B1 with respect to maximum limit of 5000 sq.ft. = 465 sq.m. to have up to 25 permanent employees.

59. To seek the retention of industrial uses in North Kensington.

60. To seek the provision of light industrial premises as part of appropriate, large developments in the area to maximise the employment potential.

12.3: LBR Scheme Objectives:

The initiating input for a SWAP evaluation is another short listing from the 111 objectives that define what the subject should achieve both operationally and axiologically, and which also encompasses the value systems of interested and affected parties. Accordingly the design architect's progressive ICU continued to form four equal lists of 12 objectives for the LBR scheme to represent the perspectives of the four types of protagonist.

12.3.1 Developer's Perspective:

C – Client's Objectives

C1 Provide circumstances that result in the increase of the developer's share values

C2 Profit from 1989 economic climate by quick submission of Planning Permission

C3 Provide best business-oriented publicity and PR

C4 To provide equal or greater than 75% Business accommodation (B1 use) from the total floor area

C5 Provide a total building scheme with a plot ratio well above the required max 2:1

C6 Demolish the existing grade II listed car factory building of 1903/4

C7 Provide continuous elevation based on Georgian style except for 23 storey tower

C8 Provide about 2000 places in basement car park
instead of the 1200 advised by the planning officer

C9 Provide a structure with fewer columns to produce
more lettable area

C10 Limit 20% of gross floor area for cores and services
to increase lettable area

C11 Provide a scheme that can become an exclusive and/or
private environment

C12 Avoid the need to produce a written brief

A - Architect's Objectives

A1 Satisfy the client in order to secure fees

A2 Base whole design on an interpretation from "B1" use
to ignore complexity

A3 Follow client's instructions

A4 Provide one large continuous building rather than
individual buildings

A5 Provide building with width in the range 16m - 17m

A6 Adhere to car parking grid of 8m x 8m for building's
planning grid and structural grid

A7 Provide a wide glass corridor on the axis of listed
office building's main entrance up to the opposite
building at the north end of the site

A8 Design a 23 storey residential tower of square plan
with 5:1 dimensional ratio.

A9 Design a spire of about 25m to top the tower

A10 Raise new ground floor by 1m to provide natural
    ventilation for car park

A11 Provide high quality presentation drawings, model
    and brochures to represent "good" design

A12 Obtain Planning Permission

12.3.2 Public's Perspective

L - Legislator's Objectives

L1 Increase residential area

L2 Reduce B1 use considerably

L3 Encourage Light Industry premises to maximize
    employment potential

L4 Limit B1 use to maximum limit of 465 sq.m. with up
    to 25 permanent employees

L5 Provide evidence that a 2000 place car park will not
    increase traffic capacity of the main road beyond
    its limit

L6 Specify a design that absorbs cars quickly and
    releases them with a calculated time lag

L7 Maintain a Plot Ratio lower than 2:1

L8 Satisfy Kensington & Chelsea Council

L9 Provide a quality environment that meets the needs
    of modern life and changes in a sensitive manner

L10 Require logical justification for the number,
    location, size and layout of the cores

L11 Avoid over simplistic approach to the design of
    building layout, height and architecture

L12 Provide energy-efficient design with solar gain and
    high efficiency services

P - Public's Objectives

P1   Require proof that LBR is not intended to become an
     exclusive environment.

P2   Require logical justification that LBR is not
     intended to change voting pattern, e.g. from Labour
     to Conservative.

P3   Provide as much as possible public open space

P4   Provide local amenities within the site

P5   Exclude the Tower from the side (if possible)

P6   Reject the present crude tower design

P7   Avoid a monolithic architectural form if possible

P8   Require that the scheme does not increase private
     car traffic to LBR

P9   Provide a bus terminal on the site from the main
     road on the south side

P10 Provide a bicycle parking space on ground level and
     basement

P11 Provide residential accommodation affordable by
     local people

P12 Require options for residential locations on the
     site

12.4: Categorization of Objectives

1: The design architect simulation team consisting of the design architect and methodology expert facilitator, scanned the previous lists of 48 objectives and agreed on the following 1st level attributes for the Multiattribute criterion:

AE   Aesthetic considerations

EN   Environmental considerations

FA   Public Facilities

EQ   Social Equity

CO   Commercial considerations

PL   Planning considerations -

AP   Approaches for road traffic

PA   Car parking

SI   Special Interests

2: The design architect allocated the 4x12 listed objectives to the attributes as follows:

ACTOR	Allocation of Actor's Objectives								
	AE	EN	FA	EQ	CO	PL	AP	PA	SI
C	7			≠11	1,2,3,4 5,6,8,9 10	≠8,≠10			
A	4,7,8,9				1&3,6 10	5		6	8,9,11
L	11	9		1,3		2,4,7 10,12	6	5	
P	≠5,≠7	3	4,9	1&11			≠8,9,10		2

Figure 18: Allocation Table of Actor's Objectives
The prefix ≠ denotes an avoidance objective
The following objectives were ignored because they appeared to be redundant, unnecessary or too general:
C12, A2, L8, P6 and 12.

12.5: Structure for the LBR Criterion

The design architect team agreed on a hierarchical structure for the LBR Criterion as shown below. It follows the standard format for a SWAP multiattribute criterion: the 1st level attributes are combined pairwise to form identifiable high level objectives until a single objective is obtained at the top level. The overall worth of the scheme - LBR Worth (LW) - will be a number between 0 and 1 indicating the relative merit of the scheme according to (i) the assessment of the LBR scheme with respect to the 1st level attributes, and (ii) the detailed internal elaboration of the criterion.

Figure 19: Hierarchical Structure for LBR Criterion
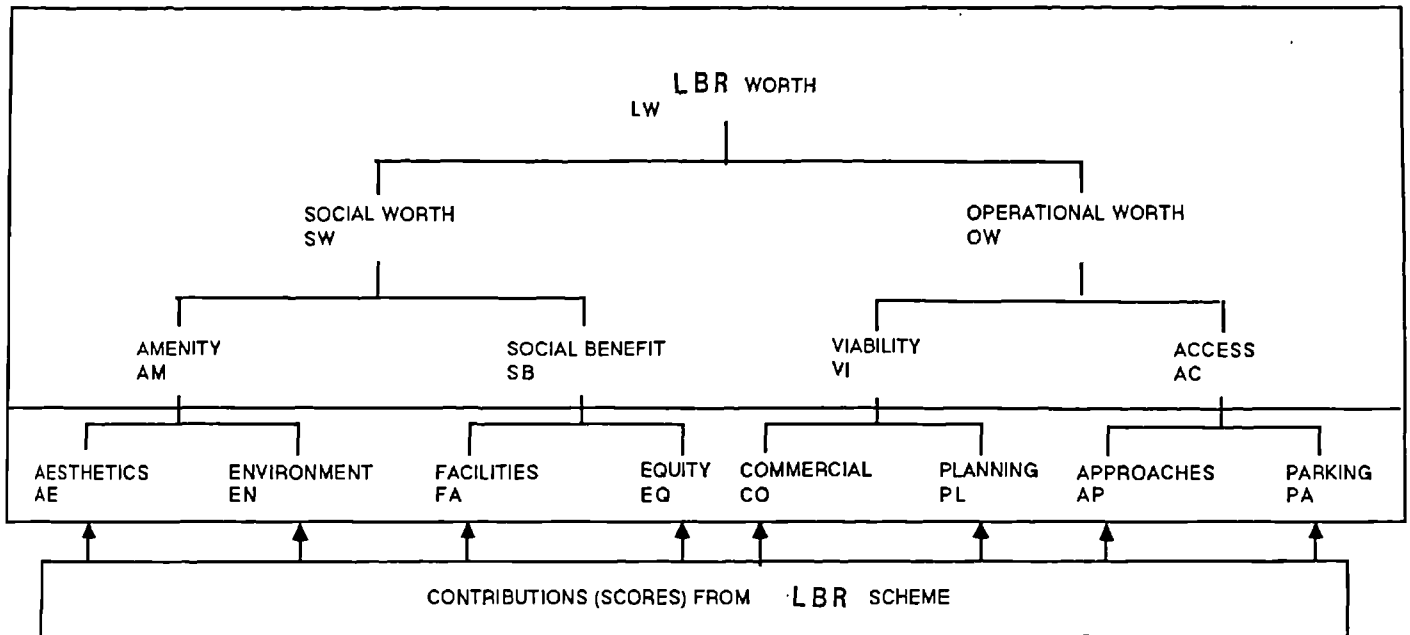
The scores were assessed by the design architect to show his ICU. The criterion was elaborated by the design architect team as a complete round of ICU-UCI.

12.6 Scoring of LBR Scheme with respect to the 1st Level Attributes

The relative contributions of the LBR scheme to the achievement of the respective 1st level attributes were assessed subjectively by the design architect using a scale (10,0) to represent his ICU, where 10 = complete achievement (from the perspective in question), and 0 = no contribution. The assessment was underaken twice, once from the Developer's Perspective (DP) with the Developer dominant;

and again from the Public Perspective (PP) with the

Legislators dominant.

The design architect team agreed to ignore the Special

Interest objectives.

The scores are tabulated below.

ATTRIBUTE	AE	EN	FA	EQ	CO	PL	AP	PA
PERSPECT.								
DP	10	8	4	8	6	10	2	10
PP	5	5	5	1(housing)* 5(employt)	6	7	2	3

* A median score of 3 was used for assessment, (assumes equal weighting for housing and employment).

Figure 20: Table of the given scores attributes.

12.7: Elaboration and Enumeration of the LBR Criterion

The SWAP Multiattribute Criterion is normally built up using

2-attribute criterions as building blocks as shown below.

Figure 21: Structure of 2-Attribute Criterion

Overall Worth
W(q1,q2)

Combinatorial Rule
Mx[q1,q2]

Weight w1

Weight w2

Utility Fn.
u(q1|W)

q1

Utility Fn.
u(q2|W)

q2

q1

q2
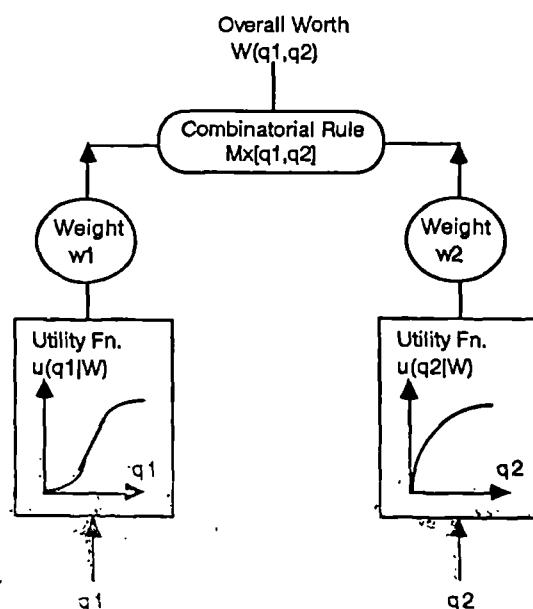
The elaboration of the criterion requires (see Appendix 4, Technical Note for more detail):-

1. The selection of a combinatorial rule that combines the value streams in a manner appropriate to the decision-maker's (DM) perceptions. Four rules are standard:

Additive (A) - the value streams are directly and linearly substitutable (e.g. money streams)

Vector Regret (R) - the DM desires the best compromise available from the value streams.

Multiplication (M) - as Vector Regret except that low levels of contribution are penalized, a zero contribution implies zero combined worth whatever the level of contribution may be on the other attribute.

Vector Norm (N) - the DM avoids compromise and prefers a "solution" that veers towards one of the value streams.

2. The definition of a Weight for each value stream indicating the relative importance of each value with respect to the other.

3. The selection of a Utility Function that acts as a preference ordering function for increments of the input value stream. The form of the function depends on the DM's perceptions.

For the LBR exercise:

1. The combinatorial rules were selected by the design architect with the assistance of the methodology expert.

This is to be considered as another round ICU-UCI.

2. The weights were assessed subjectively by the design architect according to his perception of the relative importance of the values, i.e. ICU of ICU-UCI complete round.

3. The utility functions were subsequently selected and defined by the methodology expert according to his UCI with the design architect of the Actor's perspectives, i.e. another complete round ICU-UCI.

Two Criterions were constructed, one each for the Developer's and the Public's Perspectives. The hierarchical structure was similar for each perspective, but the rules, weights and utility functions were varied appropriately. In other words the two parts of ICU-UCI were in operation with design architect's team acting as both parties and producing ICU from one for the UCI of the other.

12.7.1: Summary of Criterion for Developer's Perspective

NODE	RULE	WEIGHT	U.FUNCTION*
LW	R	w(SW)=0.5 w(OW)=0.5	n/a
SW	R	w(AM)=0.8 w(SB)=0.2	Linear
OW	R	w(VI)=0.6 w(AC)=0.4	S
AM	M	w(AF)=0.6	S

```
                              w(AE)=0.4

            SB        R       w(FA)=0.2      Conservative
                              w(EQ)=0.8

            VI        R       w(CO)=0.9      S
                              w(PL)=0.1

            AC        M       w(AP)=0.3      Linear
                              w(PA)=0.7
```

The Operational Criterion for the Developer's Perspective is
summarized below:
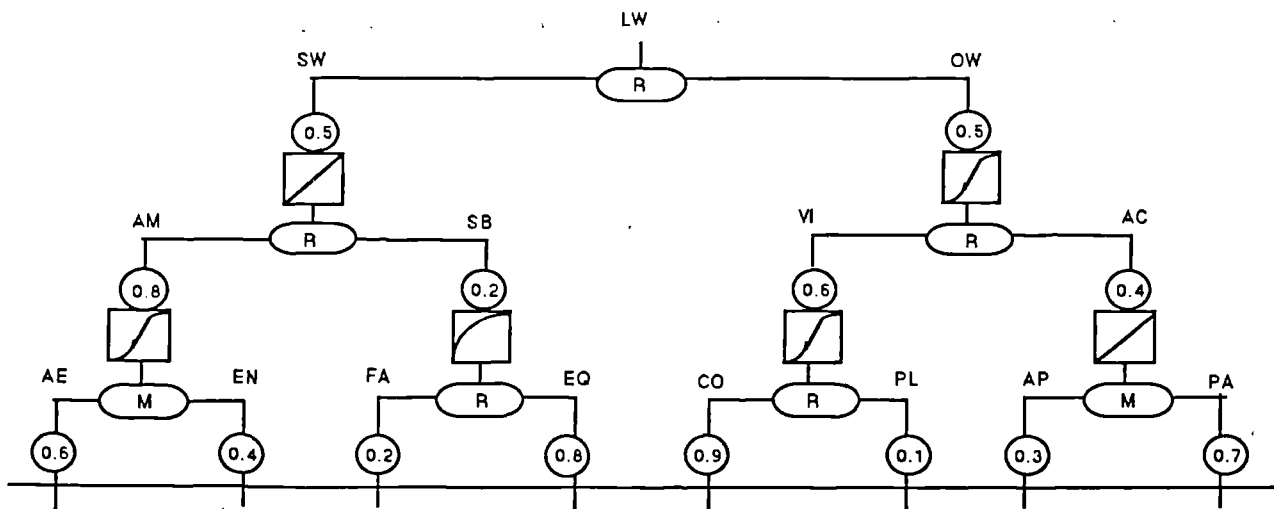
* See 12.8 Note on Utility functions

Figure 22: LBR Criterion — Developer's Perspective

12.7.2: Summary of Criterion from Public's Perspective

NODE	RULE	WEIGHT	U.FUNCTION
LW	M	w(SW)=0.6 w(OW)=0.4	n/a
SW	R	w(AM)=0.6 w(SB)=0.4	S
OW	R	w(VI)=0.6 w(AC)=0.4	Linear
AM	R	w(AE)=0.5 w(AE)=0.5	Linear
SB	M	w(FA)=0.5 w(EQ)=0.5	Achiever
VI	R	w(CO)=0.5 w((PL)=0.5	Linear
AC	M	w(AP)=0.7 w(PA)=0.3	Achiever

The Operational Criterion for the Public's Perspective is

summarized below:
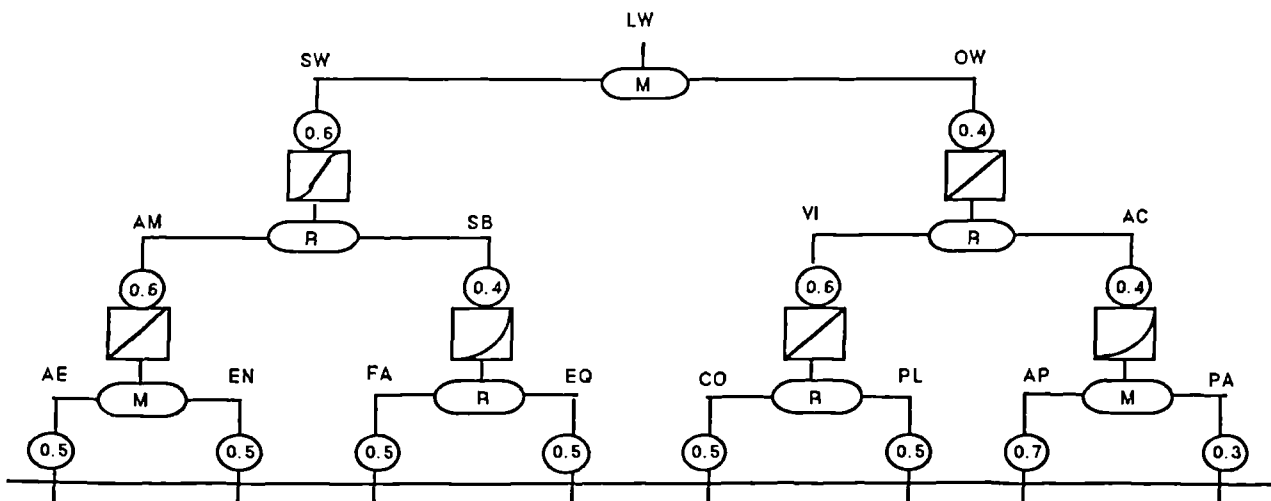
* See 12.8 Note on Utility functions

Figure 23: LBR Criterion - Public's Perspective

12.8: Note on the Selection of Utility Functions

The form of utility function for each value stream in the criterion was elected by design architect team according to its interpretation of the perception and perspective of the Developer and Legislator, i.e. complete simulation of ICU-UCI.

The summary below provides brief explanations for the selection of the utility functions. The standard forms of utility function in the SWAP menu were used: see Appendix 4-1 of the Technical Note for details.

12.8.1: Utility Functions for the Developer's Perspective

SW Node: Social Worth is usually not a major concern for Developers, but the more SW that a scheme can provide, the better for the scheme. Accordingly the Linear U.Fn. was selected because of its linear preference ordering for increments of AM or SB, (i.e. the Developer is uniformly pleased with each increment of SW).

AM Node: The provision of high quality Amenity and Environment by an architectural scheme are important issues for a scheme, from the need to gain client acceptance and from the standpoint of architectural prestige. This is a

design problem – accordingly the S-form of U.Fn. was selected. This pushes a scheme away from low achievement, but tails off at the high end because the practical limits are close.

SB Node: This low weight given to Social Benefit by the DM as his ICU suggests that the Developer has little concern with this aspect. Accordingly the Conservator U.Fn. was selected to indicate that any SB above the minimum acceptable is welcome, but high levels of SB are not an important part of the scheme.

OW Node: Developers are, of course, very concerned with the financial returns from their schemes, so the Achiever U.Fn. might have been appropriate to represent a desire to maximize returns. However the Developer placed equal weights on SW and OW indicating that a trade off between operational pay-offs and human aspirations is recognised. Accordingly the S-form of U.Fn. was selected to indicate a preference ordering that desires satisfactory rather than maximum returns.

VI Node: Again the Achiever U.Fn. might have been employed, but the need to meet Planning Requirements, although not very important to the Developer, is recognised. The S-form was selected again.

AC Node: Little can be done about existing road access within an already built environment, but the provision of a large car parking area enhances commercial values. The more parking the better from the Developer's perspective, so the Linear U.Fn. was selected.

(Note that utility functions are not required at the 1st level because the input scores from the assessment are equivalent to utility levels from mental utility functions.)

12.8.2: Utility Functions for the Legislator's (Public) Perpsective

SW Node: SW is an important issue for the local Government and the local public. The S-form of U.Fn. was selected to indicate a preference for high achievement of SW, but within reason.

AM Node: The higher the quality of the built environment the better, but tastes differ, so the neutral Linear U.Fn. was selected.

SB Node: For the public at large, rather than a privileged minority, the suitable provision of Social Benefit in the form of public facilities is a matter of considerable importance: meagre provision provides little benefit, high provision available to all is very desirable. Consequently

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the Achiever U.Fn. was selected to indicate the preference towards high provision.

VI Node: The need for good design within planning regulations, and the need to generate satisfactory financial returns from the scheme contribute towards the viability of the scheme in the public mind.   The Linear U.Fn. was selected to even out the often conflicting arguments between social planning and commercial viability in the Council chamber.

AC Node: The Achiever U.Fn. was selected to represent the strong public preference for good traffic control, access and off street parking.

SWAP - MACRIT WORKSHEET

SUBJECT NAME: **L B R** SCHEME
NAMES OF ASSESSORS: T. Plus
CONTEXT: Assessment - DEVELOPER'S PERSPECTIVE
FACILITATOR: P.K.M'Pherson
DATE 28 Sep 1990

SWAP COMBINATORIAL RULE MENU

RULE | Formula Cell | Next
All Locked

		q(X,Y)		w(qx, qy) 0.00 Formula
ADDITIVE	0.00	Gk	Rule	Qy
REGRET	ERR 9	Qx		
MULT	ERR 12	wx 0.00	wy 0.00	0.00
NORM	ERR 9	q(X) 0.00	q(Y) 0.00	
EXCLUS	ERR 7	U Type	U Type	Qyin
CONFLAT	ERR 7	Qxin		

REF VALUES
w.1 = 0.7   w.2 = 0.3
q.1 = 0.2   q.2 = 0.6

w(Q1,Q2)
AQO 0.32
REGRET 0.25
MULT 0.28
NORM 0.30
EXCLUS
CONFLAT

L B R Worth (DEVELOPER) Lw 0.91 Formula

Soc Wort Rule = R Oper'l Worth Q(OW)
Q(SW) wx 0.50 / wy 0.50 Q(OW) wx 0.50 / wy 0.50
q(X) 0.97 / q(Y) 0.88
U Type Linear / U Type S
qin(SW) 0.97 Formula

Amenity Rule = R Social Benefit Q(SB) 0.20
Q(AM) wx 0.80 q(X) 0.97 U Type S
Q(SB) wy 0.20 q(Y) 0.93 U Type Conserve
qin(AM) 0.91 Formula   qin(SB) 0.76 Formula

Aesthetic Rule = M Environment Q(EN) 0.40
Q(AE) wx 0.60 q(X) 1.00 U Type n/a   s(AE) 1.00
Q(EN) wy 0.40 q(Y) 0.80 U Type n/a   s(EN) 0.80

Facilities Rule = R Equity Q(EQ) 0.80
Q(FA) wx 0.20 q(X) 0.40 U Type n/a   s(FA) 0.40
Q(EQ) wy 0.80 q(Y) 0.80 U Type n/a   s(EQ) 0.80

Commerc Rule = R Planning Q(PL) 0.10
Q(CO) 0.90 wx 0.90 q(X) 0.60 U Type n/a   s(CO) 0.60
Q(PL) wy 0.10 q(Y) 1.00 U Type n/a   s(PL) 1.00
qin(VI) 0.60 Formula

Viability Rule = R Acces Q(AC) 0.40
Q(VI) wx 0.60 q(X) 0.74 U Type S
Q(AC) wy 0.40 q(Y) 0.62 U Type Linear
qin(OW) 0.70 Formula   qin(AC) 0.62 Formula

Approach Rule = M Parking Q(PA) 0.70
Q(AP) wx 0.30 q(X) 0.20 U Type n/a   s(AP) 0.20
Q(PA) wy 0.70 q(Y) 1.00 U Type n/a   s(PA) 1.00

SENSITIVITY ANALYSIS: w(LW) ref Input Scores

s(in)=1	0.64	0.63	0.51	0.51	0.51	0.65	0.55	0.59
s(in)=0	0.23	0.23	0.51	0.48	0.50	0.24	0.33	0.31
ΔW	0.41	0.40	0.00	0.03	0.01	0.41	0.22	0.28

Figure 24: Worksheet 1

SWAP-MACRIT WORKSHEET

SUBJECT NAME
L B R SCHEME

NAMES OF ASSESSORS
T. Plus

CONTEXT
Assessment -
PUBLIC PERSPECTIVE

FACILITATOR:
P.K.M'Pherson

DATE 29 Sep 1990

SWAP COMBINATORIAL RULE MENU

RULE	Formula Cell	Next.
	All Locked	
ADDITIVE	0.00	

REF VALUES
w1 = 0.7   w2 = 0.3
q1 = 0.2   q2 = 0.5

w(q1,q2)

		Qy
ADD.		0.32
REGRET		0.25
MULT		0.28
NORM		0.30
EXCLUS		
CONFLAT		

q(X,Y)   w(qx, qy)   0.00 Formula

	Gk	Rule			Qy
REGRET	ERR 9				
		Qx		wy	0.00
MULT	ERR 12	0.00		q(Y)	0.00
	wx	0.00			
	q(X)	0.00		U Type	
NORM	ERR 9	U Type		Qy)n	
EXCLUS	ERR 7	Qx)n			
CONFLAT	ERR 7				

L B R worth (PUBLIC)
Lw

0.28 Formula

Soc Wor Rule = M Oper'l Worth

Q(SW)			Q(OW)	
wx	0.60		wy	0.40
q(X)	0.22		q(Y)	0.40
U Type			U Type	
S			Linear	

q)n(SW)   0.36 Formula
q)n(OW)   0.40 Formula

Amenity Rule = R Social Benefit
Viability Rule = R Acces

Q(AM)		Q(SB)		Q(VI)		Q(AC)	
wx	0.60	wy	0.40	wx	0.60	wy	0.40
q(X)	0.50	q(Y)	0.13	q(X)	0.65	q(Y)	0.06
U Type		U Type		U Type		U Type	
Linear		Achieve		Linear		Achieve	

q)n(SB)   0.39 Formula
q)n(VI)   0.65 Formula
q)n(AC)   0.23 Formula

Facilitie Rule = R Equity
Commerc Rule = R Planning
Approac Rule = M Parking

Q(FA)		Q(EQ)		Q(CO)		Q(PL)		Q(AP)		Q(PA)	
wx	0.50	wy	0.50	wx	0.50	wy	0.50	wx	0.70	wy	0.30
q(X)	0.50	q(Y)	0.30	q(X)	0.60	q(Y)	0.70	q(X)	0.20	q(Y)	0.30
U Type		U Type		U Type		U Type		U Type		U Type	
n/a		n/a		n/a		n/a		n/a		n/a	

| s(FA) | 0.50 | s(EQ) | 0.30 | s(CO) | 0.60 | s(PL) | 0.70 | s(AP) | 0.20 | s(PA) | 0.30 |

Aesthet Rule = M Environment
q)n(AM)   0.50 Formula

Q(AE)		Q(EN)	
wx	0.50	wy	0.50
q(X)	0.50	q(Y)	0.50
U Type		U Type	
n/a		n/a	

| s(AE) | 0.50 | s(EN) | 0.50 |

INPUT SCORES

SENSITIVITY ANALYSIS: w(LW) ref Input Scores

s(in)=1	0.43		0.43		0.38		0.38		0.33		0.33		0.34		0.32
s(in)=0	0.04		0.04		0.24		0.24		0.23		0.23		0.28		0.28
∆w	0.39		0.39		0.14		0.14		0.10		0.10		0.06		0.04

Figure 25: Worksheet 2

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12.9: Overall Evaluation of the LBR Scheme

The combinatorial rules, weights and utility functions were used to structure the operational LBR criterion using the MACRIT worksheet from the SWAP methodology. The two previous pages show printouts of the work-sheets, one using the inputs for the Developer's perspective, the other showing the result with the Public's perspective.

The top part of the printout is composed of standard items: Identification of the assessment problem; the Combinatorial Rule menu and format; reference values for checking the individual rules after pasting onto the worksheet.

The body of the worksheet contains the enumerated form of the criterion. It will be seen that its structure is identical to the previous representations of the LBR criterion. Values for the input scores and the weights are entered into the appropriate cells, and the selected combinatorial for each node is pasted into the nodes after selecting and copying the appropriate Formula Cell in the Menu.

The output quality from each 2-attribute block feeds into the designated higher level block, where it is converted into a level of utility via the underlying utility function. The overall "Worth" of the LBR scheme which is another

round of ICU-UCI, is the final output from the top level of
the SWAP which provides possibility towards working for
consensus. The higher this number the nearer the LBR
scheme is to perfection. This is of course a perfection
which represents the decision-maker/assessor's
interpretation and/or understanding, i.e. it is the design
architect's team's ICU-UCI.

A Sensitivity Analysis is included at the bottom of the
Worksheet. A Criterion is usually validated by testing its
sensitivity to systematic variations in input scores, the
weights and the utility functions. The variations demon-
strate the credibility of the Criterion (or otherwise) to
the ICU of the decision-maker, i.e. the design architect's
team or he himself if he is facilitating the methodology by
himself. In this case the sensitivity of the Criterion to
the input scores was the only analysis performed. For this
analysis all input utilities are set at 0.5 (Score divided
by 10). Then each input utility is set in turn to a value
of 1, and then of 0. The resulting overall worth is
recorded under each input, along with the deviation ΔW. The
deviations are explainable in terms of the structure imbed-
ded within the Criterion, and help the DM gain confidence in
the Criterion. The relative magnitudes of the deviations
indicate which input indicators are important with respect
to their contribution to overall worth.

12.9.1: Developer's Perspective

Worksheet 1 uses the data and inputs obtained from the Developer's and Architect's perspectives.

The overall worth has a value of 0.91, which means that the LBR scheme as proposed and assessed meets its various objectives very well indeed (according to the Developer's value set). One may discern how this value was obtained by tracking each branch up the hierarchy. There are significant value feeds from all the sub-criterions within the structure, hence the high overall worth.

The sensitivity analysis shows that Amenity (Aesthetics and Environment) and Commercial return are important inputs (the overall worth is most sensitive to changes in these inputs). This is as might be expected: the quality and appearance of a scheme are bound to be important design variables for developers and architects, and the financial return from the scheme has deep significance for the developer. Access has some importance as a design variable, but mainly in the matter of parking provision. The Criterion is insensitive to different inputs from Social Benefit (Facilities and Equity) and Planning. This does not mean that the Developer places no value on these considerations: they each receive reasonable weights and contribute quite high utility to the higher levels. Rather, the insensitivity denotes that

changes in the provision of Social Benefit, and in meeting

Planning requirements more closely do not add any value as

far as the developer is concerned.

12.9.2: Public's Perspective

Worksheet 2 uses the data and inputs from the Legislator's

and Public perspectives.

The overall worth now has a value of only 0.28, which means

that the LBR project as proposed by the Developer does

little to satisfy the needs or aspirations of the local

council and population. There are significant utility feeds

upwards to Amenity and Viability, but the feeds into Social

Benefit and Access are much reduced. These differences

indicate where the value perspectives of the Developer and

the Public differ most.

The sensitivity analysis shows some interesting differences.

The most important/sensitive inputs are again AE and EN, but

all the other inputs have only a little

importance/sensitivity. Interestingly the Approach and

Parking inputs are least sensitive of all: one might have

expected differently from a public authority, but it may

reflect the fact that there is usually little scope for

adjustment with these items.

12.9.3 Comparison of the Two Assessments and Conclusion:

It is interesting to compare the output qualities from each sub-criterion.

NODE OUTPUT	CRITERION	
	DEVELOPER	PUBLIC
AE & EN	0.91	0.50
FA & EQ	0.76	0.39
AM & SB	0.97	0.36
CO & PL	0.60	0.65
AP & PA ·	0.62	0.23
VI & AC	0.70	0.40
LW = (SW & OW)	0.91	0.28

Figure 26: Table of comparison of the Two Assessments

There is an obvious mismatch between the Developer's and the Public's assessment of the scheme, except for the agreement over (CO and PL). It should not be surprising that the Developer and Architect consider that their efforts merit some praise! The low worth delivered by the Public perspective is a good retrofit on the initial rejection of the LBR scheme.

With increase in scale and in the face of limited knowledge
of an individual design architect about arranging and
executing all the requirements, complexities inevitably
arise. There is complexity therefore in arranging,
calculating designing and putting together all the
functions. Having done those, the behaviour of the public
towards a building is very complex. So in erecting any
structure in the world today, the socio-economic and
environmental impacts, size and scale of it will determine
the degree of public attention it attracts. Focussing that
attention, in terms of either getting support for or
opposition to the existence of a particular architectural
system creates complexity, since the response of the public
in the total life time of that cannot be known. Such
unknown response also helps to categorise any building as a
CMOAS - Complex Multiple Objective Architectural System - in
general.

Therefore, the design of an architectural system, which
involves and has a technological, social and environmental
nature, can be viewed as a problem-solving process by the
design architect. The problem is also the interaction of
the three, and probably the interaction of more aspects.
Even if the technological problems are solved, the solution

for the social aspects cannot be final. The complexity that remains is a matter that can be tackled at the appropriate moment in the future. In other words, there will always be complexity in any architectural system requiring to be dealt with when it begins to appear.

For the generation of a theoretical background for an architectural design framework as ICU-UCI, a demonstration is required that the systemic framework of ICU-UCI for the better articulation and design of CMOAS (Complex Multiple Objective Architecutral System) could be made operational within the capabilities of systems and decision methodology and applied to a real complex architectural scheme. Such schemes as LBR-CMOAS were tested in Chapter 12 by using SWAP methodology which proved an outstanding outcome conclusion.

The experiment proves that where a project is a CMOAS, the design cannot be based on a combination of trial and error policy with Popperian-like design method in the hope to be able to ignore and/or avoid complexities and the required time for large scale problem solving.

Within the ICU-UCI framework the design architect became able to provide a list of 111 objectives for LBR scheme as a result of 16 months communication with architect, client, public and legislator. The design architect examined their objectives and established a path from 'I', to 'U' towards

a possibility of better synthesis for a better CMOAS design by using systemic worth assessment procedure, SWAP methodology.

From the analysis emerged two perspectives: 1) developer's persepective and 2) public's perspective. For the developer's perspective the architect's firm (not the design architect) and the client appeared on the same side. Then LBR-CMOAS scheme were assessed with respect to the design architect's interpretations from the objectives of each of the two groups to establish the overall worth of a completed scheme of LBR-CMOAS.

The results of the two assessments were found to be extremely satisfactory. That is to say, that the overall worth of 0.91 given to the LBR CMOAS by the developer was a correct assessment, because this shceme in every way, except that leading to Planning Permission, was satisfactory to the developer. It was in the ordering of the client's 12 objectives, that the Planning Permission has shown not to have first priority. They have benefitted from the way they prioritized their objectives, with the first priority being to provide circumstances to result in the increase of the Developer's share values.

When the overall worth (LW) of 0.28 for the scheme in the Public's eyes was compared to 0.91 of the Developer's, it

was found that the Public's was also correct. The correctness does not pertain to the actual numbers of 0.28 or 0.91. The point is that the distance between the two shows the difference between the Developer's perspective and the Public's perspective, which is obviously a very big gap. This gap requires very many ICU-UCI running for the design architect to bring a consensus to his design outcome. In other words, there are needs to bring an outcome to show a minimum LW of around 0.50 as an outcome of the Developer's LW and the Public's LW. Therefore, anything between 0.51 to 1.00 will enable the Developer to see a certainty in obtaining Planning Permission. And any overall worth (LW) of less than 0.50 will indicate the existence of a conflict between the interested parties which reduces the chance of obtaining Planning Permission or maintaining the Developer's desire for construction of the scheme.

Another indicator for the correctness of the Developer's LW of 0.91 for LBR is that, at the time the scheme was submitted to the planning authorities, the scheme received its highest publicity leading to the continuous increase of the Company's share values to about £2.20 and over. But by the time the Legislators and Public had begun to react towards the scheme by way of verbal and written communications for further information and delay for decision-making, it became obvious that there were difficulties for granting Planning Permission. That is to

say, that the Public's LW of 0.28 was showing that it had an overall effect on the share values, which were decreasing daily to as low as 9 pence per share.

This shows that, however nice the scheme looked in its model and presentation drawings (see Appendix 5), it was not found valuable enough to the Public to support it and they were powerful in rejecting the scheme. The design architect, in examining and comparing the output qualities from each sub-criterion, may reinterpret that for commercial and planning — CO & PL — output, the 0.60 from the Developer's perspective looked to be an unsatisfactory assessment when compared to 0.65 of the Public's. In other words, the Developer's overall first priority was to produce a commercial development by giving as low a priority as possible to the PL, planning considerations. Therefore an expected outcome for the CO of the Developer was very high, which will widen the gap between the two LWs the LBR scheme. To examine this point it would be helpful not to ignore C12, A2 and L8 of the Client's, Architect's and Legislator's objectives (see list of 4 x 12 objectives in Chapter 12). As a result of such reconsiderations it will become clearer to demonstrate the extent of the client's objective for a high CO — commercial considerations — and the Public's objective for a well balanced CO + PL, which could reduce the latter as much as from 0.65 to 0.50. Considering the fact that P6 and P12 have also not taken into consideration, the outcome PL —

planning considerations - from the Public shows a higher value. By adding these two objectives, i.e. P6: rejection of the present Tower and P12: requirement of options for residential locations on the site, the outcome will widen the gap even further between the two LWs of LBR.

The conclusion, therefore, is that there is a need to provide a consensus between the four interested parties if the aim is to go ahead with the development of the site. The design architect, with his present knowledge of the area of differences, is able to begin the reinterpretation processes. This means he had so far given his full interpretations - 'I' - to produce an outcome - 'U' - by using the SWAP way of man-machine communication - 'C'. His 'ICU', by way of the above considerations, forms a new outcome knowledge for him as a 'UCI'. That is to say the outcome 'U' requires another round of 'I'. The continuation of the 'ICU-UCI' framework, worksheets and maps, productions and analyses, will finally bring the gap between the Developer's Perspective and Public's Perspective to an overall worth equal to or greater than 0.51. In general, as soon as the Public's overall worth for a CMOAS becomes equal to or greater than 0.51 a chance of obtaining a Planning Permission will be increased. Accordingly it would be undemocratic for the Public to reject such a CMOAS. But this does not mean that such a CMOAS could be beneficial to the Developer. Therefore the Design Architect's role would

be by continuous running of ICU-UCI to provide a) a CMOAS

for the Public's Perspective with an overall worth equal to

or greater than 0.51, and b) that CMOAS for the Developer's

Perspective has to be with an overall worth as near to 1.0

to make the outcome a feasible and encouraging scheme to be

developed.

This results in a conclusion of very significant importance.

That is to say that the design of a complex multiple objec-

tive architectural system (CMOAS) needs to use

methodological design procedure to overcome the problem of

complexity involved in the process of the Design Architect's

ICUs - his interpretations and understandings of the objec-

tives and his communication with himself and with the

involved non-architects and architects in the process of the

design evolutions.

In general, in architecture some fundamental problems are

created by wrong or crude interpretations from the brief and

from subsequent communication. Since the unjust nature of

the criticism of the work of the architects and the right of

the masses were primary motives for the creation of the ICU-
UCI framework, to sort out the design architect's own self-

interaction problems, and is the key problem in the

architect's relationship with others, which is the way in

which the interpretation process happens, it becomes a very

serious point to be mentioned that any systems methodology

in which the language is so mathematical that it is

incomprehensible to designers, will be of less and/or no benefit to them. When tackling a problem, the architect must have a design framework and methodology which communicates effectively from the designers point of view. Until such a day arrives, it will take considerable time and require many more examples to be tackled to conclude that an experimental framework is a recommendable method of work. With this reality in mind it is concluded that, by using the ISM and/or SWAP methodology, the ICU-UCI approach to the design of a CMOAS is an essential and extremely satisfactory framework which a) can function as a mandatory requirement by the Legislator for a design of CMOAS instead of a combination of a trial and error policy with Popperian like design method and b) functions as a PROOF in the eating of the pudding, i.e., that the experiment is valid.

With regard to the use of ISM and SWAP it is found that each one has a number of advantages and disadvantages. In general, ISM is less mathematical and easy to use. When e.g. objectives are entered into a computer the operation of the programme requires minimum computer knowledge and, in fact, use of "keys". This can even be reduced to just two keys, such as "Y" for "yes" and "N" for "no" answers when synthesising the relationship between the elements of a CMOAS. But the problem with the present City University version of ISM is that it cannot take more than a limited number of elements text, i.e. 50 elements and the text for

each element should be only one line. If the other version of ISM is used in which, instead of entering element text, we enter the element code number, then the problem of the limitation in the number of input elements will disappear. But the new problem will be to have an assistant facilitator to remind the design architect each time of the text of the pair of elements under considerations. This will, actually, disrupt the design architect's privacy in synthesising of the elements, thus consequently having a damaging effect on the emergence of a creative outcome.

Since the ICU-UCI framework is based on the registration of the design architect's interpretations, the ISM methodology, in the early days of this research, had contributed to the development of the theoretical background for the ICU-UCI, and it is concluded that a three dimensional interpretive structural modelling could be the first progress for the framework, enabling the design architect to create and present the relationships among the elements of his CMOAS, three-dimensionally.

With SWAP methodology it is found that it is possible to actually establish a verdict about the worth of the design architect's interpretation. The verdict basis on the outcome overall worth of the assessed CMOAS. Although SWAP requires a design architect with proper understanding of the mathematics of the methodology, which is a disadvantage for

it functionability. But its ability for producing value outcome for the design architects ICUs is its strongest advantage enabling him further judgement and ICU-UCI runnings. It makes interpretations factual and has less limitations than ISM. But, in general, and with respect to design architect's ways of performance, it requires either the design architect to become a methodology EXPERT which cannot be welcomed by all of them or always have a methodology expert as his facilitator in-house. The relationship between him and his methodology expert has to be a progressive relationship to the facilitation to be able to understand the language, thought and emotion of the design architect. For these reasons if SWAP is used with the framework independently, it would be extremely strong tool for the architect, client, public and legislator to judge the work of a design archtiect by hiring a methodology expert. In other words, on its own SWAP either in the early stage or completed stage ofproject, functions more like a tool for progress based on clear judgement rather than ISM, which is very much a learning tool. For SWAP to become more functional in the world of architects, it requires its function to be explained in a language as near to the language of architectural work environment. In other words, there has to be an emphasis on the fact that this methodolgy can demonstrate by way of measurement and scaling the value of the project with regard to criteria and judgement of the involved parties. Such a claim, which proved to be valid in

the experiment of LBR/CMOAS will be an extremely welcoming new tool for client, public and legislator to assess the architect's performance, but for the architect it would be equally welcoming if it can better be fitted in the framework of ICU-UCI. That is to say, further work is required to make easier the construction of combinational rule and criteria and understanding of utility space. In short, the performance of the design architect must remain as a design architect, rather than he becoming a methodlgy expert. To find out how this can be achieved requires further close work between a design architect and methodology expert to discover matters. When such progress is made, the outcome will no longer be referred to as SWAP methodology. It would probably be considered as further developmental stage of ICU-UCI.

With further regard to ICU-UCI application, the point is that from initial studies to sketch and detail design takes 62% of the total work of an architect, for which ICU-UCI framework is meant to be operational with less emphasis on the detail design stage. Since it is the aim to keep the nature of the job alive and more creative, as soon as the design architect is really involved with a full understanding of the work required, he is at the stage of being able to produce something from his ICUs which merits criticism or support. The crucial part of the judgement process is then whether or not there is good communication or a vaild way of discovering the UCIs for the design

architect from non-design architects. It is after the completion of ICU-UCI running that a point at which the design architect pauses and designs with a new cognitive map of himself appears. At that stage his new cognitive map and ICU-UCI maps will guide him into drawing the lines which represent a solution. This solution is claimed to be the most creative part of the work. The claim is based on the fact that ICU-UCI outcome, regardless of being two-dimensional or three-dimensional, are highly motivating. It is such motivation that provides the drive to think of new ideas, as is seen in the LBR exercise. The new ideas emerge in the design architect in such a way that he sees himself as a system designer who views the profession as an organisation of the parts. The organising is the creation of the whole in which there is a clear, conscious understanding of the connections and relationships of the parts. The responsibility of the organiser, i.e. system thinking design architect, is seen in a spectrum which, at one extreme, he is involved with subjective aspects of the final production, and at the other he has the responsibility of the organiser, having to think mathematically to some degree, to envisage an organisation which can function properly, i.e. to bring emotional and physical satisfaction.

It is concluded that ICU-UCI is a new area of design research which is an original contribution to the development, existence and valididty of the concept of

architectural design methodology. Since, ICU-UCI is such a methodology and/or framework which at least helps to reduce the level of complaints by users, clients, architects, non-architects and society, is therefore an introduction of a suitable framework which requires support and proper backing by the legislators to bring it to its most practical stage.

As we know, architecture is not a profession which can immediately be productive and beneficial to society. To improve an outcome, architecture requires many resources concentrated together at the beginning of a process, which is seen through to a final outcome. Some percentage of resources need to be given to the development of design methodology with regard to CMOAS type projects. It is the case of the real world that the presentation of the final outcome is usually no guarantee of satisfaction, while requiring so much effort and consuming so many resources. The uncertain and complex outcome, especially if there has been no proper interpretation, understanding and a way of communication to examine the design architect's interpretation and the overall worth of future production of the user's requirements, will be considerably reduced by using the ICU-UCI framework, even at its present level of development. This claim has obviously been found extremely valid with the LBR-CMOAS example. It is therefore believed that any positive move towards the development of ICU-UCI is to be regarded as an original contribution to architectural

education, practice and to society in general, in which contribution of systems methodologies such as SWAP and/or ISM are to be considered very seriously. Of course, when ICU-UCI is fully developed, the language of it would be as near as possible to the language of a layman user of architecture. When such a day comes ISM and/or SWAP will be amalgamated with the ICU-UCI concept in which direct reference to them cannot be obviously made. The importance of the ICU-UCI development will also be in the possibility of an increase in the notion of a united opinion on the nature of artistic criteria by scientific ways of measurement and scaling. This framework for a CMOAS, while leaving much less room for miscalculation than the Popperian-like design method with trial and error policy, offers a chance for architects, while leaving them free to talk, act and function within an artistic paradigm, to feel and enjoy a role as scientist.

Since the ingredients of architecture are art, science and technique or craftmanship, it requires the emphasis to be towards all sides of this profession in architectural schools. Since the emphasis is more towards the artistic side, the formation of architectural students' opinion offers little in the way of a scientific basis. Consequently, they resort to explanations in the light of their experience and do not normally tackle problems of a scientific nature in a scientific way. The ISM/SWAP (mainly SWAP) therefore comes as an outsider to a familiar, non-

scientific looking work environment of the design architect's CMOAS/ICU-UCI framework. It is the language, vocabulary and terminology of it which is strangely different from that of a design architect's architectural work environment. Thus, the need for development of ICU-UCI represents very seriously such a problem area and requires solution. This problem is more apparant at present when a design architect wants to communicate with his client on a basis, for example, of SWAP-MACRIT worksheet, instead of presentation of design drawings for early stage of a CMOAS scheme. There are always, of course, methodology experts who may read the worksheets and explain the progress in a particular stage, but the aim is to come to a conclusion ICU-UCI which can be used by the design architect on his own, as well as by others in architectural practice or education without reference to methodology experts. Therefore, as mentioned before, this very strong methodology has to be presented in a language which enables any architect or anyone from any other discipline as a comparative layman to understand the workings of the SWAP within the ICU-UCI framework.

Another consideration is that, with every design decision, there is an evaluation process. When a design architect chooses between two elements and their connection, his evaluation process happens in silence, including elements excluded from the decision. In other words, in order to

decide how to connect the element A with the element B and
with the element C an evaluation is made regarding which
will go next to which, and the final idea is reached after
the appropriate self-interactions. The ICU-UCI is meant to
make more possible the self-interaction process by
minimizing the number of elements and interactions with
every decision. The result which provides the possibility
of a "free and wild" approach desired by the creative
designer towards synthesizing results in a creative CMOAS.
But if the design architect is compelled to include
methodolgy experts in his design decision process, the
outcome gives the impression and/or possibility that the
design architect functions within the second generation of
design methods. This would not be in harmony with the idea
of ICU-UCI generation, which is meant to be neither first
generation design methodology, nor the second.

Since it is concluded that the fundamental nature of the
problem between the design architect and non-design
architect is to bring the interpretation of each of them to
a high level of understanding as a result of a successful
exercise in communication, therefore the development of ICU-
UCI must be based on a idea to enable the design architect
to present the outcome three-dimensionally. It is also
concluded that circumstances can be seen to change the way
of looking at a problem, to view it from different angles,
and to formulate it in different ways at different stages of

its development. With this in mind, thinking of a framework, i.e ICU-UCI, based on coping with the root of the problem, i.e. the misunderstanding, misinterpretation and poor communication between the design architect and the non-design architects seems to be a kind of thought which circumstances should not change the focus which is a generation of a design methodology which can enable a non-creative design architect to design creatively. ICU-UCI enables the design architect at every stage of design decision not to worry about the perspective of synthesising an enormous number of elements of a CMOAS. He achieves this by way of considering freely and creatively the relationship between only two elements at every stage of design decision.

With regard to the question of how to produce a "better" architecture, it is concluded that a "better" architect can produce a better architecture. This, in the opinion of the author, is found to be more important than a methodology. As a result Systems Thinking explored and recommended with various interpretations as a form-giving and fundamental to the production of the Systems Thinking Architect as a better architect.

It is concluded that although every building has architectural value, depending on the relative quality of the design and/or evaluation criteria, but the desire is seen to make 'architecture' synonymous with "good"

buildings',

The conclusion is reached that architecture is a process
that comprises communication channels in which the data
input and information output are the contribution of more
than one architect and more than one discipline. It is also
like music, involving the same mental processes, but with
the emphasis on the total score of the composition, i.e. the
wholeness should exist in the imagination/mind of the design
architect before he produces his ICUs and the final design
of a CMOAS scheme.

With regard to systems defintion, the conclusion is reached
that any building can be known as an architecutral system,
and because of the multi-objective nature of it, the optimum
solution of the whole system is not sought – in fact it is
found to be meaningless. The best solution is concluded to
be one involving a consensus, and even then the consensus is
not fixed , i.e. not acceptable for ever. The future and
the passing of time may bring out other complexities
differing from those of an earlier period, which will then
require different solutions.

Although the architect maintains a responsible attitude, the
function of his earlier work which will require new
different solutions must not be influenced by politicians,
economists or other opinion-formers who lead the rest of

society in effecting a change to its needs and requirements, to the extent of creating an atmosphere which goes counter to the architect's role, as a responsible, free and creative person. The public needs to be made aware of who has what role in the building process, and how many key roles exist within it. One way of accomplishing this is to give the architect the right to explain his decision processes, i.e. by ICU-UCI running for production of his ICUs. The method itself will help him to explain the way by which he has arrived at the final design ideas for various parts of the building. But he will nevertheless be unable to explain, other than by showing his ICUs, the creative processes which took place in his mind. When ICU-UCI framework becomes a future way of communication between architect and non-architects, then it would not be fair to criticise such a systemsthinking architect for the final outcome of his design production. Because the decision processes involved that lead up to the final product are beyond his control and his goal cannot be certainly to take over all decision processes. It is concluded that the designer's board or coalition team is responsible for examining whether the design architect's ICUs are fulfilling his role with respect to the needs and necessities of the final users. Therefore, within the possibilities of ICU-UCI framework, while defining his role, and while making the public aware of them, he is given the right to exercise his creativity which is the most desirable criteria to him as an individual free

responsible systems thinking practitioner in the process of
CMOAS design.

A Few Final Words

The spectrum of architects' knowledge, beliefs and ideology
as a motivating source for their design productivity is seen
to be wide, long, diverse and very uneven. Two specific forms
of their contribution in the process of an architectural
production were considered to be representatives of two
different types of architects. On one side is an architect
as a dominant expert and on the other side is an architect
as a non-dominant expert in a team with an assumption of
symmetry of ignorance among its members.

The aim in this research was not to prove or disprove
either. The preferred aim was to work towards a way to
bring unity and productivity to architects' beliefs and
ideology, which is regarded as a noble enough objective to
be worth spending time on, even if the gain is minute.

With the role of a design architect in mind, the aim and
objective of architecture and the relationship between a
design architect and non-design architect was considered.
Due to the disharmony that appeared to exist among their
interpretations of a "good" building and their understanding
of problem solving process in architecture the conclusion is
reached that if there was design/evaluation methodolgy in

the field of systems science to be used before the beginning of the actual design drawing and/or after completion of the design stage, in which the degree of mathematical language of the methodology were compatible with the language of the layman, then the design architect might have been in a better state of understanding with the non-architect, when he/she created a new design as a solution to their needs and requirements.
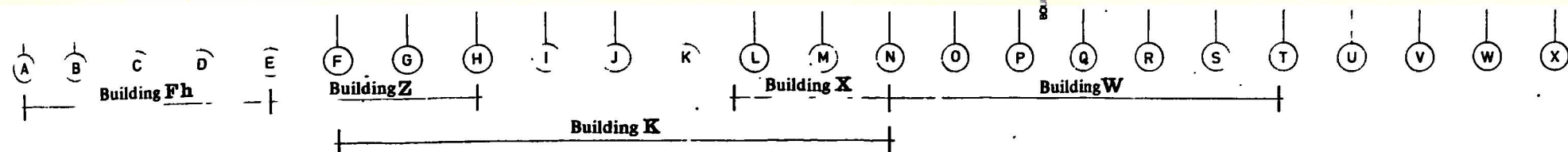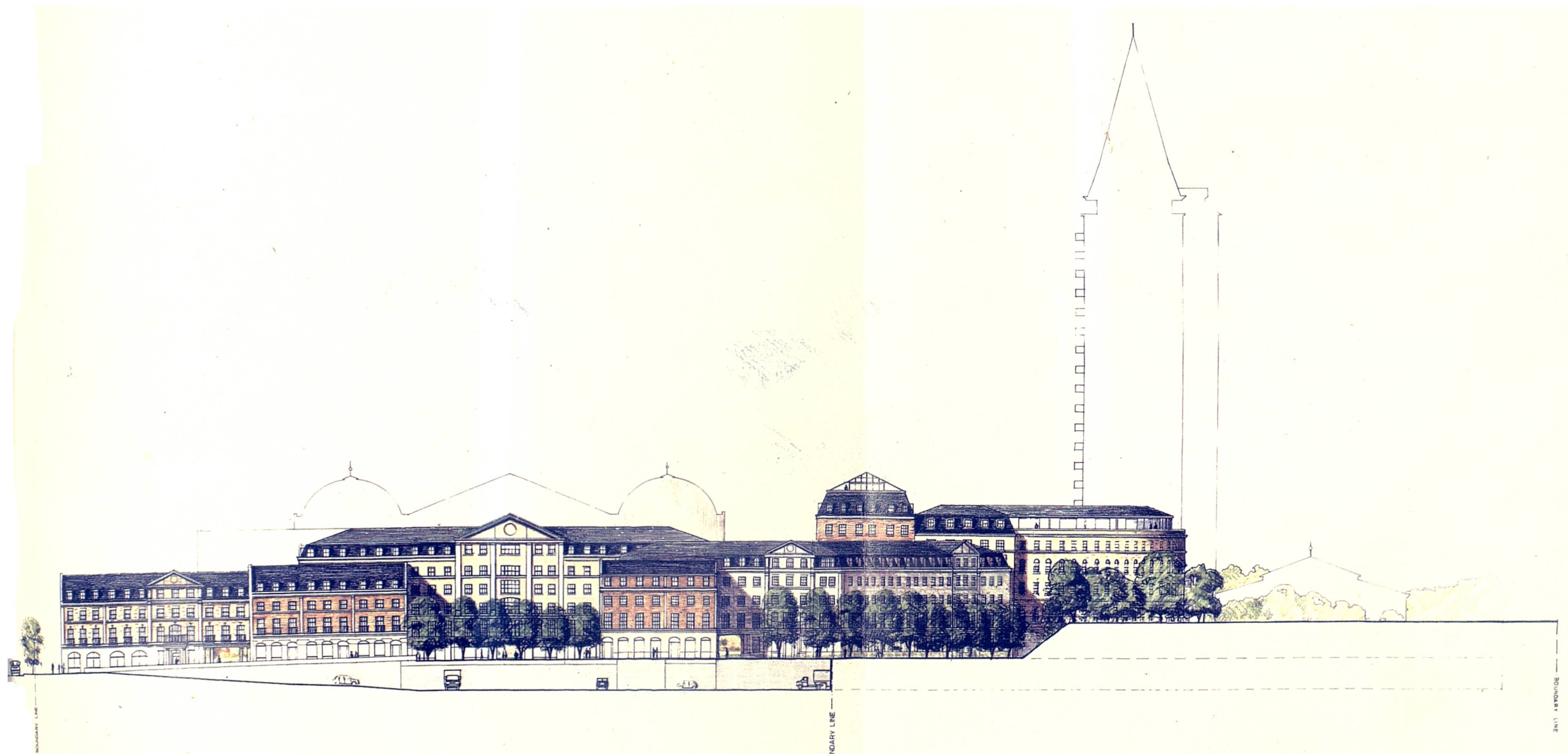
If it is understood that having home and environment to live and work in is the right of every human being then, to rearrange things more equitably on a global scale, it needs to be understood that although it is not possible to change the whole world overnight, it remains our responsiblity to tackle the problem as a whole, while and even if only achieving solutions at a local level. If we think in that way, the architecture in the rich parts of the world cannot continue without regard to the poor parts of the world merely for the sake of architecutral progress.

I have come to the conclusion that for this profession to advance itself, even to the post-modernist, there is no need to follow irresponsibly freedom of ideas for the satisfaction of only the elite, other than the experimental in the pursuit of progress.

The point is to bring the missing, 'thinking' part to this profession and its attitude to education, and to enable new people to take on responsibility, with the availability of all the means necessary to solve the problem. The aim is not to create one-or-two design methods, but to introduce a new way of thinking. New, perhaps, systems thinking is required in architectural education to bring to the attention of the public the expertise of the new kind of responsible architect. Let the public judge them while the architects enjoy the problem-solving role, while at the same time having the flexibility of searching creatively for an equitable environment, where equitable means bringing a pleasant environment to all the people by way of new thinking in which, it is believed, ICU-UCI design framework will fall in that category to help the systems thinking design architect in solving the complexities in the design of every CMOAS.

Building **Fh**

Building **Z**

Building **X**

Building **W**

Building **K**

(A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (K) (L) (M) (N) (O) (P) (Q) (R) (S) (T) (U) (V) (W) (X)

5

0m 5 10 15 20 25
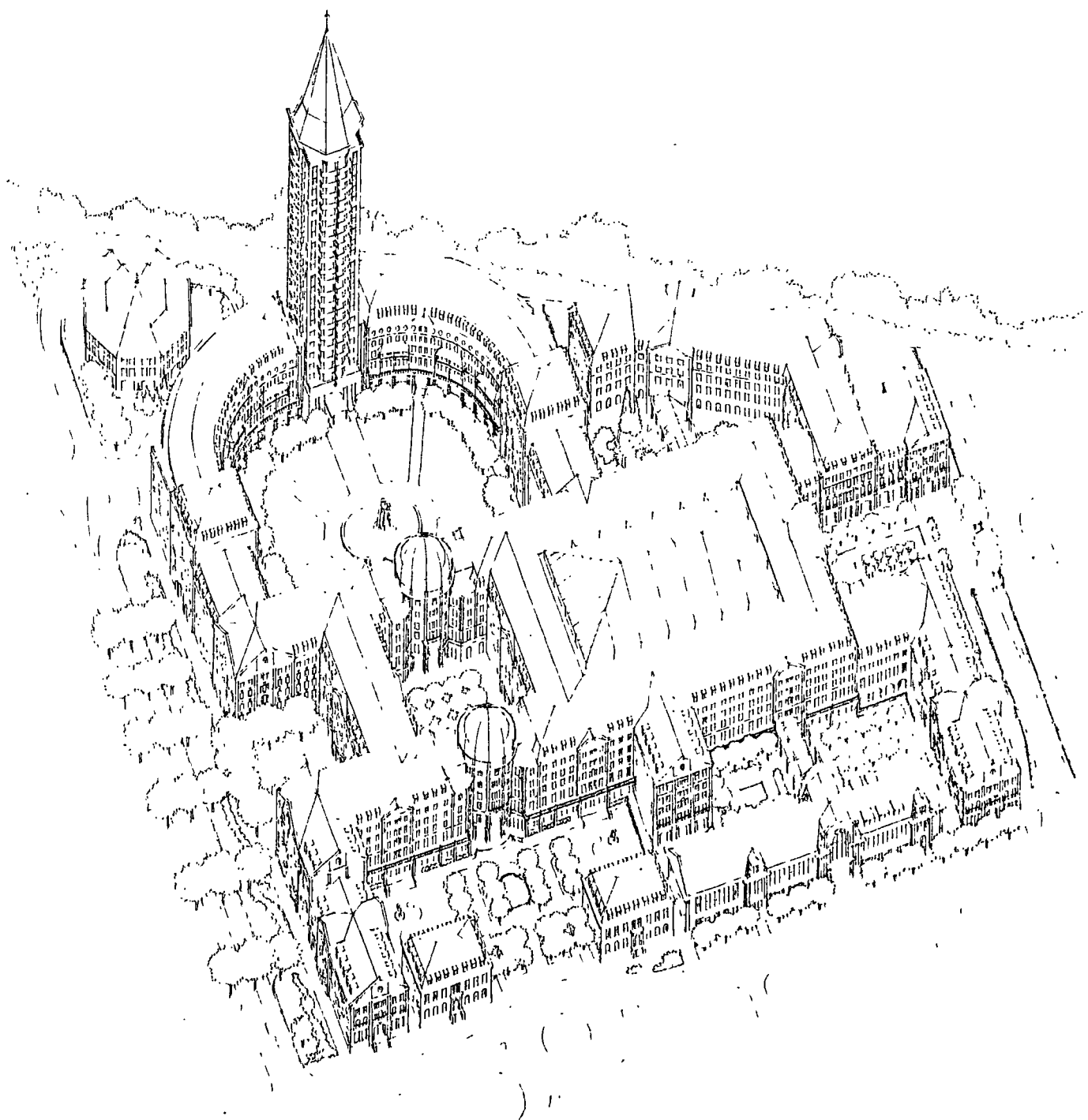
APPENDICES:

1. BASIC SERVICES OF AN ARCHITECT (Source RIBA)

2. INTERPRETIVE STRUCTURAL MODELLING (ISM)

3. RELATIONSHIP BETWEEN USER AND DESIGNER (Based on Y. Friedman, 1975 diagrams [29])

4. TECHNICAL NOTE (SWAP)

5. SOME DRAWINGS OF LBR-CMOAS

This Part Prescribes Preliminary and Basic Services

Which an Architect Will Normally Provide.

Preliminary Services

Work Stage A: Inspection

1.1 Brief

Discuss the client's requirements including timescales and any financial limits; asses these and give general advice on how to proceed;agree the architect's services.

1.2 Information to be provided by the client

Obtain from the client information on ownership and any lessor and lessees of the site, any existing buildings on the site, boundary fences and other encloures, and any known easements, encroachments, underground services, rights of way, rights of support and other relevent matters.

1.3 Site apprasial

Visit site and carry out an initial appraisal.

1.4 Advice on other consultants' services

Advise on the need for other consultant's services and on the scope of these services.

1.5 Design work by specialist firms

Advise on the need for specialist contractors, sub-contractors and suppliers to design and execute part of the works to comply with the architect's requirments.

1.6 Site staff

Advise on the need for site staff.

1.7 Timetable and fee basis

Prepare where required and out line timetable and fee basis for further service for the client's approval.

Work stage B: Feasibility

1.8 Feasibility studies

Carry out such studies as may be necessary to determine the feasibility of client's requirements; review with the client alternative design and construction approaches and cost implications; advise on the need to obtain planning permissions, approvals under building acts or regulations, and other similar statutory requirements.

Basic Services

Work stage C: Outline proposals

1.9 Outline proposals

With other consultants where appointed, analyse client's requirements, prepare outline proposals and an approximation of the construction cost for the client's preliminary approval.

Work stage D: Scheme design

1.10 Scheme design

With other consultants where appointed, develop a scheme design from the outline proposals taking into account amendments requested by the client; prepare a cost estimate; where applicable. give an indication of possible start and, completion dates for the building

contract. The scheme design will illustrat the size and character of the project in sufficient detail to enable the client to agree the spatial arrangements, materials and appearance.

1.11 Changes in scheme design

With other consultants where appointed, advise the client of the implications of any subsequent changes on the cost of the project and on the overall programme.

1.12 Planning application

Make where required application for the planning permission. The permission itself is beyond architect's control and no guarantee can be given that it will be granted .

Work stage E: Detail design

1.13 Detail design

With other consultants where appointed, develop the scheme design; obtain the client's approval of the type of construction, quality of materials and standerd of workmanship; co-ordinate any design work done by consultants, specialist contractors, sub-contractors and suppliers; obtain quotations and other information in connection with specialist work.

1.14 Cost checks and changes

With other consultants where appointed, carry out cost checks as necessary; advise the client of any consequences of any subsequent changes on the cost and programme.

1.15 Statutory approvals

Make and negotiate where required applications for approvals under building acts, regulations or other statutory requirements.

Work stage F and G: Production information and bill of quantities

1.16 Production information

With other consultants where appointed, prepare production information including drawings, schedules and specification of materials and workmanship. Provide information for bills of quantities, if any, to be prepared. All information complete in sufficient details to enable a contractor to prepare a tendre.

Work stage H: Tendre action

1.17 Other contractors

Arrange, where relevant, for other contracts to be let prior to   commence the work.

1.18 Tender lists

Advise 'on and obtain the client's approval to a list of tenders.

1.19 Tender action appraisal

Invite tenders from approved contractors; appraise and advise on tenders submitted. Alternatively, arrange for a price to be negotiated with a contractor.

Work stage J: Project planning

1.20 Project planning

Advise the client on the appointment of the contractor and on the resposibilities of the client, contractor and architect under the terms of building contract; where required prepare the building contract and arrange for it to be signed by the client and the contractor; provide production information as required by the building contract.

Work stage K: Operations on site

1.21 Contract administration

Administer the terms of the building contract during operation on site.

1.22 Inspection

Visit the site as appropriate to inspect generally the progress and quality of the work.

1.23 Financial appraisal

With other consultants where appointed, make where required periodic financial reports to the client including the effects of any variations on the construction cost.

Work stage L: Completion

1.24 Completion

Administer the terms of building contract relating to the completion of works.

1.25 Guidance on maintenance

Give general guidance on maintenance.

1.26 Record drawings

Provide the client with a set of drawings showing the building and the main lines of drainage; arrange for drawings of the services installations to be provided.

INTERPRETIVE STRUCTURAL MODELING (ISM)

1. Description
    Interpretive structural modeling is defined as a computer-based,interactive,learning process, which facilitates the task of organizing complex issues or problems.

2. Brief History
    ISM is based on various branches of mathematics-graph theory (Euler,1736),logic (Boole and de Morgan,1847),matrics (Cayley,1858), relation theory (de Morgan;Pierce,1892),and lattice theory (Brikoff,1948).

3. Basic Premise or Assumption
    ISM is based on assumption that the task of organizing and structuring the large quantities of quantitative and qualitative data connected with complex societal problems can be easily handeled by computer algorithms, together with the communication tools of words,graphics and mathematics.

4. Purpose/Goal
    To extend capacity to define complex systems and enhance inter-disciplinary efforts to communicate about system improvement [Warfield,p.205].

5. Mental Operations Supported
    Memory
    Convergent production
    Evaluation

6. Benefits
    Graphical modes of communication are used to illuminate complex issues,systems,or concepts [Warfield,p.199]
    ISM provides for a means of organizing and giving structure to large quantities of information[Warfield,p.198].
    Facilitates learning,comprehension, and communication [Warfield, p.194].
    Provides for the development of a rationale that will support a decision [Warfield,p.198].

7. Limitations

The size of the element set that can be accommodated in a given time is limited by the speed and memory capacity of computing equipment. The process is tiring, so that the time of session cannot exceed about four hours.

8. Participants Quantity

Number of participants is limited to a group not more than eight members.

Qualifications

Broker: Should understand context requiring study, learning, and organization.

Facilitator: Should have skill to help groups work together and be familiar with ISM process.

Technitian: Must be well trained to handle the equipment needed for ISM process and know how to use ISM software.

Participants: Should be knowledgeable about problem area, capable of contributing to implementation of ISM results, aware of source of information; politically sensitive, capable of representing constituency, and capable of engaging in focus dialogue.

Observers:

Roles of Group Members

Broker. Identifies participants and encourages them to take part in ISM process, financial matters, selection of facilitator and technician are looked after by Broker.

Facilitator. Responsible for metaprocessess (those process necessary to maintain group stability and help the group reach its desired goal).

Technician.Arrangements for installation, implementation, and maintenance of computer software and hardware.

Participants.

Observer.

9. Input

Set of elements and variety of relations [Lendaris,pp.346-347].

10. Output

Interpretive structural model [Warfield,p.204].

11. Basic Elements

Set of elements germane to the problem, for example, variables, subsystems, objectives, or goals [Warfield.p.71].

Contextual relation [Warfield,p.349].

12 Rules for Use/Syntax

Transitive embedding [Warfield,p.349].

Weighted embedding [Warfield,p.354].

Scanning method [Warfield,p.254].

Coupling method [Warfield,p.354].

13 Operational Procedures

1. Time is selected.
2. Developer is identified.
3. Elements and contextual relations are identified.
4. Leader is identified.
5. ISM programe is entered in computer.
6. Adequate computer time is allocated.
7. Facilities are ready.
8. Session plan is complete.
9. Computer contains elements and contextual relations.
10. Session can begin.
11. Element set is edited.
12. Reachability matrix is complete.
13. Total structure is available.
14. Ammendments are complete.
15. Final structures are satisfactory.
   [Source: Warfield,p.347]

14. Time Required

Each session, not more than three hours. A rough approximation can be stated as follows:

$$T(hours) = (1/600) \, e \, p$$

Where e is the number of elements in the element set and p is the numberof participantsengaged in the model development process [Warfield,p.353].

15. Meeting Room/ Environment

Television disply screen accessed remotely through a telephone line connected to a copute terminal(kept in low profile).

Table and comfortable chairs.

Black board.

[Source: Warfield,p.348-349].

16. Supplies

Dictionary.

Paper and pencils

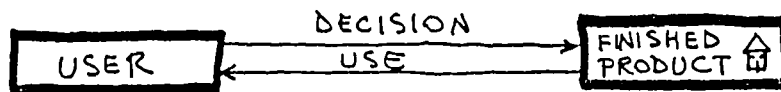Chalk.

17. Technology

Software

Computer program.

Hardware

Computer terminal with telephone access to a computer containing ISM software. Display units, Automatic drafting equipments etc.
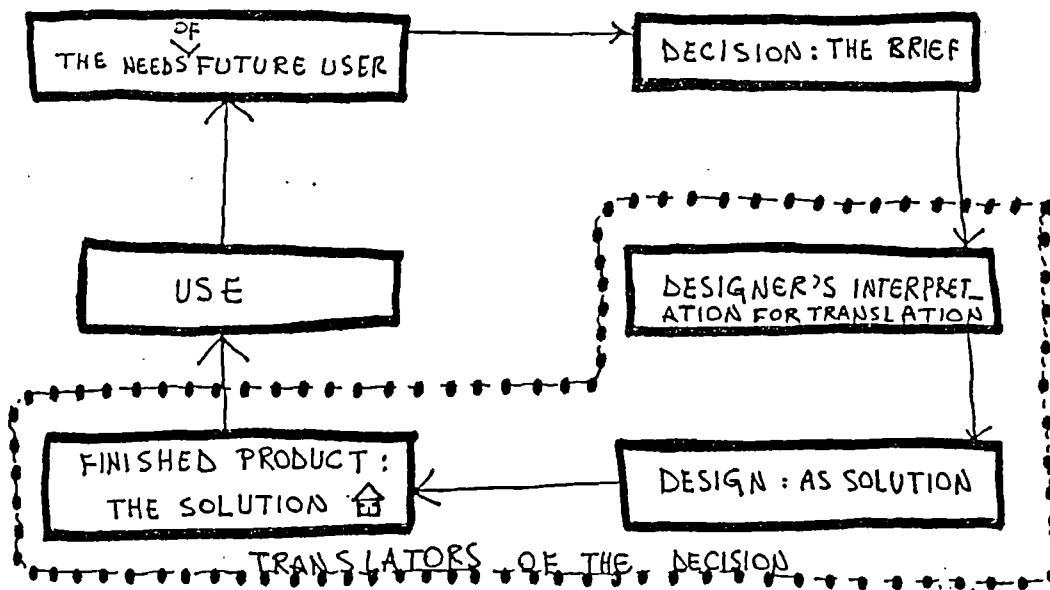
18. Former users

Wide variety of applications in industry,education, and government.

The BASIC PROCESS INCLUDES ONLY THE USER AND THE PRODUCT

The TRANSLATOR ENTERS THE PROCESS AND LANGUAGE AND
INTERPRETATION BECOME EXTREMELY IMPORTANT AS FORM-GIVER
TO THE FINAL PRODUCT : THE FIRST GENERATION (PROBABLE) DESIGN-PRODUCT
DUE TO INTERPRETATION PROBLEMS

APPENDIX 3: Relationship between user, designer
AND THE PRODUCT.
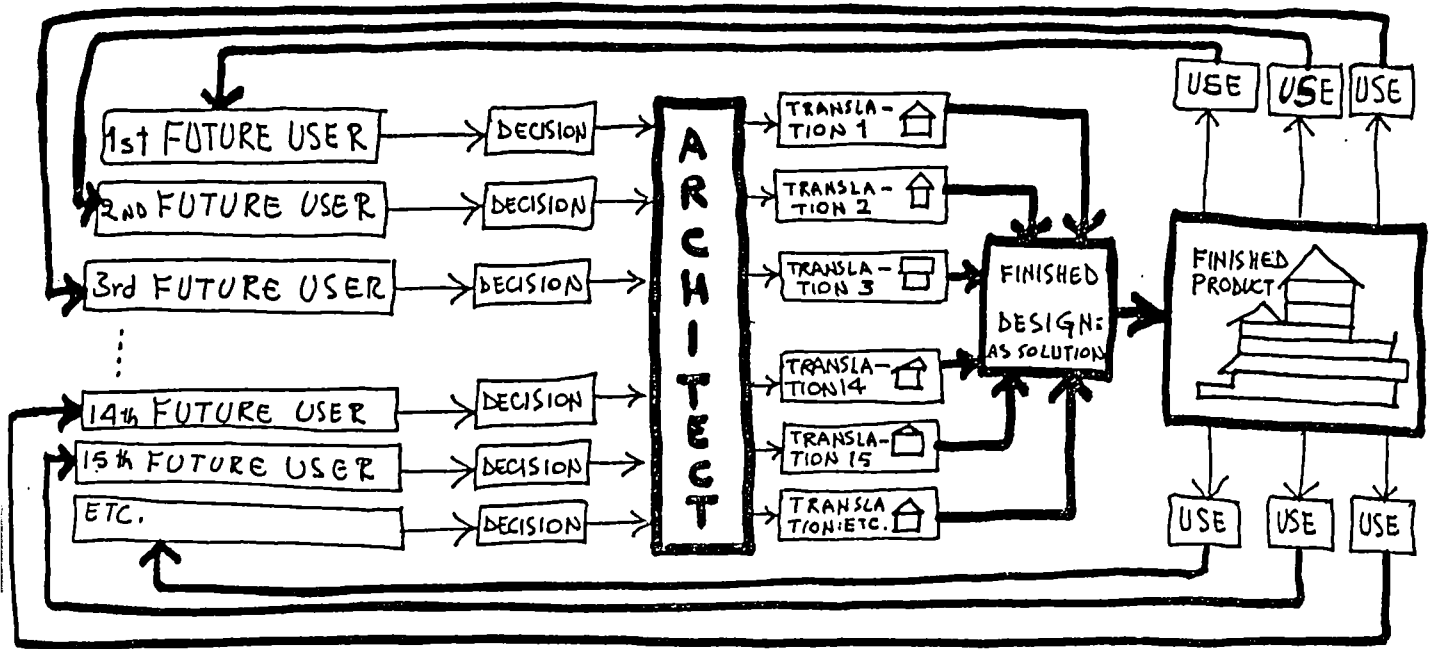
The Finished Product is a multiple objective Architectural System with less complexity : THE SECOND GENERATION (POSSIBLE) DESIGN - PRODUCT PROBLEMS

DUE TO INTERPRETATION AND INTERACTIONS
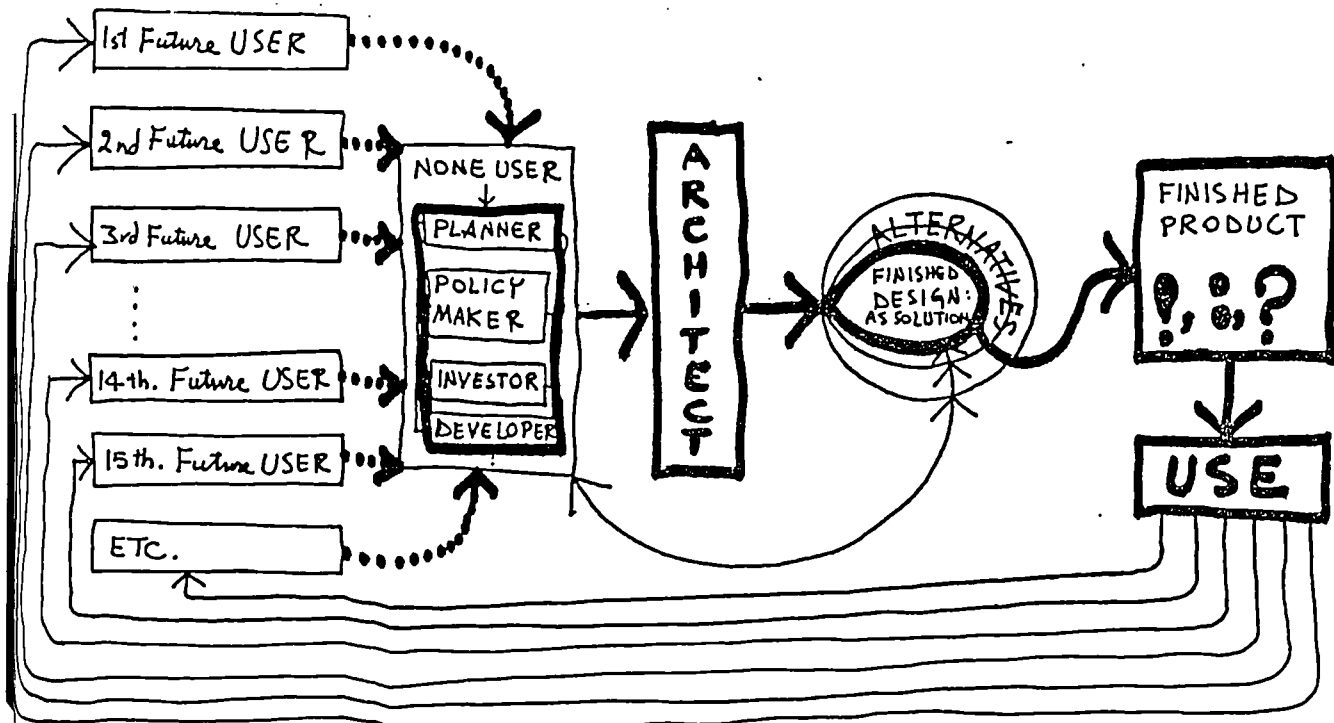
The Finished Product is a multiple objective Architectural System with more complexity : THE -THIRD- GENERATION (EXPECTED) DESIGN -PRODUCT PROBLEMS

: DUE TO INTERPRETATION, INTERACTIONS AND UNCERTAINTY.

APPENDIX 3: Relationship between user, designer AND THE PRODUCT.

TECHNICAL NOTE

THE MULTIATTRIBUTE CRITERION:
ITS CONSTRUCTION USING THE SWAP METHODOLOGY

(P.K.M'Pherson)

The assessment of the L B R scheme is a problem entailing multiple objectives, multiple criteria and multiple perspectives. The example assessments were made using the Systematic Worth Assessment Procedure (SWAP), which is a set of operational computer-aided procedures for dealing with the various types of multicriteria decision problem encountered by decision-makers and designers.

This note summarizes the problem of multiobjective, multiattribute assessment in terms of the fundamental 2-attribute subcriterion, and then shows how a multiattribute criterion may be built up using these blocks. As such this note provides a methodological summary to support and explain the procedures deployed in the construction of the MACRIT Worksheet (MACRIT = Multiattribute Criterion).

SWAP is a member of the family of methodologies within the field of Multicriteria Decision Analysis (MCDA), and is based particularly on Multiattribute Utility Theory (MAUT). SWAP's characteristic is that it provides a computer-aided interactive procedure that allows a decision-maker to construct a multiattribute criterion that meets the needs of the current problem within a methodological framework that preserves the axioms and logic of preference ordering and MAUT.

There is an extensive literature covering the MCDA field. For present purposes references are limited to publications that illuminate SWAP, and which provide a general survey of the MCDA field.

P.K.M'Pherson (1990)   Assessment under multiple criteria. MacPherson Systems Ltd.

--- (1990)   Structured Thinking System: STRUTS. MacPherson Systems Ltd.

--- (1981)   The design of sensitive performance criteria for complex multiple objective systems. Department of Systems Science, City University, London.

V. Chankong, Y.Y Haimes (1983) Multiple Objective Decision Making: Theory and Methodology. North-Holland.

V. Belton (1990). Multicriteria Decision Analysis, in L.C Henry, R.W Eglese (Eds). Operational Research Tutorial Papers, Operational Research Society.

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1 THE STANDARD 2-ATTRIBUTE CRITERION

The L B R criterion is typical of a hierarchical multiattribute criterion: its structure is reproduced in figure 1 below.
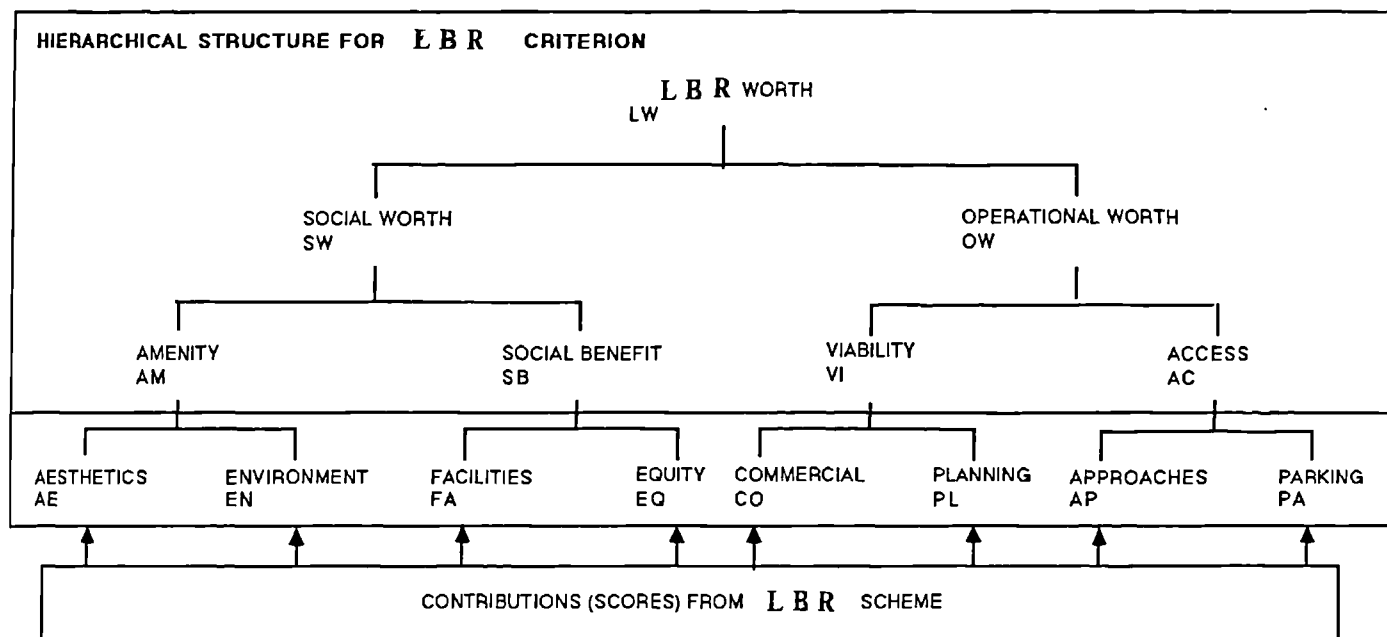

Figure 1

The hierarchy is built up using a standard building block formed from a simple 2-attribute criterion. The blocks provide the hierarchy that reduces the 1st Level attributes systematically to the final value indicator at the top. The structure of this simple criterion will be considered first: after that, the rest of the criterion is a matter of repetition.

Structurally there is little difference between the natural (additive) assessment procedure and the SWAP procedure in utility space: the stages are similar. Consider figure 2 (next page) which gives a bare outline of SWAP applied with a 2-attribute criterion. The structural similarity is apparent from the left hand diagram, (the right hand diagram gives a pictorial summary of the procedures). Start from the bottom and work up:

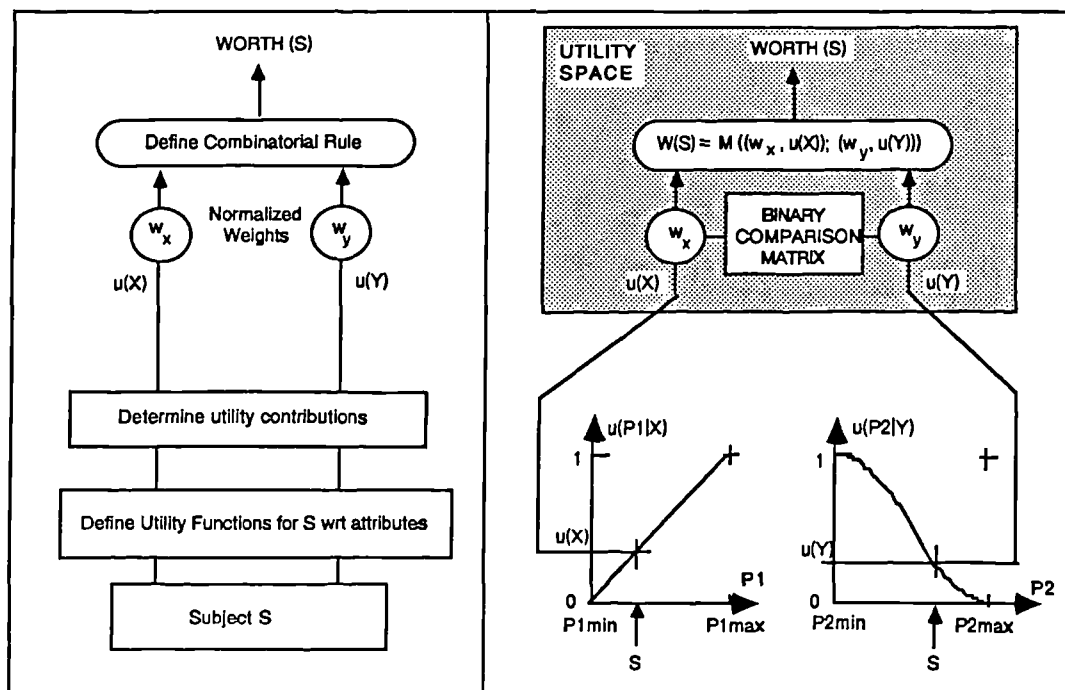| SWAP	NATURAL ASSESSMENT
Subject S	Subject S
Define utility functions for S wrt the given attributes X and Y	Select the scoring procedure to be used; define the numerical score bands wrt the attributes X and Y
Determine the actual levels of utility contributed from each utility function	Assign scores for each attribute
Assess the relative importance (weights) of the attributes	Assess the relative importance (weights) of the attributes
Determine the appropriate combinatorial rule for the value context of the criterion	Assume that the additive combinatorial rule applies in every case
Calculate the worth of S using the algorithm appropriate to the combinatorial rule	Calculate the worth of S by adding the weighted scores

Figure 2

Although the two structures look similar, the comparison shows that there is a significant *methodological* difference, as SWAP imposes no preconditions other than the logical axioms of utility theory, whereas the natural assessment procedure imposes the very strong precondition that the universe of value assessments is always additive.

The following items are required to formulate the 2-attribute criterion:

1   The two attributes X and Y, which in a real case will be a named and meaningful couple from a set of objectives or value attributes that has been defined for the criterion,

2   Weights w_x and w_y for the two attributes: these distinguish their relative importance.

3   Two utility functions, one for each attribute, to convert the incoming contribution into an equivalent utility on the attribute in question. (See Appendix 2 for a note on Utility Functions.)

4   A combinatorial rule to represent the manner in which the utility feeds along each attribute are to be combined. (See Appendix 1 for a note on Worth Assessment in Utility Space, and the Combinatorial Rules.)

With these in place, the 2-attribute criterion is formulated and ready for action.

2   THE 2-ATTRIBUTE CRITERION AS A BUILDING BLOCK

In practice the 2-attribute "SubCriterion" is used as a building block for the main Strategic Criterion: SubCriterions that have more than two attributes "at the first cut" are broken up into an equivalent nest of 2-attribute criterions. This is done because the definition of a combinatorial rule for a criterion requires trade-offs between its attributes. Binary trade-offs between two attributes can be handled easily, but simultaneous trade-offs between triples and higher require a degree of mental discipline and strain that asks too much of most people. SWAP avoids the temptation to resort to exquisite analysis in a multi-dimensional mathematical space because this immediately inserts a barrier between the internal structure of the Criterion and the real decision-maker. SWAP's design philosophy requires that the Criterion be transparent to the responsible decision-makers: they own the problem, they construct the Criterion (with help from SWAP) to represent their perspectives and preferences, they will use the Criterion only if they understand how it works. Highly mathematical structures may be analytically elegant, but they force a mathematical optimizing criterion onto the problem which may not represent sensitive human perceptions at all. (SubCriterions with three or more attributes are permitted by SWAP when it can be demonstrated that the same combinatorial rule applies strictly to all possible trade-offs between the attributes, as would occur, for example, between a set of monetary attributes.)

3   PROCEDURE FOR CONSTRUCTING THE COMPLETE CRITERION

The ten steps in the construction of a Criterion can now be summarized.

1   Define the top Ideal and the bottom 1st Level attributes that will be used for practical assessments of subjects in the class S.
2   Disaggregate the Ideal into a tree of well-defined (meaningful) objectives or attributes that link the Ideal through the tree to the 1st level.
3   If necessary adjust the tree objectives and the 1st Level attributes to ensure that there is a proper match: the upper hierarchy covers all 1st level attributes that ought to be measured: the 1st Level attributes provide contributions to all higher level objectives (via the tree).

The criterion now has its hierarchical structure defined together with the labels for all the objectives/attributes in it.

4   *Identify the nodes (branch points) in the tree. Appropriate combinatorial rules will have to be defined for each node.*
5   Ensure that each node is a binary branch wherever possible. Disaggregate multiattribute branches into nests of binary branches using the recommended procedure (which also permits multiattribute branches if certain tests are passed).

The Criterion now has a listing of all the nodes at which combinatorial rules must be defined. The list identifies the various SubCriterions.

6   Define the combinatorial rules using the recommended procedure.
7   Define the relative weights for the attributes in each SubCriterion using the recommended procedure.

Each SubCriterion now has an appropriate combinatorial rule, and the related set of importance weights.

8   *Generate the utility functions for each of the 1st level attributes. (This is not required if the input indicators are already in the form of utility functions.)*
9   *Generate the utility functions for the higher level SubCriterions.*

The Criterion is now complete.

10   Submit the Criterion to a credibility test using Sensitivity Analysis and the recommended procedure.

The Criterion is ready for application when the credibility test is passed.

The actual procedure followed depends on whether the Criterion is being assembled during a facilitated Decision Conference, or if it is being constructed by a manager using SWAP as an interactive computer aid. In either case the 10 steps listed above still have to be completed.

The assembly of the criterion is undertaken on a MACRIT Worksheet which contains a menu for the combinatorial rules and the format for the 2-attribute criterion building block - see worksheets 1 and 2 in the Example. The assembly uses the following procedure:

i   Build the Criterion by pasting the 2-attribute block into appropriate locations on the worksheet.
ii   Label the blocks as appropriate.
iii   For each combinatorial node in the criterion select the appropriate Formula Cell from the combinatorial rule menu, copy and paste into the node cell.
iv   Type the weights into each weight cell as appropriate.
v   Link each utility function cell to the appropriate function cell on a related worksheet, (for small scale exercises the input utilities may be read off from a graph of the function).
vi   Link each utility input cell to the appropriate lower level quality output cell.
vii   Conduct a standard sensitivity analysis over the 1st level inputs to check the criterion.

EXPRESSING VALUE CONTRIBUTIONS AS UTILITY FUNCTIONS

The utility function used in multiattribute decision analysis defines a decision-maker's preferences wrt incremental changes in contributions to a value criterion.

The SWAP methodology adopts the following conventions for utility functions:
All variables and indicators from real-world purposeful systems, of whatever nature, can be mapped onto a common utility scale in such a way that their proportionate contributions to the achievements of the system's objectives are indicated by corresponding values of utility on the scale. Thus utility becomes the common currency for value assessment.

Let Px be a performance variable of the subject S, (Px is in the set of all performance variables for S). Assume that Px has a feasible range from minPx to maxPx. minPx is the threshold value of Px at which S's performance is deemed to be "just good enough", (this convention eliminates the need to deal with negative utilities). maxPx is an upper limit to Px set either by practicalities or by the state of art. Px will be one of many performance variables: it could be revenue, cost, weight, reliability, speed, accuracy, portability, number of channels, style, equity, etc, etc.

Px is desirable in that it contributes to the overall value of S. Assume in the first instance that every incremental increase in Px adds value to a defined attribute or objective Gk in the set of objectives that S ought to achieve. Measure the relative amount of value contributed towards the achievement of an objective as "utility". Then define the utility of minPx as 0, ie the Subject S is just beginning to contribute value towards Gk if Px rises above minPx. Define the contributed utility as 1 if Gk is completely achieved. Hence the utility of S with respect to the attribute Gk as contributed by Px is a member of a utility function which has values in the range [0, 1]. The actual utility level will depend on the level of the performance Pk and how the assessor perceives that utility contributions increase (or decrease) as Pk rises through its feasible range [minPx, maxPx]. The mapping of performance into utility is illustrated below.
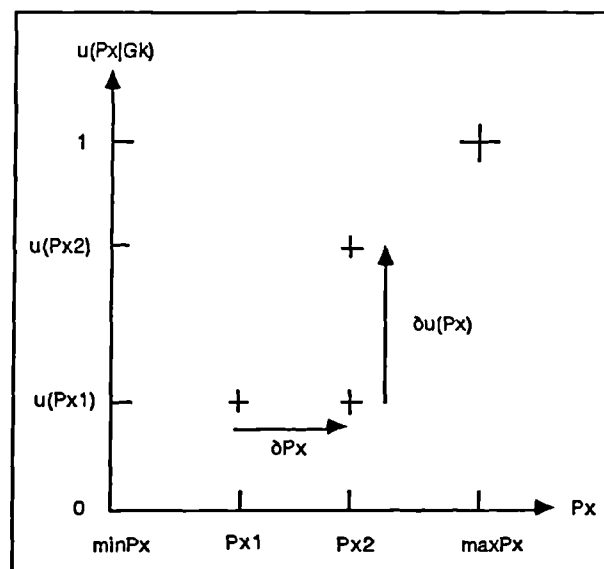

Figure A1.1

By definition u(minPx) = 0.
Px1 > minPx, hence u(Px1) ≥ u(minPx). But u(Px1) > u(minPx) iff a Subject S with Px1 is preferred to a Subject S' with minPx, all other matters being equal.
Px2 > Px1, hence u(Px2) > u(Px1) iff a Subject S with Px2 is preferred to a Subject S' with Px1, all other matters being equal.
If each rising increment of Px within the range [minPx, maxPx] is perceived to provide a larger contribution to the achievement of Gk (adds more value), then the slope $\partial u(Px)/\partial Px$ is always positive, and u(maxPx) = 1. This is quite common, but is not always the case.

The line (curve) that joins all the utilities is called a Utility Function U(Px|Gk). Its form will depend on how the assessor reckons that increments in Px add (or subtract) value with respect to the objective Gk. Thus:

iff $\partial u(Px)/\partial Px > 0$ for all Px $\in$ [minPx, maxPx], then

u(Px|Gk) $\in$ U(Px|Gx); and: $0 = u(minPx|Gk) \leq u(Px|Gk) \leq u(maxPx|Gk) = 1$ Q1

More complex forms of utility function are invoked according to the context: they may have reverse slopes to indicate that increases in Px are undesirable, and maximum utility can occur for Px < maxPx. The same subject S may require different forms of utility functions to express the particular nature of the value adding contributions from any one combination of Px and Gk. (The suffices x and k can be omitted now that the point has been made.

A utility function expresses and orders the decision-maker's preferences with respect to increases in P over its range from minP to maxP.

$P_1 > P_2$ iff $u(P_1) > u(P_2)$ Q2

Typical curvilinear and linear utility functions are illustrated below and contrasted with a staircase scoring function.
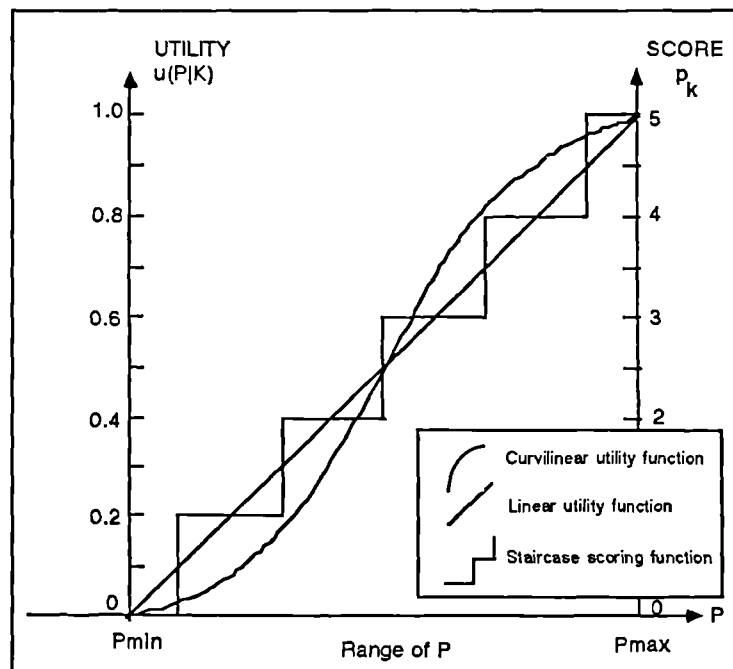

Figure A1.2

The two utility functions carry precise and sensitive information concerning a decision-maker's perception of the incremental value contributed by increases in P over its range. The linear function says: "All increases in P are equally useful: a 10% gain in P will add 10% to its utility". On the other hand the curvilinear utility function says: "All increases in P are useful. But increases over the lower range from 0 to about 20% are hardly worth bothering with (we ought to be able to do very much better). From about 80% and above we are very near to the ideal and there is little more to be gained. The value-added per unit change in P is highest between 20% and 80% of P's range". The staircase function, representing the bands on a scoring scale, can be seen here to be a jerky type of utility function. There is little difference in principle between assigning scores for the level of performance, and determining the utility function for P over its range.

Utility functions can assume many different shapes according to the context. Figure A1.3 shows the standard forms employed by SWAP, and short descriptions follow on page A8. The graphs of the standard forms used for the L+R example are shown on pages A9,10. The standard forms are used to determine the level of a utility function for insertion into the MAGRIT worksheet, either by reading off from the graph or by linking directly to a mathematical formulation that computes the utility level. The standard forms may be modified to suit an individual decision-maker's perceptions.
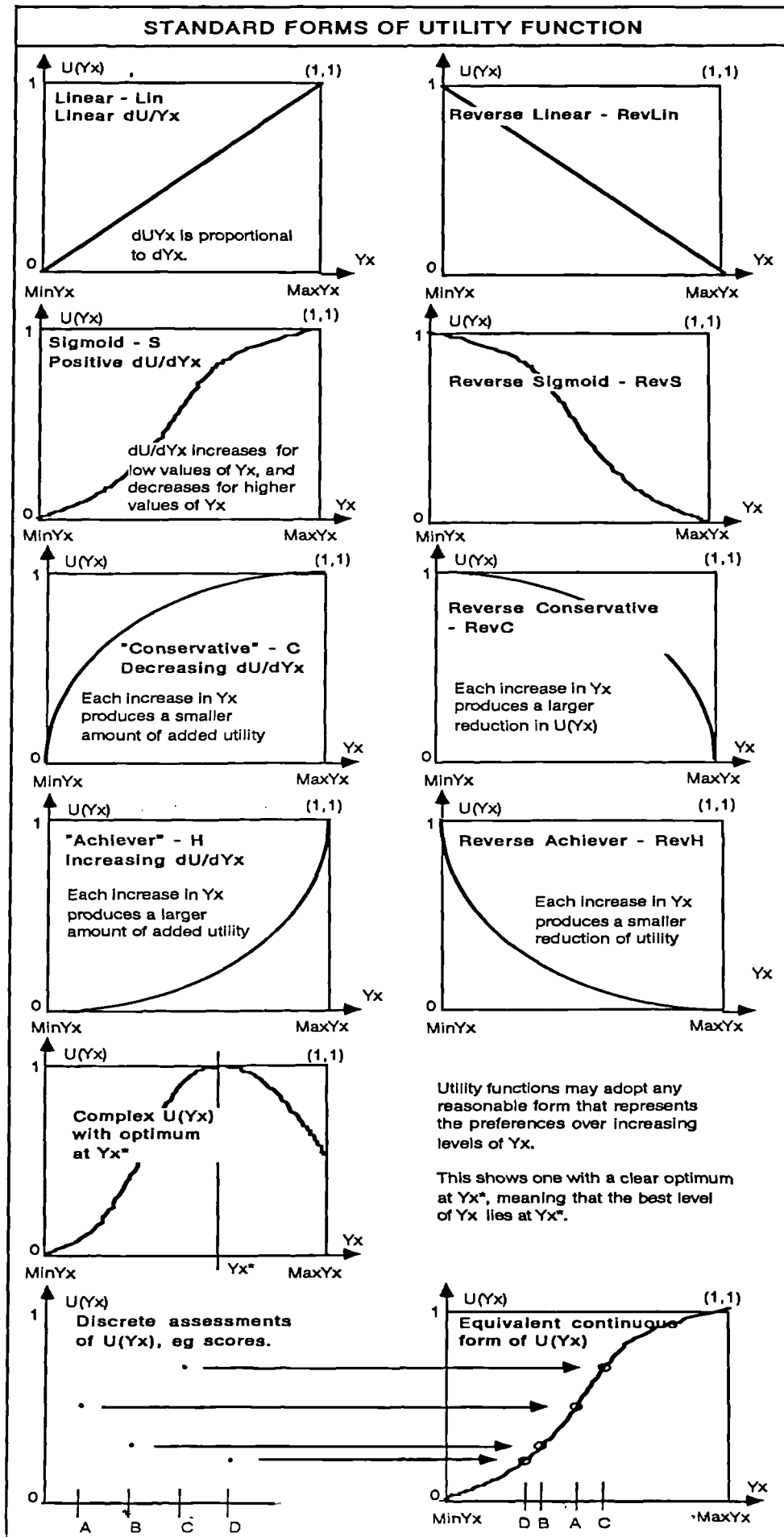
STANDARD FORMS OF UTILITY FUNCTION

Figure A1.3

L   Linear Utility
The higher the level of Y (or P) the better; Value adding contributions are exactly proportional to increments in Y.

RevL   Reverse Linear
The less of Y the better, ie Y is undesirable and should be avoided; Value decrements are exactly proportional to increments in Y.
[Note that reverse utility functions can be thought of as "avoidance functions".]

S   Sigmoid
The "Designer's" utility function. The higher the level of Y the better, but near to minY increments of Y do not add much value (we can do better), while near to maxY increments of Y contribute ever smaller amounts of value added (we are near to the ideal, so we do not need to struggle any more).

RevS   Reverse Sigmoid
The Designer's avoidance function. The less of Y the better, small amounts of Y above minY do not matter very much, but any further increases in Y should be penalized severely.

C   Conservator
The more of Y the better, any increase above minY is very desirable, but the rate of value added reduces increasingly as Y increases, (we must get away from the threshold at minY, but once we have done that we can relax and conserve what we have gained).

RevC   Reverse Conservator
The less of Y the better, small amounts of Y above minY do not matter very much, the disadvantages of Y only get serious near to maxY.

H   Achiever
The more of Y the better, low performance must be avoided, value is added in significant amounts only as maxY is approached   (We aim to be second to none.)

RevH   Reverse Achiever
The less of Y the better, any increase of Y above minY should be avoided/severely penalized.

IO   Intermediate Optimum
The "Satisficing function". The more of Y the better up to a critical level Y* which is ideal. Above Y* the value contributions are negative. (One can have too much of a good thing; there is no need to offer the client more than he has asked for.)

DA   Discrete Assessment.   A continuous utility function cannot be drawn, the assessor is only able to provide discrete scores to indicate relative value contributions, (eg Yx may be a set of different styles or colours).

The shapes of the utility functions shown in figure A1.3 are representations of the standard forms offered to the decision-maker by SWAP in the first instance. They can be pulled around to suit individual perceptions and contexts. Fairly rigorous techniques exist for determining the form of a utility function, but a knowledgeable person or group can usually arrive at a satisfactory form via discussion and argument.

There is nothing mysterious about a utility function.   It is merely a device that captures a decision maker's preferences over the range of a real world performance indicator, and expresses them in a precise and numerate format that can be discussed and then read into a computer as a numerical function.   The point to be remembered is that a utility function is "true" for a given individual or group; it does not represent absolute truth.   However if the individual or group is the responsible decision-maker then the associated utility function carries the authority of the decision-maker.

LINEAR UTILITY Lin

u(Yx) (y-axis)

NYx (x-axis)

S UTILITY S

u(Yx) (y-axis)

NYx (x-axis)
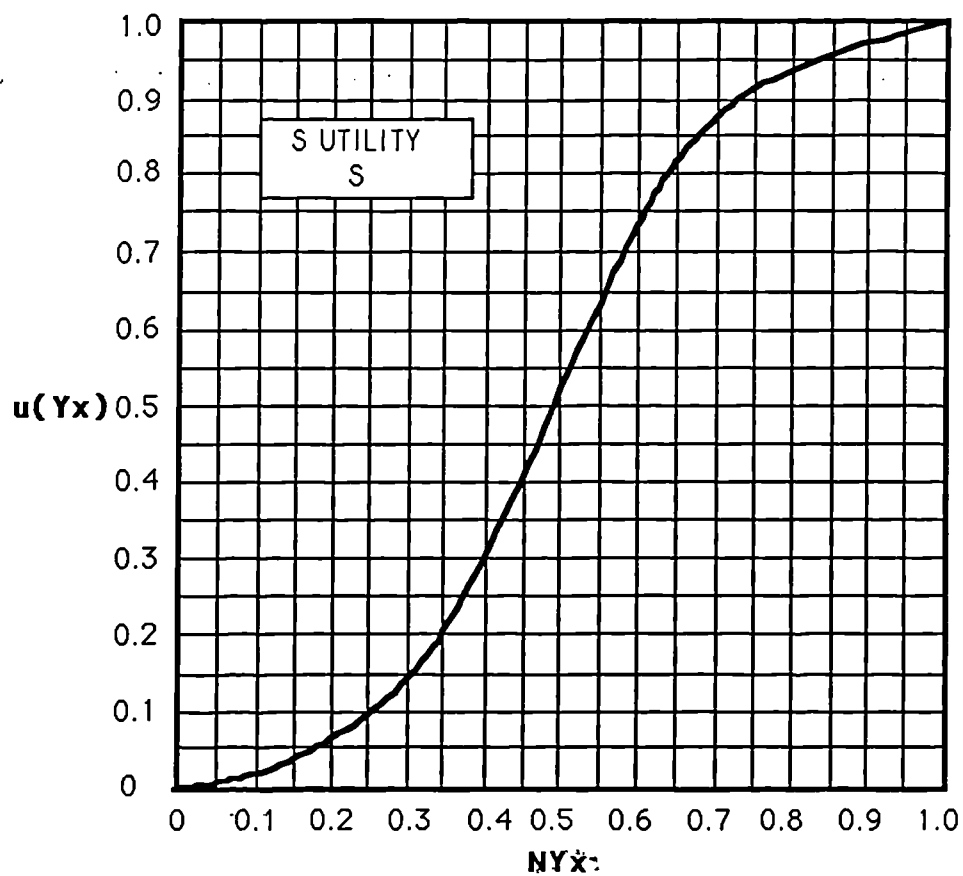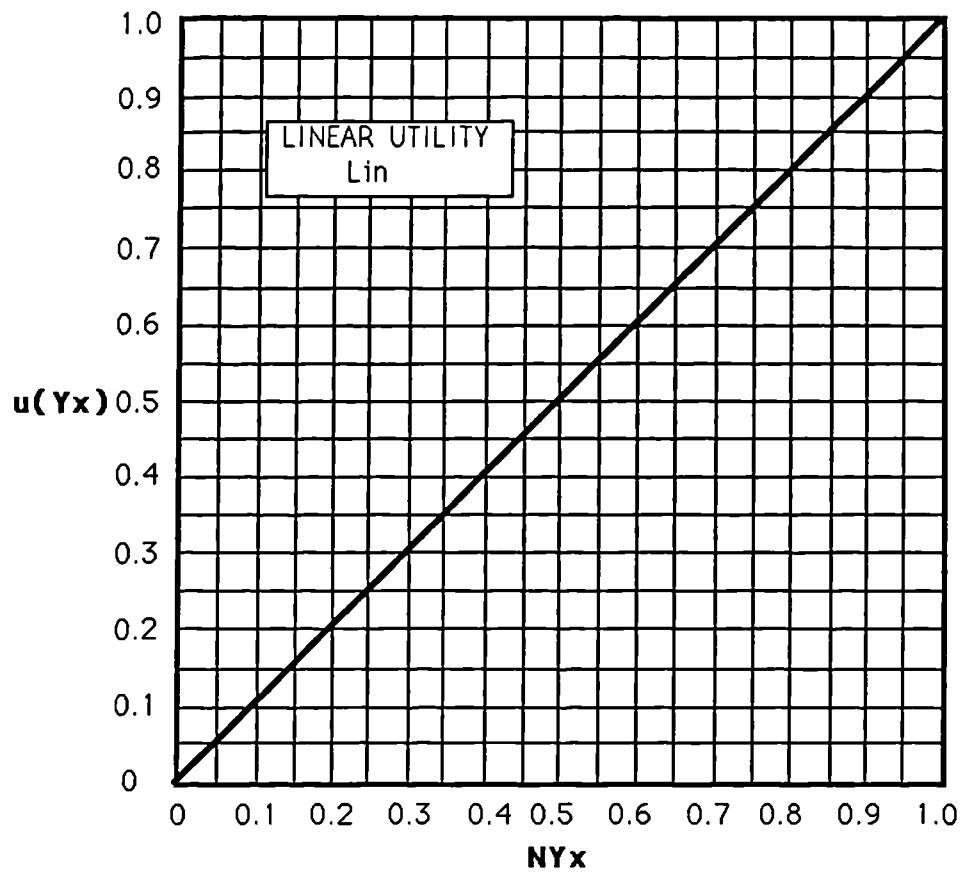
Note: NYx is the normalized value of Yx: NYx = (Yx - minYx) / (maxYx - minYx), Thus NYx can be treated as a utility in its own right when feeding up to higher levels in a criterion.

ACHIEVER UTILITY
H

CONSERVATOR UTILITY
C
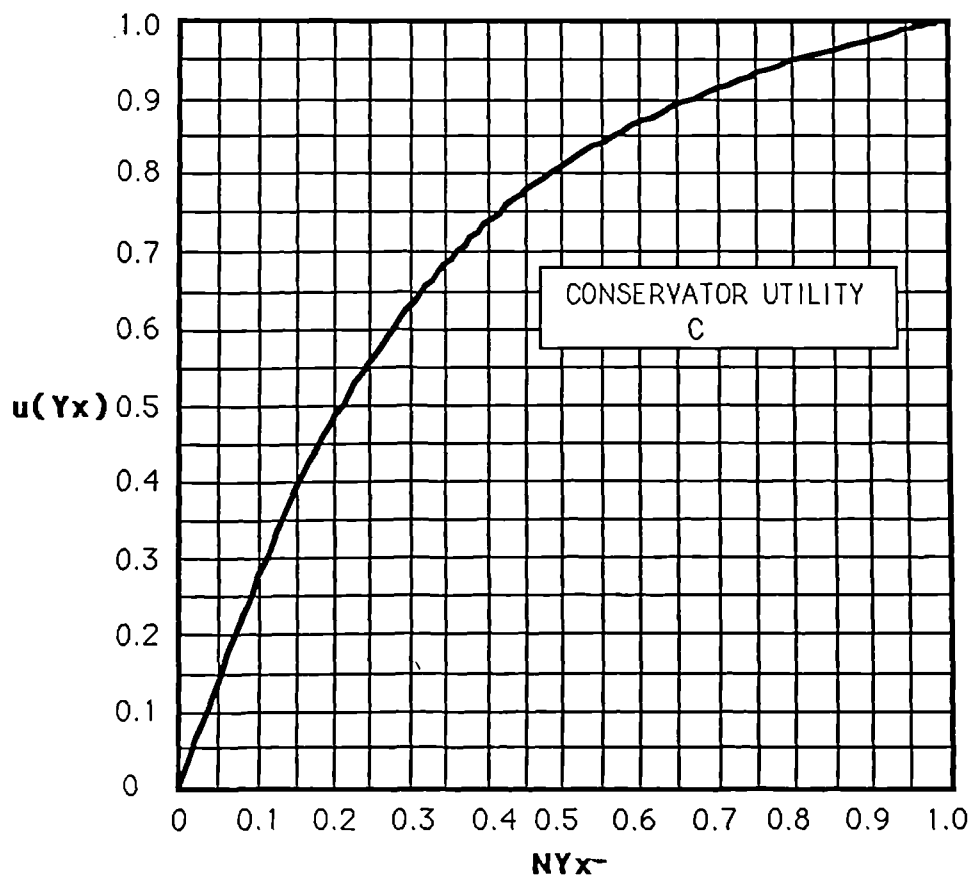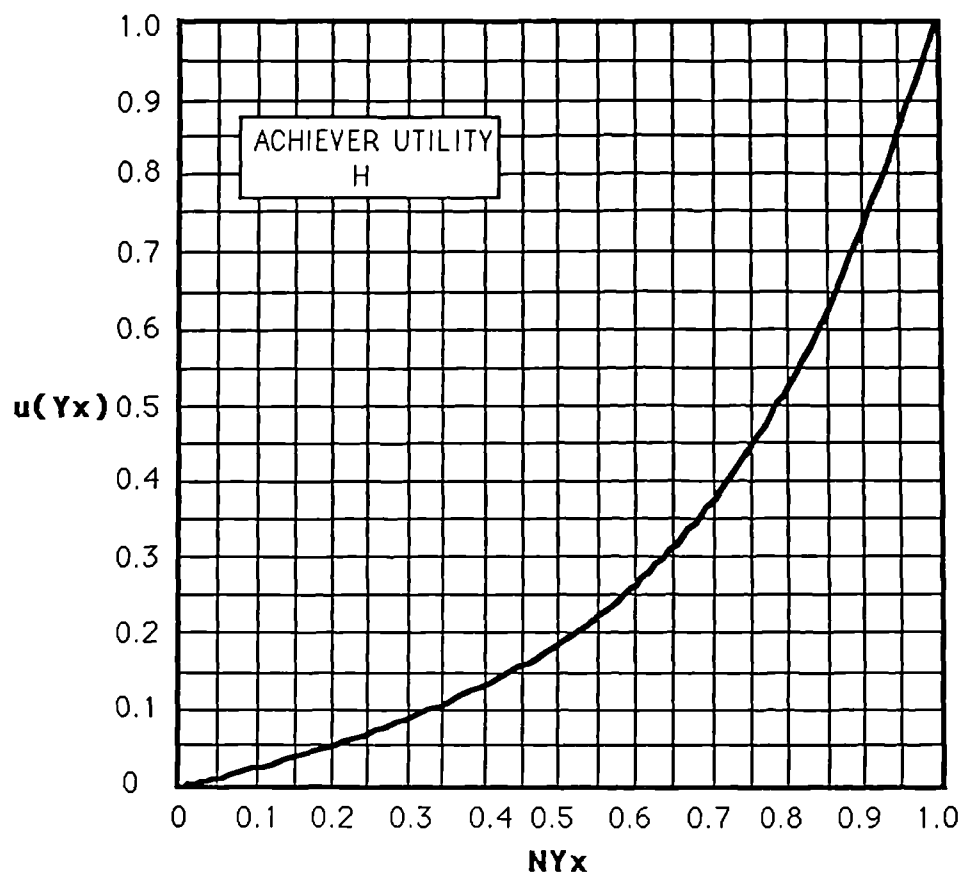
(The Reverse Functions are not shown as they were not invoked by the L B R exercise.)

WORTH ASSESSMENT IN UTILITY SPACE: THE COMBINATORIAL RULES

A useful property of the SWAP procedure is that it completely separates the actual assessment of a particular subject from the assessment process that uses a given Criterion. Look again at figure 2 (in the Technical Note) summarizing the 2-attribute criterion. The only contact that the subject under assessment has with the criterion is through its performance indicators which are measured (or assessed) to lie at corresponding points on their feasible performance scales. These points are converted into appropriate levels of utility using the already defined utility functions in the 1st Level of the Criterion. Take the right side of figure 2 as an example. The subject S has lowish performance wrt the indicator P1, and high performance wrt P2. The measured/assessed points on the P scales are indicated by the vertical arrow. P1 is desirable, the more of it the better (perhaps it is "income"): a linear increasing utility function has been defined for it. The corresponding utility on the attribute X is read off as u(X). Unfortunately P2 is undesirable (perhaps it is "pollution", with P2max set at a legal or ethical limit): a decreasing S utility has been drawn for it, and the corresponding utility on the attribute Y is u(Y).

The subject S is now defined with respect to the assessment problem (assuming that the 2-attribute criterion provides complete "coverage"). All that the assessors need to know is that a subject has been offered that contributes the utilities u(X) and u(Y); they do not even need to know the actual shape of the utility functions. Consequently the particulars of the actual subject together with the details of the translation from performance to utility can be dropped from the assessment discourse. The assessment problem is reduced to the following question: With respect to the given 2-attribute criterion, how good is any subject that contributes U(X) and U(Y)?

The assessment problem has been divided into two distinct and independent parts:
1   what utility does a subject contribute by virtue of its measured/ assessed performance?
2   what is the worth of a combination of utilities?

This section defines a procedure that answers the second question for a 2-attribute criterion. This same procedure can be used at any combinatorial node in a more complex criterion.

THE UTILITY PLANE

Forget about subject S. Think solely in terms of the worth of utility combinations.

A utility plane U(X, Y) describes the 2-attribute criterion. The plane is defined by orthogonal axes u(X) and u(Y) with scales [0, 1]. The plane exists within a square boundary defined by corners with the coordinates (0,0), (1,0), (0,1), (1,1). Any point on this plane is defined by a coordinate (u_x, u_y).

$(u_x, u_y) \subset U(X, Y); \quad 0 \le u_x \le 1 ; \quad 0 \le u_y \le 1$ Q3

The plane is cartesian and vectors may be defined in it. Thus the coordinate (u_x, u_y) can also define a vector of calculable length from a given origin. If the origin is the corner (0, 0) the vector length is $\sqrt{(u_x^2 + u_y^2)}$. If the origin is the corner (1, 1) the vector length is $\sqrt{((1 - u_x)^2 + (1 - u_y)^2)}$. In practice the length of these vectors will be normalized so that a vector from (0, 0) to (1, 1) will be reckoned to have unity length.

A diagram of the utility plane is shown in figure A2.1 (next page). The subject S is uniquely defined by the point with the coordinates (u_x, u_y). The second question is now transformed to: what is the worth of a point with the coordinates (u_x, u_y)?

The worth of S wrt the 2-attribute criterion may be redefined as

$W(S|C) = W (u_x, u_y) = M[(w_x, u_x), (w_y, u_y)]$ Q4

where w_x, w_y are the normalized weights of the attributes X and Y. The combinatorial rule M[ ] is to be defined.
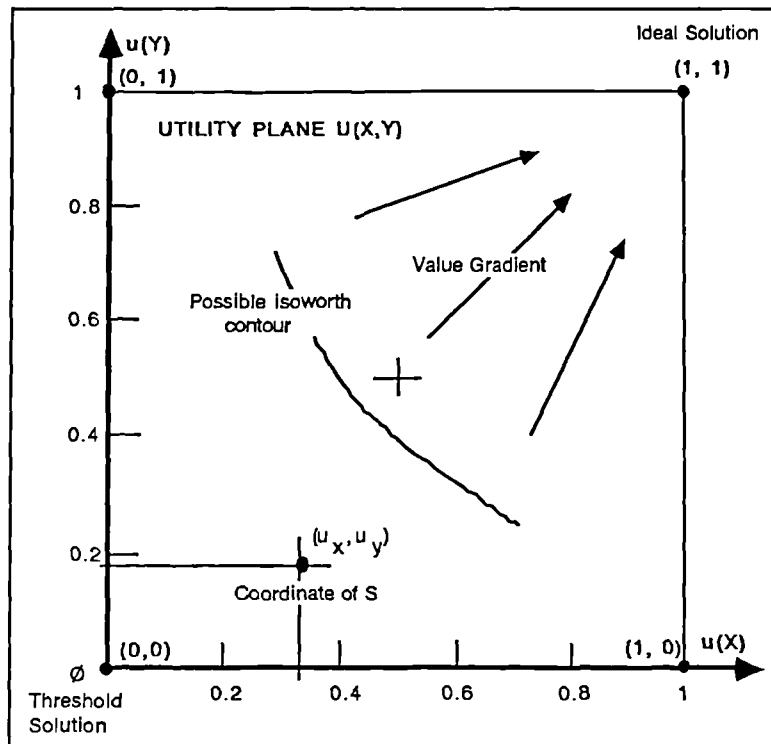
Figure A2.1

Consider the four corners of the utility plane. The (0,0) corner represents the "Threshold Solution" which has zero utility on both axes meaning that the point at (0, 0) must have zero worth. This does not mean that the underlying subject is useless because a zero utility represents, by definition, a subject whose performance is just acceptable. Consequently the corner (0, 0) represents a subject that is just visible on the utility plane. The opposite corner (1, 1) represents the "Ideal Solution" because it represents a subject that achieves the two attributes X and Y in full measure: it is perfect. Consequently this corner must have a worth of 1. The other two corners are intermediate: they represent solutions that are perfect wrt one attribute but marginal wrt the other.

Consequently there must be a gradient of increasing worth (value) across the utility plane rising from the Threshold corner up to the Ideal corner. In which case the utility plane becomes a planar map of worth on which there will be contours of equal worth (isoworth, isopreference): Worth is represented by the altitude above the plane.

THE WORTH SURFACE

A three dimensional projection of the utility plane with Worth as the vertical axis is shown in figure A3.2 (next page). Now one can envisage Worth as a surface in this three dimensional space. The surface will always have zero altitude at (0, 0), and unit altitude at (1, 1). In between the surface will adopt a shape that reflects the worth of each coordinate in the utility plane. Thus the shape of the surface is determined uniquely by the combinatorial rule. The surface represented in figure A2.2 is convex (bulges out), and is tilted about the main diagonal so that the (0, 1) corner is higher than the (1, 0) corner. The bulge means that coordinates towards the middle of the plane are preferred to coordinates towards the edges, ie the decision-maker is looking for a good compromise. The tilt means, in this case, that the attribute Y has a greater weight than X.

The Worth surface preserves the basic logic of a utility function. Consider two distinct points in the utility plane with the coordinates $Q1 = (u_{x1}, u_{y1})$ and $Q2 = (u_{x2}, u_{y2})$. Then

$$Q1 \geq Q2 \text{ iff } W(Q1) \geq W(Q2) \Rightarrow M[(w_x, u_{x1}), (w_y, u_{y1})] \geq M[(w_x, u_{x2}), (w_y, u_{y2})] \qquad Q5$$

Now $M[...]$ implies a worth surface $W(X, Y)$ with a definite shape, but which is presently unknown because the combinatorial rule has not been defined. But a preference order between Q1 and Q2 can be established by
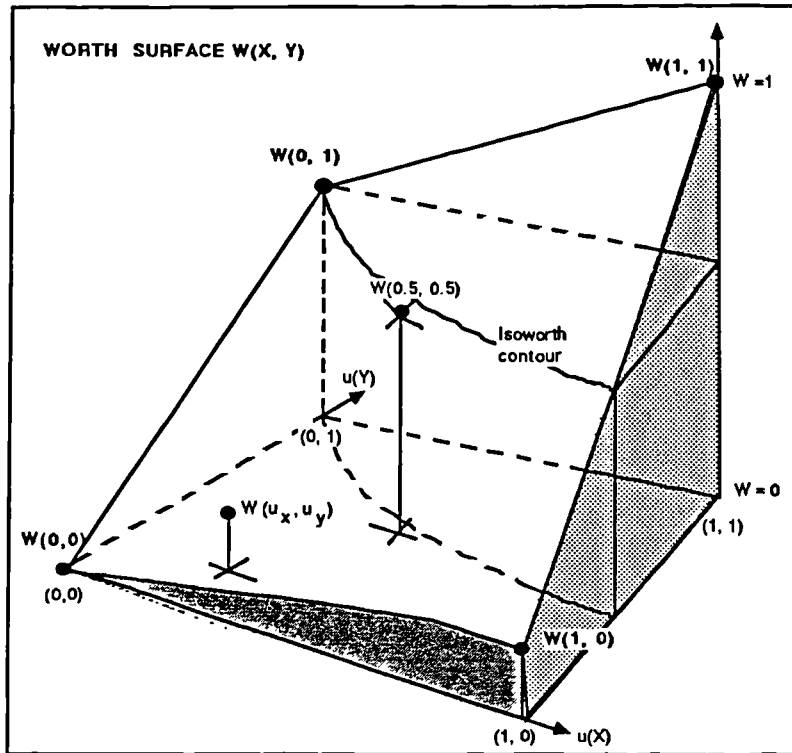
Figure A3.2

referring to the magnitudes (ie altitudes) of the results obtained from the two combinatorial operations:

$$Q1 \geq Q2 \text{ iff } |M[(w_x, u_{x1}), (w_y, u_{y1})]| \geq |M[(w_x, u_{x2}), (w_y, u_{y2})]|$$ Q6

The interpretation of this inequality is easy with the aid of figure A3.2. Suppose Q1 is at the corner (0, 1), giving a worth W(Q1) = W(0, 1) and an altitude as indicated in the figure. Now consider three locations for Q2:

(i)   Q2 lies at some point along the isoworth contour that passes through (0, 1):
      W(Q2) = W(Q1), so there is nothing to choose between Q2 and Q1.
(ii) Q2 lies at any point in the region on the (1, 1) side of the isoworth contour:
      W(Q2) > W(Q1) because anywhere in this region is uphill relative to the corner (0, 1). Thus Q2 > Q1.
(iii) Q2 lies at any point in the region on the (0, 0) side of the isoworth contour:
      W(Q2) < W(Q1) because anywhere in this region is downhill relative to the corner (0, 1). Thus Q2 < Q1.

One may now track back to two subjects A and B that are being assessed. Suppose that subject A is the one at Q1. The preference order between A and B can be established *whatever* levels the performance indicators of B have within the feasible range.

This demonstration shows that the Utility Plane and the Worth Surface provide functions that establish preference orders between objects with the same rigour as the simple axiomatic utility function. Moreover the preference orders are established with the same rigour for combinations of utilities on several attribute dimensions. In addition, this technique provides a multiattribute assessment criterion that can be both understood and visualized very easily by non-experts.

The combinatorial rules themselves can now be defined.

The utility plane can be used as an experimental field on which an assessor can determine how utility contributions combine with respect to two attributes. The mode of combination will depend on how the assessor perceives that the overall worth changes between different coordinates in the plane.

CASE 1   The ADDITIVE RULE (AR)

Consider figure A2.3 and the points A,B with the coordinates (0.5, 0.5) and (0.3, 0.7). Is the solution represented by A preferable to the solution B, or B to A? (Note that A is placed at the midpoint of the plane).
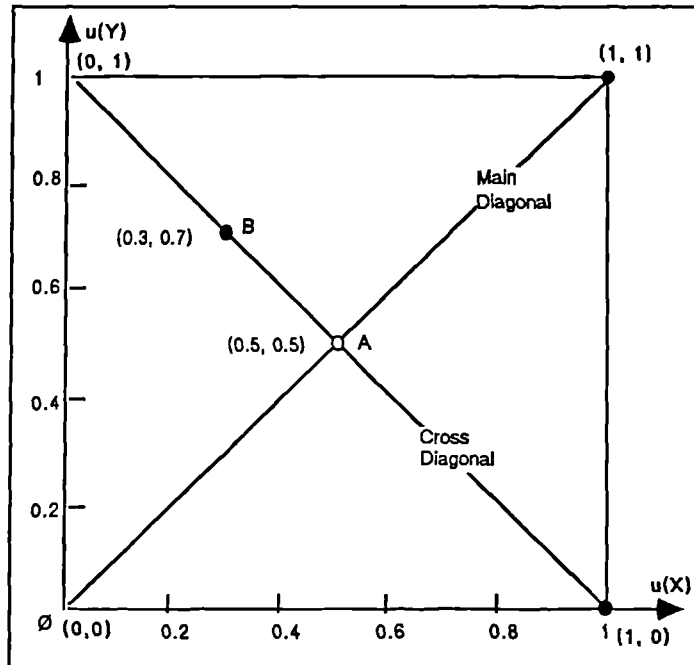

Figure A2.3

If the answer to these questions is "no" either way, A and B are being seen as equal in preference terms, ie they have the same worth. This means that a loss of utility on the X attribute of 0.2 is compensated for by a gain of utility of 0.2 on the Y attribute. If the same conclusion is reached for other coordinates along the line through A and B, additive substitutability has been confirmed. In other words the assessor is applying an additive combinatorial rule, and the line between A and B is an isoworth contour. The Additive Rule (AR for short) represents a mode of thinking that can be described as "Additive Preference".

The relative weights of the attributes X and Y can also be inferred from this response. Since a loss of utility on X is compensated for by an equal gain on Y, the importance of X must be the same as that of Y: the weights are equal and normalized at 0.5 each. If Y were more important than X, a smaller utility gain on Y compensates for a loss on X: the slope of the isoworth contour reduces because the u(Y) coordinate of B also reduces.

Thus the Additive Rule in the utility plane is defined by straight isoworth contours whose angle relative to the main diagonal depends on the relative weights of the attributes X and Y.

The additive rule is represented by Ma[ ]. When an additive rule applies, the combined worth of utilities on the two attributes X and Y is given by:

$$W(X,Y|AR) = Ma[(w_X, u_X), (w_y, u_y)] = (w_X * u_X) + (w_y * u_y)$$ Q7

Accurate representations of the two combinatorial rules used in the L B R example are shown on pages A18,19. They are shown only for the case of equal weights.

CASE 2   The VECTOR REGRET RULE (VRR).   (used in   L B R   example)
Consider the two points A and B in figure A2.3 again.   Is A preferable to B?

If the answer this time is "A is preferable to B" the assessor perceives that the worth of a solution at A is greater than one at B, ie A has more altitude on the worth surface.   Consequently the isoworth contour through A will have a curvature that is convex wrt the ideal solution (1, 1).   (Assign the letter P to (1, 1) because P = Perfect.) This implies that the assessor prefers solutions that are nearer to P.   Assessments like this are akin to the Regret (or Opportunity Loss) criterion of elementary Decision Theory.   The assessor is perfectly satisfied only if the solution is at P, he experiences regret if the solution is less than perfect - the regret increases as the distance between the actual solution and P increases.

Formalize this mode of assessment as the Vector Regret Rule with lines of equal regret represented by isoworth contours that are circular with centres at P, as shown below.
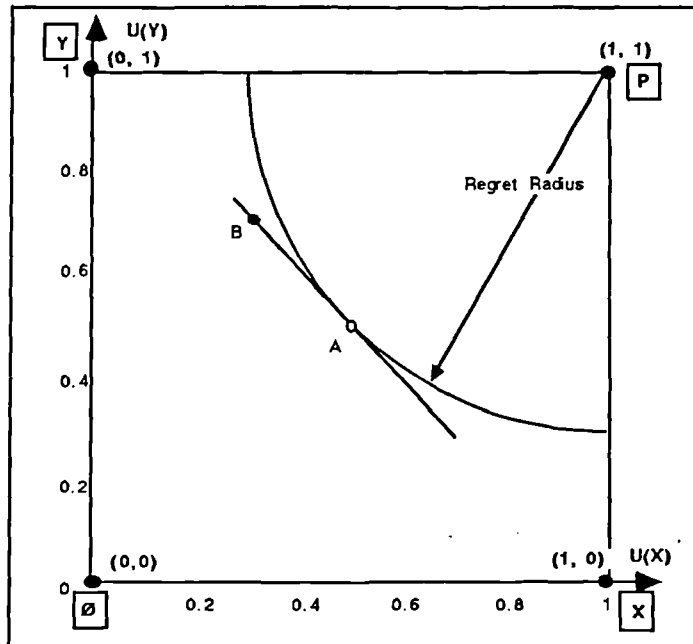

Figure A2.4

The circular contours centred on P produce a convex worth surface (bulges outwards) so that the altitude of a point on the main diagonal is higher than that of the cross diagonal through the same point - (if attributes X and Y have equal weights).   Thus, in figure A2.4, A has more altitude than B.   If the weights of X and Y are unequal the circular contours skew into an asymmetrical shape: the bulgy surface is tilted, just as the flat additive surface was tilted.   The length of the Regret Vector has to be normalized so that perfect solutions have unit worth.

The Vector Regret Rule (or VRR for short) represents a mode of thinking that prefers solutions in which the weighted utility contributions are equal.   This mode can be represented as:
(i)   the "Compromiser's Preference": balanced contributions on both attributes are better than unbalanced solutions.
(ii)   the "Deontic Preference": good solutions ought to consist of balanced contributions.

Note that the VRR still allocates worth to extreme solutions in which one of the attributes has zero utility, ie "something is better than nothing".

The VRR mode of thinking represents a clearly defined and typical human approach to the union of different value categories and to trade-offs between them.

The VRR is represented by Mv[   ]:-

— - W(X,Y|VRR) =Mv[(w$_x$, u$_x$), (w$_y$, u$_y$)] = 1 - Sqrt((w$_x$*(1 - u$_x$))^2 + (w$_y$*(1 - u$_y$))^2) / Sqrt(w$_x$^{2} + w$_y$^{2})   Q8

CASE 3   THE MULTIPLICATIVE RULE (MR) (used in . L B R   example)

The Multiplicative Rule (MR for short) represents an extreme form of the VRR in that it applies a veto to any solution which includes a zero utility contribution.

The initial response to the question with respect to preferences between the points A and B is the same: A is preferred to B.   A second question is asked: does B have any value at this point? to which the answer "yes" is expected.   But if the point B is moved along its cross diagonal until it reaches the edge of the utility plane, the answer to the second question becomes "no".   This arises because the edge of the plane implies zero utility for one of the attributes, and is deemed to cancel out any utility contributed to the other axis.   Thus there is a region in the plane represented by very low utility contributions that is effectively banned from consideration. Figure A3.6 below represents this mode of thinking, the banned region being shown shaded.
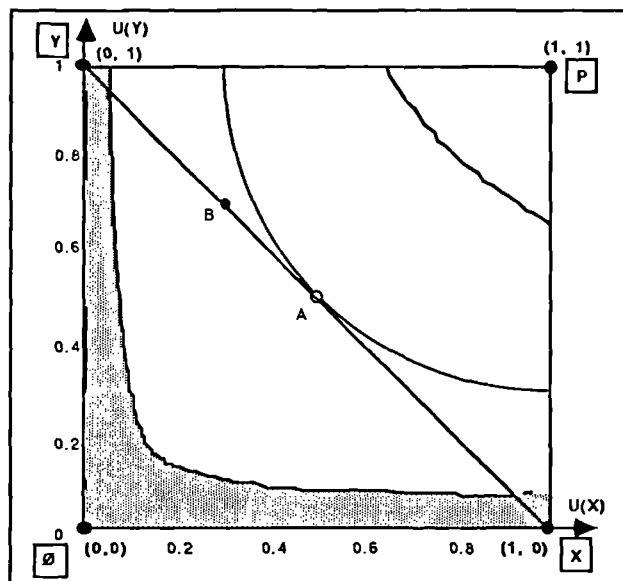

Figure A2.5

The isoworth contours are curvilinear and convex away from P.   This implies a worth surface that is again convex and bulging outwards.   But, unlike the VRR surface, the surface near to the edge along the U(X) and U(Y) axes begins to slope down steeply and is "nailed" to zero at the edge.

Conversely, the isoworth contours near to the ideal at P have less curvature than the equivalent VRR contours in the high region.   This reflects a reduced feeling of regret in the high regions because the veto in the low regions has been so well avoided.

This again is a typical mode of human thinking when attributes are vital to "success". (eg: Would Perkins buy a car with high performance and high safety? Yes.   Would he buy a car with high performance and low safety, even if it was cheaper? No.   If he had the funds to buy that car with high performance and safety, would he buy a car with high safety and low performance? No).   The mode of thinking can be represented as the "Deontic Preference with imposed Veto".

Isoworth contours to represent this mode of thinking are provided by a straightforward multiplication of the utilities being combined.   Hence the Multiplicative Rule (MR) represents the VRR with imposed Veto.   (Note that the weights become exponents in order to make proper provision for the weights, and to preserve the preference ordering of worth.)

The MR is represented by Mm[ ]

$W(X,Y|MR) = Mm[(w_x, u_x), (w_y, u_y)] = u_x^{w_x} * u_y^{w_y}$ O9

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CASE 4 THE VECTOR NORM RULE (VNR)

Sometimes the response to the initial question is that B is preferred to A. This indicates immediately that B has higher altitude, which implies that the isoworth contour has a curvature concave to the ideal point P. The worth surface loses its bulge and has a valley along the main diagonal instead. The situation is represented in the figure below, in which a circular isoworth contour has been drawn with centre on the Threshold point Ø.
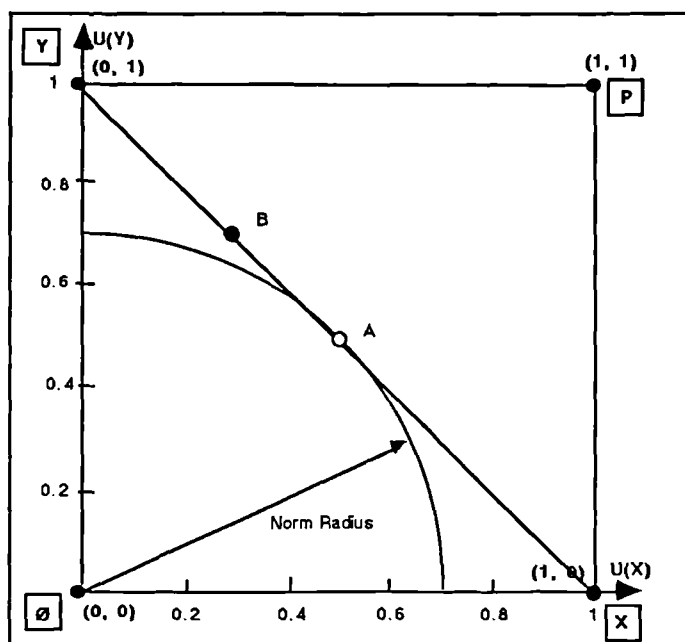
Figure A2.6

This suggests a Vector Norm Rule (VNR) to represent assessments that prefer solutions that are more remote from the Threshold, no matter what the relative distance to the Ideal may be. Such assessments indicate a preference for the edges of the utility plane rather than its middle: in other words worth is increased by the avoidance of compromise and movement towards whichever attribute has the greater utility contribution.

Again this mode of thinking is quite common in situations where alternatives and mixtures are on offer, (eg a trivial but useful example being the preference for true blue or true red, rather than the sludgy mauve of the mixture). The mode will be referred to as the "Alternative Preference".

The isoworth contours for the VNR are represented by the length of the vector from Ø to the point in question, (hence the use of "Norm"). The vector length must be normalized to ensure that maximum worth is unity.

The VNR is represented by Mn[ ]

$$W(X,Y|VNR) = Mn[(w_x, u_x), (w_y, u_y)] = Sqrt((w_x{}^*u_x)^2 + (w_y{}^*u_y)^2) / Sqrt(w_x{}^2 + w_y{}^2) \qquad Q10$$

The SWAP combinatorial rule menu contains two more rules:

Exclusion Rule (XR) which takes the Vector Norm Rule to its limits in order to represent the avoidance of any compromise: only the attribute with the maximum contribution of utility is recognised, any utility on the other attribute is ignored.

Conflation Rule (CR) which is required only for complex forms of assessment in which the subject's performance is disaggregated into several distinct types of performance indicator, each of which can have many impacts on the 1st-level attributes of the criterion.

These rules are not described as they were not invoked by the L B R exercise.

VECTOR REGRET RULE
(Equal Weights)

WORTH SURFACE

u(SVA)

w(ROI)	= 0.5
w(SVA)	= 0.5

W(S)

u(ROI)

UTILITY PLANE

u[SVA]

(1,1)

(0,1)

(0,0)   (1,0)

u[ROI]
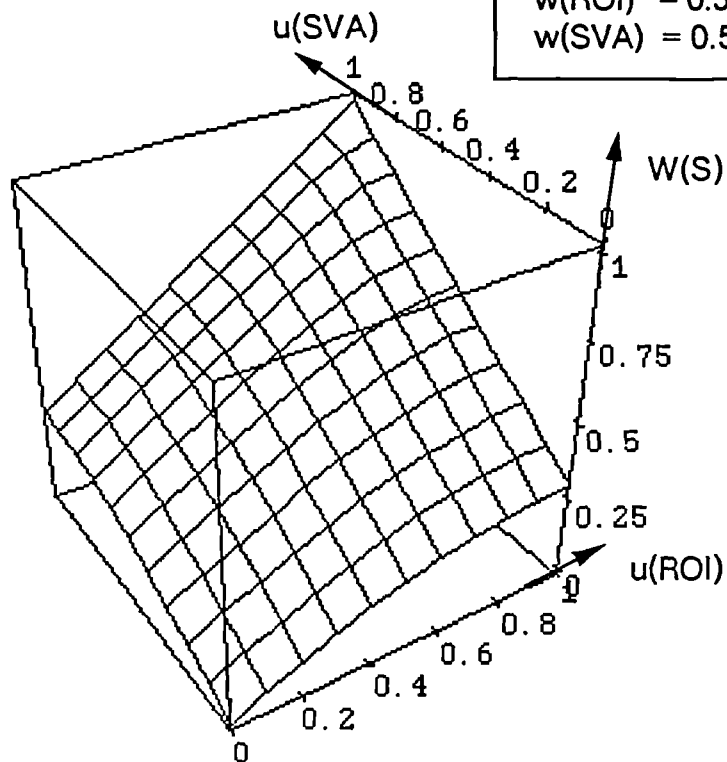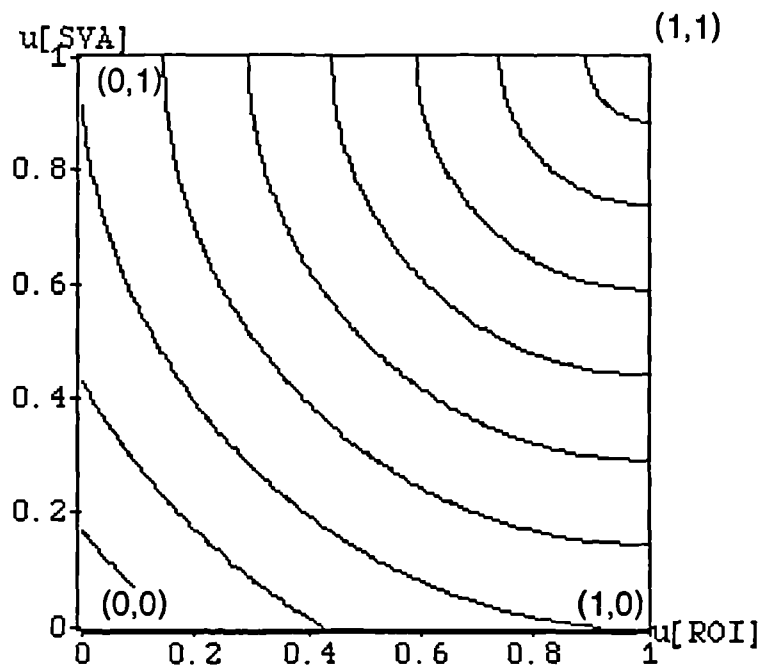
r = ROI; s = SVA

W(S) = 1 - Sqrt[1/(w(r)^2 + w(s)^2)]*Sqrt[(w(r)*(1 - u(r))^2 + (w(s)*(1 - u(s))^2]

MULTIPLICATIVE RULE
(Equal Weights)

WORTH SURFACE

w(ROI) = 0.5
w(SVA) = 0.5

u(SVA)

W(S)

u(ROI)

UTILITY PLANE

u[SVA]

(1,1)

(0,1)

(0,0)   (1,0)

u[ROI]
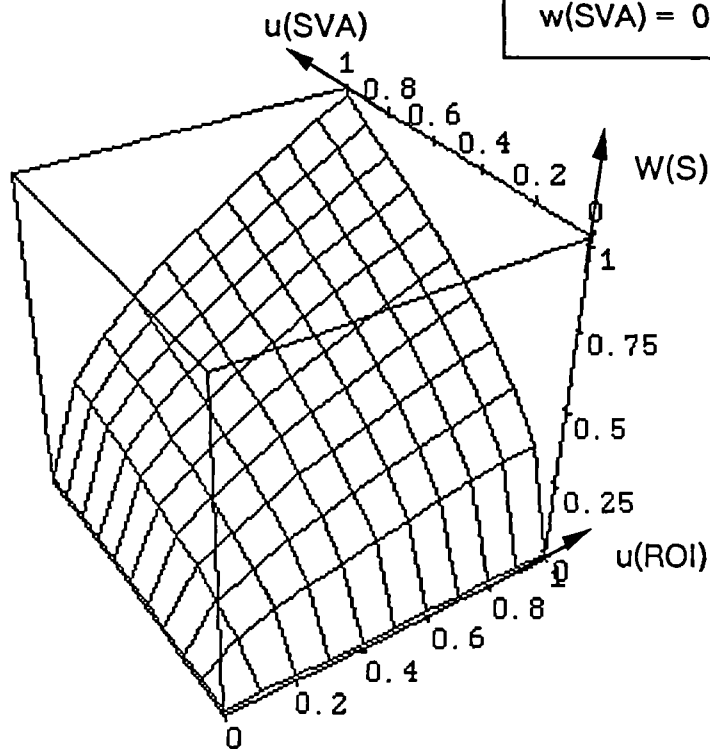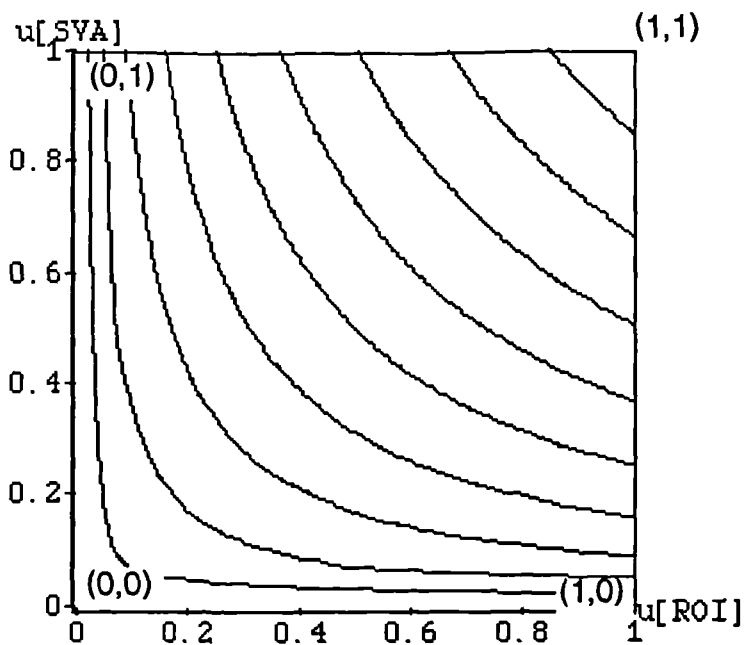
r = ROI; s = SVA

W(S) = u(r)^w(r) * u(s)^w(s)

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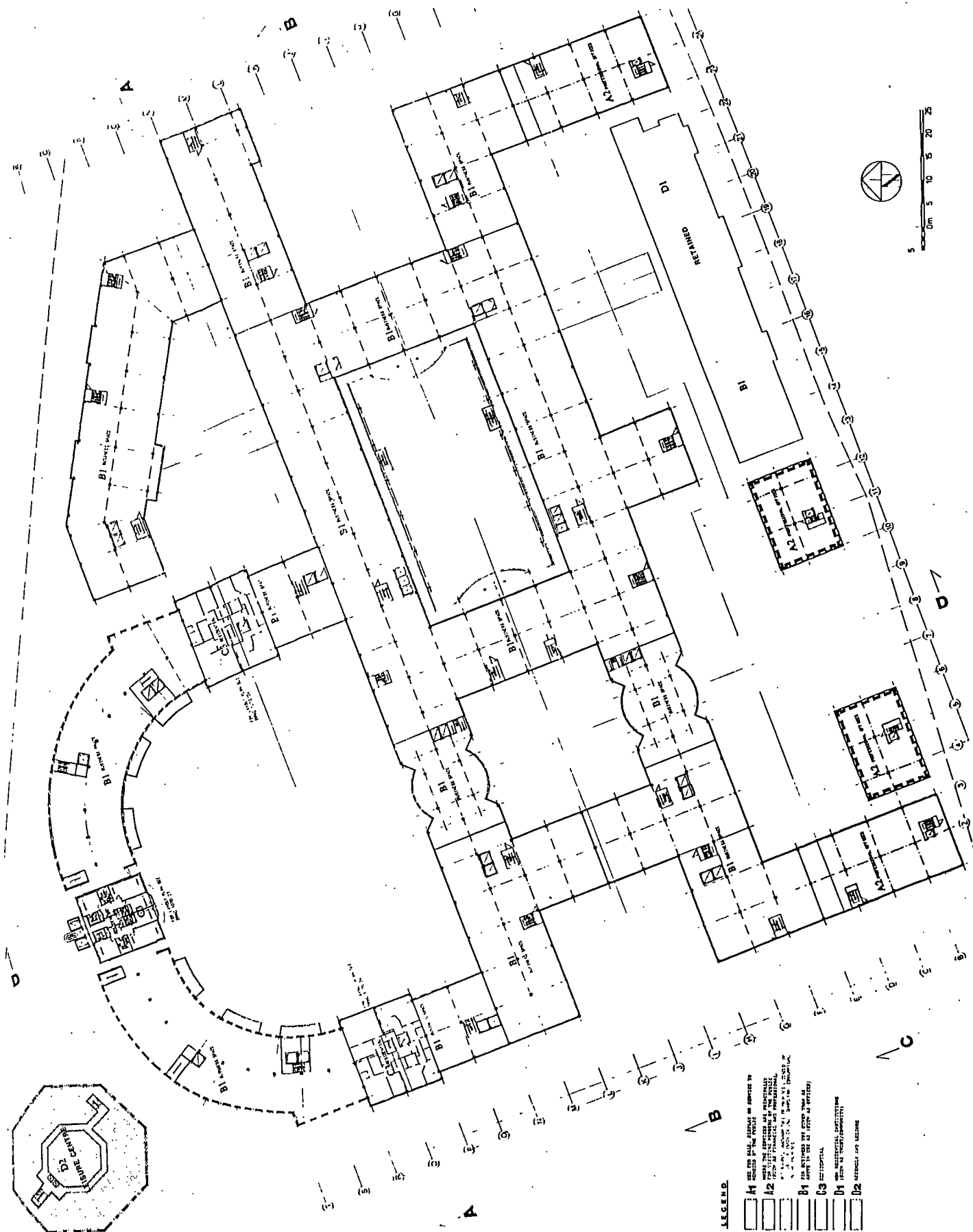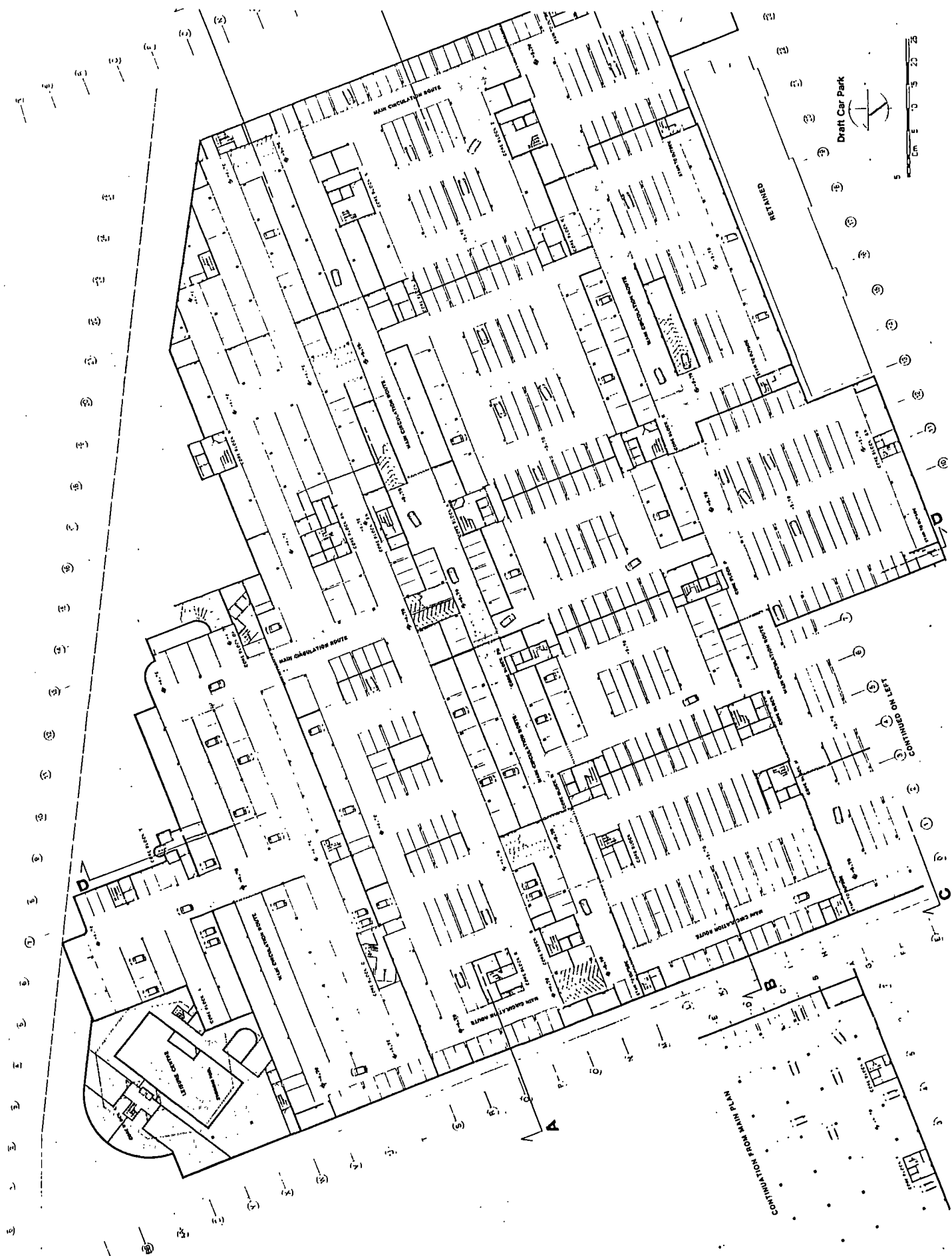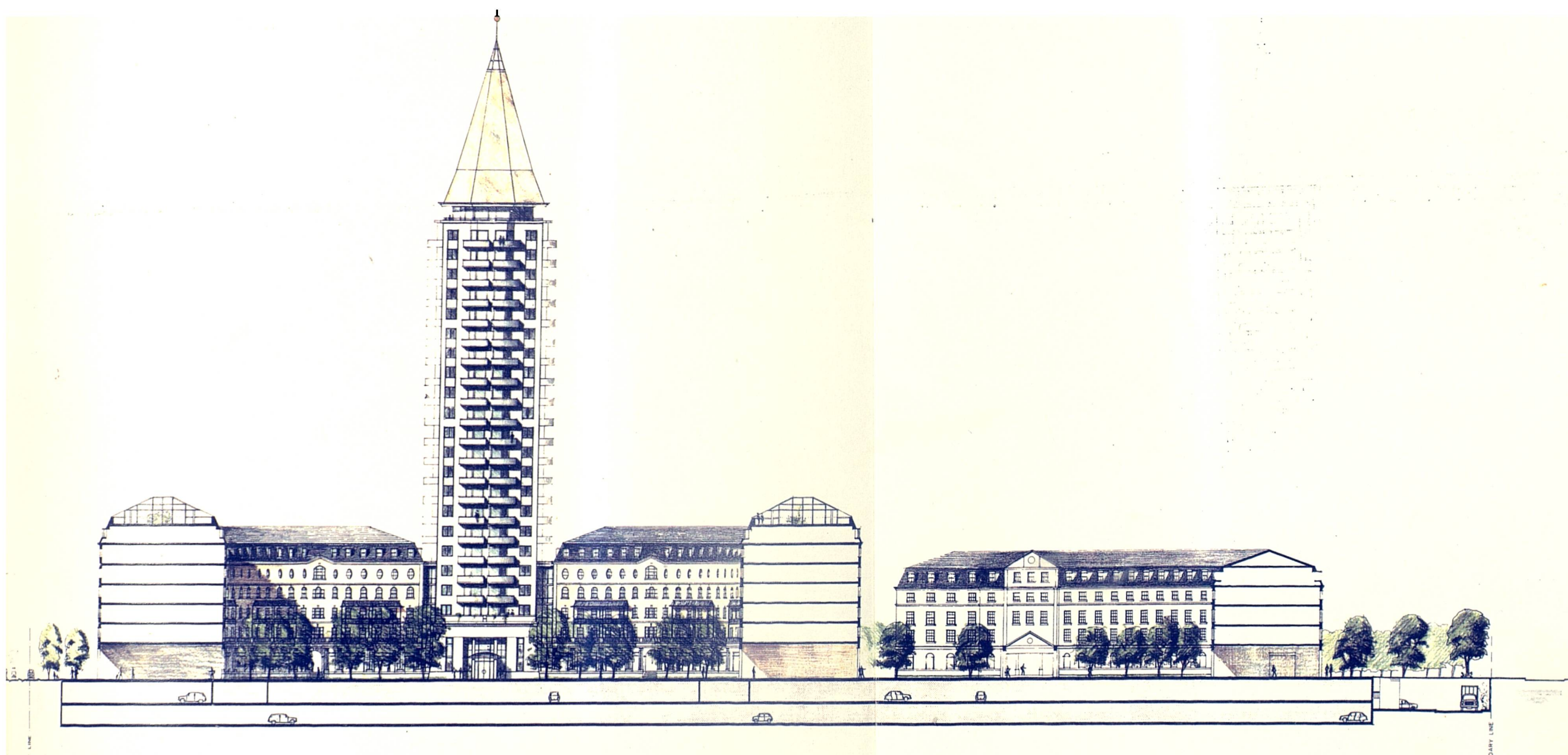
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |

Building **R**   Building **Q**   Building **T**   Building **Q h**   Building **R h**   Building **W**

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