DESIGN METHODS IN ARCHITECTURE

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A report of the Portsmouth Symposium on Design Methods, December 1967

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SYMPOSIUM

South Parade Pier, Southsea—setting for the Portsmouth Symposium on Design Methods in Architecture, which attracted some 400 delegates, including 50 from overseas

UNITED KINGDOM

DESIGN METHODS IN ARCHITECTURE

A report on the Portsmouth Symposium by Geoffrey Broadbent, Head of the Portsmouth School of Architecture

The Portsmouth Symposium on Design Methods was held from December 4 to 6, and it attracted some 400 delegates, including fifty or so from overseas. Unlike its predecessors, at Imperial College in 1962 (Jones & Thornley: 'Conference on Design Methods', Oxford 1963) and at the University of Aston in 1965 (Gregory, SA: 'The Design Method', London 1966) it was concerned specifically with design method in architecture. Of the 16 speakers, ten were architects, and the full list included Ian Moore (Ministry of Public Building & Works); Barry Poyner (Birmingham School of Architecture); Keith Hanson (Cambridge School of Architecture); Professor I. G. Guerra (University of Naples); Professor R. Studer (Brown University, Rhode Island, USA); Janet Daley (Berkeley and Birkbeck College); Bruce Archer (Royal College of Art); S. A. Gregory (University of Aston); Professor T. Markus (University of Strathclyde); Dr Jane Abercrombie (Bartlett); John Luckman (Institute for Operational Research); Amos Rapoport (Berkeley and Bartlett); Gordon Best (Berkeley and Bartlett); Anthony Ward (Portsmouth School of Architecture); Neville Longbone (Ministry of Public Building and Works) and Christopher Jones (Manchester Institute of Science and Technology).

Christopher Jones, in the last formal paper of the Symposium, presented a useful basis on which the others could be classified. He indicated six fields of design research:

1 the 'black box' approach, 2 the 'glass box' approach, 3 control, 4 observation, 5 problem structure, and 6 design in evolution.

He then used these as the basis for his analysis. The 'black box' approach is for those who believe that design is a mystery, something which happens in the brain, susceptible to manipulation, but not to analysis. It is concerned with 'creativity', which may be promoted by techniques such as 'brainstorming' and 'Synectics' (Broadbent, G. H.: 'Creativity' in Gregory, *The Design Method*, 1966).

As Jones pointed out, no-one actually spoke about this approach at the Symposium, but we had plenty of 'glass-boxers', who believe that design can be systematised and analysed—pinned-out, I always think, like a frog on a dissecting table. We can, of course, learn a great deal by dissecting frogs; Bruce Archer and Professor Markus were 'glass-boxers' in this sense. They took a Systems Analysis, Operational Research view of design method. As an assemblage of OR techniques, Bruce Archer's 'Logical Model of the Design Process' was an impressive performance. He used Critical Path Method to plan the 'design programme' itself, and he plotted the various 'properties' of an object—cost, brightness, roughness, and so on, against 'degrees of satisfaction', using a simple correlation technique from statistics. He had a graphical method of expressing 'degrees of satisfaction' for different properties of the *same* object, which he then translated into Set Theory, and a method for placing entire objects, such as chairs, into order of, say comfort, against the scales for psychological measurement set up by S. S. Stevens. It was crucial, he said, to have

a way of negotiating with developers, local authorities and such, and he developed one from the Theory of Games. Lastly, he had a detailed 'map' of the 'design programme' based on Systems Analysis, and a method of 'decomposition' from Graph Theory, similar to Alexander's (see below).

There was, however, a difference between Archer and Alexander for he (Archer) insisted that his 'decomposition' was simply a 'map' of design territory, whereas Alexander's was a 'problem-solving' device. Archer's techniques should only be taken as 'maps', or navigational aids; given these devices for exploring unfamiliar territory, one still had to 'damn well go'. And like any other wise explorer, the designer should keep his eyes open when he is actually moving across the terrain, making quick decisions all the time as to what to do next.

Professor Markus used the RIBA Plan of Work as his 'map' of design territory (see *Architects' Journal*, 20.12.67). We had some difficulties in terminology here; Professor Markus opted for Asimow's definitions (Asimow, M. *Introduction to Design*. Prentice Hall 1962), in which the entire sequence of design events, Archer's 'design programme', is called the design 'morphology', whilst the individual 'loops' of briefing, analysis, synthesis, evaluation and implementation within this sequence are called the design 'process'. But other designers use 'morphology' in a different sense and the Symposium as a whole agreed to the following definitions:

1 The Design Process is the entire sequence of events which leads from the first inception of a project to its final completion.
2 An individual 'loop' within this process of briefing, analysis, synthesis and so on is a Decision Sequence. This brings our terminology into line with OR, Management and other fields.

Professor Markus has a particular interest in building appraisal, and the Plan of Work allows for this in its final phase, which is called 'feedback'. Markus suggested that this be renamed 'feed-forward' because although it couldn't help much to improve the quality of what had just been completed, it might help the designer to avoid mistakes on future projects.

His own appraisal techniques were described under four headings: 1 Identification, 2 Relationships, 3 Model Building, and 4 Optimisation.
The first two of these were elaborated in some detail. *Identification* is a matter of finding out what the designer's original intentions were, and then of testing his building against these intentions. *Relationships* form a valuable classification of the various 'systems' which come together to *form* a building, relating human needs to inanimate objects. The first of these, the *building* system, is concerned with structure and construction; the second, the *environmental* system is self-explanatory; the third, the *activity* system is concerned with human behaviour in general and the fourth, the *organisational* system, with the 'objectives' which prompted the client to build in the first place.

These 'map makers', who work out abstract patterns for the design process itself, came in for a good deal of criticism during the Symposium, notably from Professor Nelson, of the Ecole des Beaux Arts in Marseilles, who worried about their apparent lack of concern for *actual* buildings. But at this stage in the development of the art, they serve an extremely useful purpose and we should remember, after all, that Sir Francis Chichester himself is a 'map maker' by profession. It may be, however, that we have enough maps now; some of them are very elegant, but perhaps we ought to call a moratorium on the design of new ones.

Jones's next two categories, *Control* and *Observation*, were hardly represented at the Symposium. *Control* is a matter of self monitoring, of observing oneself, what one does in design. A good teacher will enable a student designer to exercise control in this way—Jones cited Matchett of Bristol as someone who could do this, but OR-based design processes may inhibit the development of such control. Most of them start with a massive 'briefing' exercise, in which *all* the information, which in any way *might* be useful to the designer, is collected at the beginning of the job. This 'information explosion', as Jones described it, can be fairly traumatic for the designer; he abandons his good intentions and lapses into traditional methods. The design team too may suffer from lack of control. If one simply assembles a group of people, representing different interests, their efforts may well be abortive unless each additional brain, bringing with it extra intelligence and extra creativity, brings with it also extra control.

Observation, by Jones's definition, is a matter of watching the designer at work, to see what he does. Little has been done in this direction since Levin's brilliant analysis of a planning team at work (Levin, P. H.: *Decision Making in Urban Design*. BRS Current Papers 49). But in contrast to these last two, the *problem structure* approach was very well represented at the Symposium. Morphological analysis, by definition, is concerned with problem structure; John Luckman and Sydney Gregory described variations of the technique which was originally given this name by Fritz Zwicky. As Gregory said, it has to do with 'pattern and shape'; Zwicky's version is refreshingly simple. He takes the *requirements* of a system, calling them 'significant parameters'. For a jet engine, for instance, some of these might include thrust generation, jet, propellant state; and so on. These are listed, and, opposite each parameter on his list, he plots a number of ways in which it can be achieved. The solution is then assembled by taking one solution for each parameter —one entry from each line.

Luckman's technique, which he calls AIDA—analysis of inter-connected decision areas—improves on this by 'mapping' the ways in which solutions to the various parameters can be assembled, to form a whole. He defines each *factor* in the design. Some factors can only be satisfied in one way, but others may be satisfied in a number of ways. Yet a particular solution to one factor may be quite incompatible with certain solutions to another factor. In a rationalised-traditional house, for instance, all the walls may be load-bearing, or only the crosswalls, with infilling panels for the end walls. In the first case, floor joists could span in either direction but in the second, they could only span between crosswalls. And in the same house, other factors will be interconnected in similar ways. Given foundations, walls, partitions, ceilings, floors and so on, each with, say, two solutions, it may seem, at first, that there are 2^{12} ways of designing the house—4096 in all. But once certain major incompatibilities have been noted, this will be reduced quickly to 2^5, or 32, and before long, it will be apparent that there are only 2^3, or 8 possible kinds of solution. These could then be tested against cost, and other relevant criteria, so the best of the eight would quickly be indentified.

Gregory drew certain analogies between chemical engineering and architecture. In designing a large chemical plant, for instance, the simple, familiar diagrams of Systems Analysis enable a very rapid check on costs to be obtained. Each step in the process is counted, to give the Functional Unit Number (FUN) and the designer's task, therefore, is to cut the FUN as far as possible. Not only that, but in costing such a system, one assumes that each functional unit, however complex, costs exactly the same as the others, and that the overall envelope or enclosure will cost at least as much as the plant it houses. This led to certain analogies with architecture and urban design; he suggested, for instance, that Chermayeff and Alexander, in *Community and Privacy* (Penguin 1967), only hinted at the morphology of enclosures—courtyards and other specialised areas. Process design offered a much richer method of analysis, which could be used, not only in criticism, but in designing traffic, circulation, pipework and other flow systems with very firm cost-control. And the idea of overall enclosure, led to Fuller-type domes as the answer to environmental control.

The other analysis of problem-structure,

which came in for inordinate attention during the Symposium, was Christopher Alexander's method of 'decomposing' the problem into 'fit' and 'misfit' variables. In this technique, which is based on Graph Theory, the problem is broken into its tiniest, constituent components (the 'misfit variables'). Each of these is then checked for its 'connection' with the others, and eventually, 'groups' of 'misfit variables' are built up. The problem presented by each group is resolved by means of a 'diagram' which sums up geometrically its essential characteristics. These diagrams are then assembled, combined and modified into each other, to achieve a total solution to the problem. (Alexander, C. *Notes on the Synthesis of Form*, Harvard U. P. 1964). Alexander expanded this technique, in certain directions, when he was with Ian Moore's research team at the Ministry of Public Building and Works, and several of his colleagues from that period reported this work to the Symposium.

Ian Moore set the scene—he gave the first paper of the Symposium, by describing the work of his team (now the Offices Development Group) in general terms. He spoke of the difficulties of finding out what people *really* want in their buildings, and of ensuring that major decisions to build—anything, whether it be an army depot, a hospital or a housing estate—are made in full knowledge of the overall context. Context, in this case, would include everything relevant which is there, now, physically on the ground; its present state and its users' future needs; all seen against a background of the national economy. I liked particularly his definition of one scale against which priorities should be plotted—that of 'human misery'. This intensely human approach permeated everything that the Ministry team had to say; it applied at all levels. Ian Moore, for instance, also mentioned the 'other half' of design which most of us pretend isn't there. However fully we may have taken the brief, and analysed it, however good the solution, it still has to be implemented. And that depends on *persuading* people, politicians and others, who finally will make the decision to build—or not to build—as the case may be. If one's design process has been exceptionally thorough, one's solution may be so different in kind from the conventional, or the expected, that its implementation will be extremely difficult.

As for Alexander's technique, there were four descriptions of this, and its developments, during the course of the Symposium. Barry Poyner, Keith Hanson, Tony Ward and Neville Longbone each had variations on it. It is tempting to call them the Alexander quartet, but that would be unfair, because there was considerable variations in the ways in which they had developed from the original. Keith Hanson came nearest to describing the Method from Alexander's book, which is not surprising, because his example was worked out as a student scheme at Cambridge University. He was concerned with housing design, and threw some light on the difficulties of finding meaningful diagrams for each group of variables. In some cases, he said, the diagram was misleading. In other cases, it was impossible to draw one. There is considerable doubt, therefore, that a solution built up by combining diagrams of this kind can have much validity. Hanson himself was quite honest about this. Having gone through the Alexander process once, he said, he would never do it again.

Barry Poyner described the research which he and Alexander had completed at the Ministry on 'Relational Theory', which has been published as *The Atoms of Environment* (MPBW 1967). It starts from the fundamental premise that in relation to particular human activities, the physical environment can be 'right' or 'wrong'. The impact of one on the other can be expressed in terms of 'tendencies', 'conflicts' and 'relations'. If somebody, given the opportunity, wants to do a certain thing, they call this a 'tendency'; a typical tendency migh read: 'People . . . try to get a view from their offices'. That, they say, is more than an expression of 'need' —it is a testable hypothesis. At first sight, the designer ought to *satisfy* these tendencies, but according to Alexander and Poyner, he should do something more subtle, which is to design the environment in such a way that people are encouraged to satisfy these tendencies for themselves. But tendencies conflict. You have a tendency to park your car in your garage. Your guests have a tendency to park in your drive. If they satisfy *their* tendencies, they frustrate yours; you can't get out. So the designer should plan your garage and drive in such a way that the conflict is resolved; and this planning is simply a matter of *geometry*. The diagrams of Alexander's theories are expressions of this geometry; a diagram of your garage and drive would illustrate the relations *between* them.

Poyner illustrated the theory with reference to examples from a study of office entrances; Tony Ward and Neville Longbone were concerned, respectively, with prison workshops, and workshops for the blind. Each had a rather harrowing series of photographs, harrowing, that is, to the designer, which showed what people *do* with buildings which fail to 'fit' their tendencies. They modify them, of course, they add things, take short cuts, leave things lying around. These indications of 'misfit' can be photographed, but, so far, there seems to be no mechanism for feeding the implications of those photographs forward into design. Alexander-type diagrams can be gravely misleading and it was interesting to note that in one practical, worked example which Ian Moore described—the design of furniture for new office buildings—actual, mock-up furniture was built, and tested by real people in the working situation.

Professor Guerra also had a practical way of handling Alexander's technique. His method starts with the collection of data on the client's demands, in terms of social need, costs and so on. He then investigates the site, under two headings: the actual, physical site and the available 'site', as defined by town planning and other statutory requirements. Finally, he looks at generalised human needs, in terms of physiology, ergonomic and similar data. Once this material has been analysed, Professor Guerra allows the site itself to determine the choice of an actual building form, by preparing diagrams of the available structural types, and 'crossing' these diagrams in an interaction chart. These structural possibilities are then tested against the economical use of space, and, throughout, he develops two distinct kinds of information in parallel:

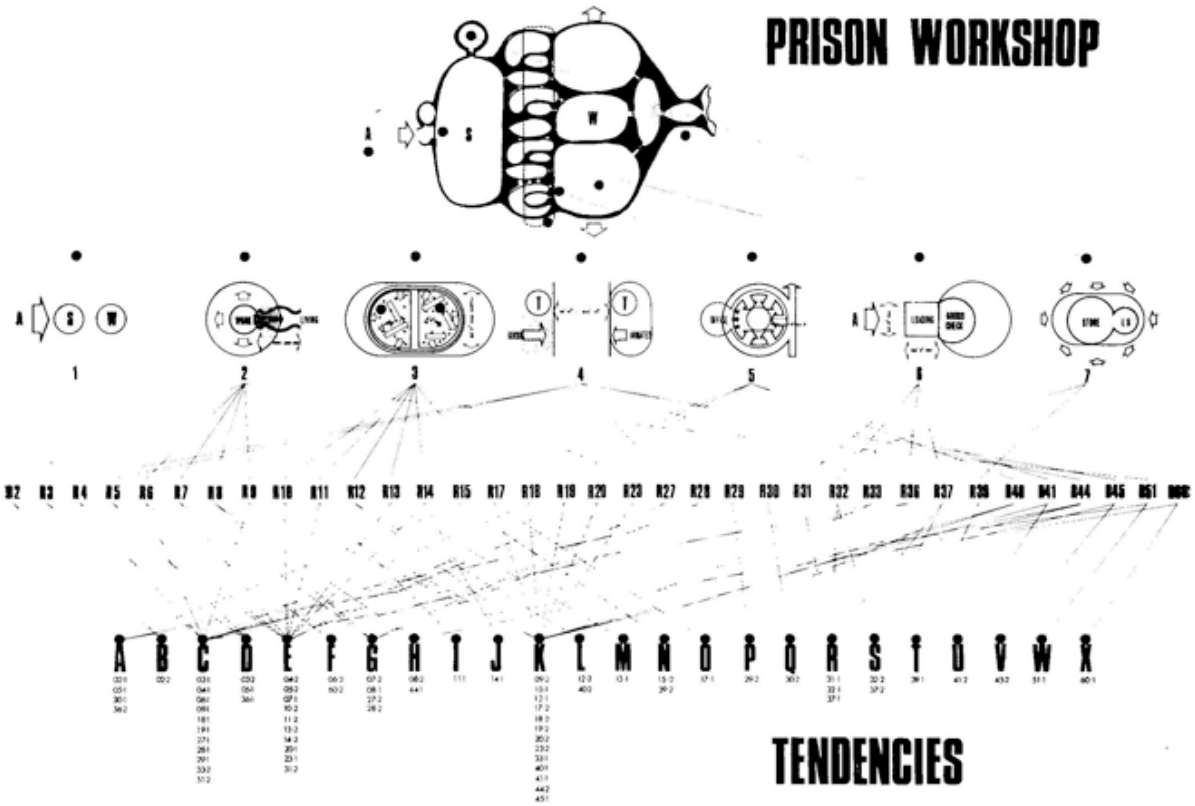
1 All functional matters, other than those concerned directly with structure.

2 The structural possibilities.

At the appropriate time, he collates these two streams of information, and the building itself finally amounts to a synthesis between them.

Alexander's Method is based essentially on the observation of human behaviour, and the drawing of conclusions from this observation. As might be expected, it draws heavily on Behaviourist psychology, and the whole Behaviourist case came in for devastating attack from Janet Daley, who simply poured scorn on the presumptions on which it is built. She questioned, first of all, the validity of the Behaviourist's belief that he can be objective in the observation of human affairs. He claims complete objectivity for his tests and measurements, but they depend entirely on his definition of 'normal' behaviour. The belief that there can be such a thing as 'normal' behaviour is itself a moral judgement, and what is more, anyone who fails to conform to the Behaviourist's notion of normality is considered odd, eccentric or sick, and given 'treatment' to make him 'normal' again. So Behaviourism is a 'muddle-headed' movement; it claims, by its 'objectivity', to transcend philosophy, but in fact it is based on an over-simplified, deterministic philosophy, hangover from a 19th Century mechanistic view of the world.

Relational Theory's 'rightness' and 'wrongness' in the physical environment is equally naïve. Alexander argues that one cannot judge the environment in terms of one's own 'goals, or policies, or values' (MPBW 1967) but this itself is a *moral* attitude, as 'muddle-headed' as the Be-



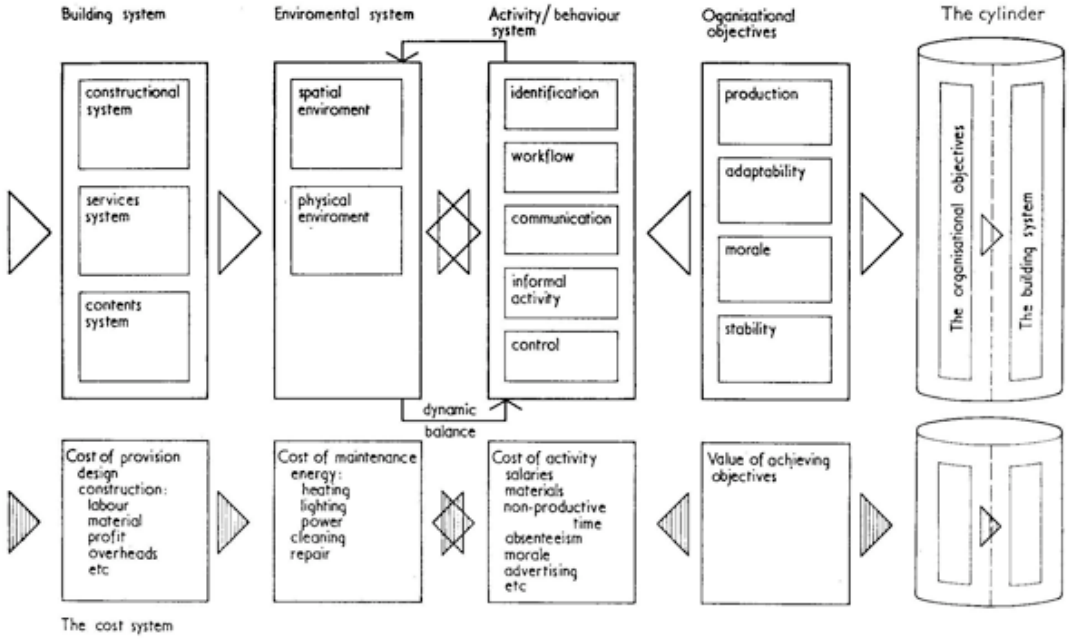
Prison Workshop—Relational Synthesis, by Anthony Ward. This is an application of Christopher Alexander's Method, in which the various Relations of a prison workshop are indicated diagrammatically and then fused to form a complete diagram of the workshop as a geometrical abstraction. The Relations themselves are based upon observations of what people are seen to do in existing prison workshops (observed user-behaviour patterns or Tendencies)

haviourist's. He dismisses such judgements as 'arbitrary', thereby confusing the word 'arbitrary' with 'non-factual'. Yet the designer must make judgements on matters which are 'non-factual'—in the sense that they cannot be measured in simple, physical terms. But such judgements need not be 'arbitrary'. Janet Daley herself suggested that if she said of a house: 'I like it', that was an arbitrary statement, and of no particular interest to anyone else. But if she added: 'because it is conducive to good human contact', then that was no longer arbitrary, as a statement, it could be defended, even though there is no way of measuring 'goodness of contact' in physical terms.

Lastly, Janet Daley castigated Alexander and his colleagues (not to mention several other people in the Symposium) for inventing 'private languages'. People who use ordinary words in special ways are obviously unsure of their ground. It is impossible to *test* what they are trying to say, because if one challenges what they *appear* to have said, they can always shift their ground, and change the special meanings of their words. Words like 'tendency', 'conflict' and 'relation' have simple, ordinary meanings. It can only fog the issue if these same words are used with special meanings as parts of a private language. Nor should it be necessary to use jargon. We have some fairly complex things to say, in discussing problems of environmental design, but it should be possible to say them all by means of good, honest, simple words, used with the meanings by which most people understand them.

She is right, of course, but perhaps she underestimates the power of 'in-groups' in the architectural scene, and of the desperate need that many environmental designers have to be recognised as 'respectable' by science. It is easy to acquire a tolerably imitation of respectability by expressing simple thoughts in complex jargon, and certainly it is my experience that architects moving into the field of design method, don't *want* to be told the simple truth about what they do. That makes it sound too easy, and they are really looking for a complex mystique.

Professor Studer expressed some simple, elegant thoughts but Janet Daley found his language, in particular, far too complex. And yet his avowed aim was to *find* a language in which the structure of environmental problems could be expressed. The chief difficulty, he said, in building for human needs, is that the *needs* themselves cannot be observed. We *can* see people's behaviour, which he defined as 'a system of operationally defined needs . . . within a given environment'. In other words, what we *see* them do is an expression, presumably, of what they *want* to do, in a given set of circumstances. We can describe the environment—physical, social, cultural, political and educational —and we observe people's behaviour, but we have no language in which we can express the nature of the 'interface' between the two. The Behaviourists have such a language, or the beginnings of one, but it is not yet suitable for our purposes because it is too simple. They isolate individual phenomena, subject them to experimental test, under controlled conditions, with very few variables. Their view, consequently, is fragmented and analytical. But designers have a much more complex task. We are concerned with wholes rather than with parts, with the simultaneous interactions of a vast number of variables, with elaborate patterns of human behaviour and with synthesis in addition to analysis. So every day, we make decisions of a complexity which is quite



This conceptual model, by Professor T. Markus, which really takes the form of the cylinder on the left, attempts to plot the entire relationship between the hard facts of building and the human beings who will use it, under four headings: The Building System, the Environmental System, the Activity Behaviour System and the Organisational Objectives. Similarly, the lower cylinder deals with costs under each of the four major headings

beyond the Behaviourist's experience. Yet his language, and especially in terms of 'operant behavioural analysis' can give us a lead, because it is a mathematical language. It is highly likely that the language we need, to describe the interface between behaviour and environment, will also be a mathematical one.

Amos Rapoport also presented a complex argument. It was decidedly non-linear, in the McLuhan sense, but it was profoundly concerned with the human-ness of human affairs. He rejected entirely the validity of OR-based design methods, and of Alexander's method too; he had grave doubts, anyway, about the place of scientific method in design. The prime danger, as he saw it, was that because certain factors —such as proximity, lighting standards and so on—are measurable in the physical sense, computable and otherwise supportable by 'objective' evidence; some designers tend to emphasise them and think them all-important. Professor Markus, in fact, had said that in appraisal if a thing could not be measured, it was not worth bothering about. But according to Rapoport, other factors, not so measurable, are equally important. They might be matters of emotion, judgement and values; whether we like it or not, they *do* get built into buildings. He cited the example of court-houses; it would be possible to infer from the plan and sections of a court-house almost everything that one needs to know about the administration of justice in a country. The physical planning, the three dimensional relationships of chairs, tables and of other furniture, expresses a hierarchy of human relationships which is built into the actual 'form' of the building. And furthermore, any attempt to 'rationalise' the plan of a court-house, to find an economical circulation pattern by computer analysis, *might* result, eventually, in the miscarriage of justice. For 'wasted' spaces in and around corridors may be just those places where council chose to meet, informally, 'by accident', to settle things out of court.

Alexander's 'relations' are attempts to resolve the 'conflicts' between human 'tendencies', by means of clear, simple geometrical statements. But they presuppose that everyone is going to adapt to the environment in the same way. They process and package people, but each of us adapts to the environment in different, personal ways. So instead of looking for geometrical clarity, we should encourage complexity and ambiguity—these will allow people to 'choose' how they are going to adapt, instead of forcing them into some standard pattern.

Gordon Best compared various ways of designing—Alexander's (naturally), Aalto's as representing 'traditional' ways of designing, and a Bartlett student's, who worked according to typical, OR-based design methods. Best thought that, in each case, the total design process could be 'mapped' against a simple communications channel, in five stages: input, encoding, processing, decoding and output. The designers also started with a common aim, which was to reduce the vast complex of information with which they started into simple, manipulable form, a process which he called 'homomorphic reduction'. Where his designers differed, enormously, was in the process of 'encoding'—Alexander used Graph Theory for this purpose, 'processed' his information by means of diagrams, and 'decoded' these to form his design solution. Aalto's 'input' consisted of a conventiontal brief, amplified by a walk across the site; he 'encoded' his information by producing a preliminary sketch of what the building was going to be 'like' and to do this, he drew on his vast experience as a designer. The design itself, when it was 'decoded', looked remarkably like this first sketch. The Bartlett student, having no such experience to draw on, relied on the paraphenalia of OR-based design method—interaction charts, bubble diagrams and so on, for his 'encoding'. And most significantly, the final design in each case was *determined* by the system of encoding. In Alexander's case, there was a tendency to convert the lines of his diagrams into the actual lines of plans, in Aalto's, the first sketch determined the 'form' of the building, and the student's plan *looked* remarkably like his final analytical diagram.

I have described this phenomenon, which seems to me fundamental in design,

as 'analogue-take-over'. It occurs whenever a design problem is translated into some medium other than the actual materials themselves, manipulated to full size on the site. Drawings, models, written descriptions, and even the computer programme, all 'take-over' from the designer, and impose their own characteristics on what he is designing. This need not surprise anyone who listened to Jane Abercrombie at the Symposium. She was concerned with two aspects of design: the ways in which we *receive* information, under the general heading of Perception, and the ways in which we put ideas together, which she called 'Construction'.

She demonstrated the fundamentals of perception, with devasting economy, by using her Ames window (a rotating window constructed in 'perspective' which affords some impressive optical illusions). And on this basis she explained that the taking in of information is a transaction, between what is 'there', physically, in the 'real' world, and what we *want* to see on the basis of schemata we have built up, from what we are used to seeing. However 'rational' we may try to be, say in observing people's 'tendencies', we shall always bend the 'facts' to fit our personal predilections. Elsewhere she has cited the case of a scientist who when taking 'objective' thermometer readings, was unaware of moving his head, ever so slightly, until the mercury lined up with the mark he *wanted* to read.

Dr Abercrombie had a great deal to say about the difficulty of learning *anything* new. When a child is learning to read, for instance, he throws his whole body into the act. His eyes move, and the whole of his head, not to mention his body, arms, legs and even his toes. In trying to build up the abstract, mental concepts which reading requires, he cannot help relating them, fundamentally, to bodily feelings and emotions. We all do this, whether we like it or not, especially when we have to attempt something difficult; and if we *try* to separate mental functions from bodily ones, we find ourselves in difficulties. She cited a simple problem—cutting a plank into two parts, in a certain proportional relationship — which people tried to split in this way. Some of them translated it directly into abstract, algebraic terms, and failed to spot an inherent ambiguity in the problem. Others saw simple, visual images, and they had difficulties too. The most efficient problem-solvers were those who could alternate these two ways of looking at things. There was a profound message here for the design methodologist. He needs to see the problem in both ways too. We know that the 'traditional' designer, who tends to work only in visual images, is prone to significant error, but the 'map-maker' also, who tried to deal *only* in mathematical abstraction, is equally prone to make mistakes, where the evidence of common-sense is submerged in a welter of intellectual processes.

She talked about two levels of designing:

1 Putting real things together, which we percieve with our senses, and manipulate in three-dimensional space.
2 Designing in the abstract, which is a matter of visualisation.

We tend to sneer at the first. It seems too direct and simple. Yet it seems to me that sooner or later, the only way in which people can experience our buildings will be by means of their senses. Why, then, should we be afraid to *manipulate* the design of buildings in this way? The answer, of course, is that Plato told us to beware of using *real*, material objects in the solving of problems. He castigated Archytas, a mathematician, for using models to work out solutions in geometry. And ever since, we have believed, with Plato, that mental processes, somehow, are 'better' than physical ones. Yet if the two are intimately related, as Jane Abercrombie said, there is nothing inherently 'better' in one *or* the other. And if 'analogue take-over' is the insidious device I believe it to be, then the wise designer will *always* deal with real materials, to full size, wherever this is possible.

Designing in the abstract is certainly very difficult. As Dr Abercrombie showed, to do it at all, one has to learn a 'code'—the 'code', in this case, of three-dimensional visual representation. It is a difficult code to learn—analogous to learning a language. It is always easier to *decipher* a language, once one has started to learn it, than it is to *manipulate* the language oneself. One can understand other people speaking the language long before one feels confident enough to speak it. Manipulation, eventually, can only be learned by *doing;* this is true of three-dimensional manipulation as it is of learning any other code. But recently, in schools of architecture, it has become fashionable to avoid the *doing* of three-dimensional manipulation. The interaction chart has taken the place of the drawing as the object for final presentation, and whilst no one would wish to re-instate the presentation drawing as an end in itself, it is becoming increasingly clear that students are failing to *learn* the three-dimensional code, which is their stock-in-trade as architects.

Dr Abercrombie illustrated some difficulties in learning to draw with reference to experiments with spastic and otherwise handicapped children. Some of them showed marked lack of co-ordination between hand and eye, and even the 'normal' child, up to the age of seven or so, found it difficult to draw diagonals. Even more revealing was a series of models, made from assorted building shapes, by 'normal' boys and girls. The boys tended to make forts and other outward-pointing devices, whereas the girls made hollow, protective, domestic-seeming spaces. In each case, she said, the child was simply externalising obvious, personal bodily feelings. When design method can take account of these things too, it might begin to call itself truly 'systematic'!

Several reviewers (eg *Architects' Journal*, 17.1.68) have detected a major split in attitudes to design method at the Symposium, but the dichotomy, in fact, resulted from their own one-sided views. We presented a spectrum of ideas, and like any good spectrum, it had ends. But, it also had fine gradations of 'colour' between these ends which, in looking for a split, the reviewers proceeded to ignore.

Our conclusions? That design method *is* moving into a new field of enquiry. It is no longer adequate to take techniques straight from OR, or even from Graph Theory, and foist them onto the designer. They may inhibit him, or they may be quite irrelevant to his purposes. The new approach will be based on a passionate concern for people's needs. It will draw increasingly on the resources of philosophy and the psychology of perception to help define these needs (sociology has shown itself almost impotent to deal with this problem, based, as it must be, on the analysis of people's *past* experience). There is much work to be done, at a personal level too, on the designer himself, what he does, and how he gets his results. It is likely that the new design methods will *look* remarkably like what the designer thinks he does already, but there will be a difference. They will *draw* on all the techniques available from OR, Systems analysis, Computing and the New Maths. But they will not be dominated by these techniques. The process itself will determine *which* techniques might seem to be relevant. Such processes are available, and can be described now. But we are not ready for them yet—we have to convince ourselves, by the use of jargon and private languages—that there is a substantial discipline in what we are doing. It makes us *feel* good to talk of parameters, behaviour-contingent systems and relations. We are not ready to make, *or* to receive, the simple statements that Janet Daley asked of us. We like to think we can be objective in our observations of the physical world; we refuse to *believe* the evidence of Jane Abercrombie's window that inevitably, we cannot. But there are enough people now, in the field, who obviously *care* about satisfying people's needs to ensure that, in the long run, there could be a philosophical shift which would make this desirable aim a fashionable one. And design method then could begin to serve its purpose. ●

The full proceedings of the Portsmouth Symposium are to be published by Lund Humphries as an AA paper towards the end of the year.

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