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Robert A. Fowles

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The DESIGN METHODS GROUP is a tax-exempt, non-profit association existing for the purposes of communication and education in the areas of design methodology and the application of systematic procedures to designing, especially but not exclusively in the environmental design and planning professions. The DESIGN METHODS GROUP is an international organization counting members in 38 countries.

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DESIGN METHODS AND THEORIES is published three times per year. The submission of articles is cordially invited.

DESIGN METHODS AND THEORIES is the third in a sequence of periodical publications of the DESIGN METHODS GROUP. The first was the DMG NEWSLETTER, published 1966-1971 (Volumes One through Five). The second was DMG-DRS JOURNAL: DESIGN RESEARCH AND METHODS published 1972-1975 (Volumes Six through Nine). The current title has been published from 1976 (Volume Ten) through the present.

Back issues of the periodical publications of the DESIGN METHODS GROUP, as well as of some irregular bulletins and occasional papers, are available from the editorial office.

Donald P. Grant, Ph.D., Chairman
THE DESIGN METHODS GROUP

This issue of the journal is going to the printer on the 21st of December, 1978. Our efficient printer, Preuss Press of San Luis Obispo, promises delivery before the end of December. Our intent is to have this issue in the mails by January 1st, 1979, shortly after the rush of Christmas mail has ended, and with luck it should be in the hands of our readers well before the end of January, 1979; not only on schedule, but even a shade early.

We fell far behind on our printing and mailing schedule during late 1976 and early 1977, and only recovered our schedule "as per the cover date" with issue 3/4 of Volume 12. We are firmly resolved to stay on schedule in the future, and to have each issue in the reader's hands within the date brackets printed on each issue's cover.

We appreciate the patience of our members and subscribers, who stuck with us even through the period of very late fulfillment of their subscriptions. Thank you.

THIS ISSUE

This issue of the journal, Volume 13 Number 1, represents a first and a last. This is the last issue to be prepared by the DESIGN RESEARCH SOCIETY of Great Britain, and the first to introduce a new format for the journal pages.

First, the last: The DESIGN RESEARCH SOCIETY (DRS) has hoped for some years to publish a journal of its own. They went so far as to announce the appearance of a DRS journal in the pages of the DMG NEWSLETTER in 1969. However, for various reasons, they were unable to start such a publication for some years, and in the interim they cooperated in the publication of the DESIGN METHODS GROUP's journal, entering a block subscription for their membership and editing one issue per year. Now, the DRS has entered into an agreement with IPC Science and Technology Press of Great Britain and will initiate their own journal, they hope within the year. While we of the DMG are sad to see them depart, and will miss the first quality issue that they prepared each year, we are pleased to see the DRS realize its longstanding ambition to have a journal of its own, and are also pleased to see the emergence of a second journal in the field of design research and methods. We extend our best wishes to the DRS for the success of their new venture. We will carry full information on the new journal in the pages of DESIGN METHODS AND THEORIES as soon as it is made available by the DRS and IPC. This issue, edited by Robert Fowles of the Welsh School of Architecture in Cardiff, is the last full issue of DESIGN METHODS AND THEORIES to be prepared by the DESIGN RESEARCH SOCIETY. This does not preclude the publication of articles or groups of articles by our colleagues in Great Britain, and we look forward to receiving future material of the high quality level that we have come to expect from that quarter.

And now, the "first." That we are experiencing a period of severe inflation in the United States should come as a surprise to nobody; the fact that we at the DESIGN METHODS GROUP are charging the same rates for the coming year that we have charged for the past five years may be at least mildly surprising. During the past few years, the rate of inflation that we have experienced in our crucial areas of postage, printing and supplies has far exceeded the rate admitted annually by the federal government; that may be because publishing and mailing operations are generally inflating faster than the general economy, or it may simply be that we, along with everybody else, are experiencing reality and the government is proclaiming illusion when it states the annual inflation rate. Whatever; obviously, something has to given in a period of static income and inflating outgo.

We decided to attempt to meet the challenge of inflation by other means than raising our rates. The means that we decided upon center around publishing policy and page format. Here were the parameters considered:

1. The journal content should remain the same, or increase, but not be decreased as a means of cutting costs. During the past few years, we have generally aimed for 240 pages per year, with two fifty-character by twelve-inch columns per page. Decision one was that the amount of text published in this past format should not be reduced by any cost-cutting future format.
2. The number of issues per year could be adjusted if desirable.
3. The number of pages per issue and year could be adjusted, provided that the total textual content was not reduced on an annual basis.
4. The physical size of each journal should remain constant (approximately 8½ x 11) to avoid storage and shelving irregularities.

The cost-cutting decisions made within the above guidelines are:

A. The number of issues will be reduced from four per year to three, to be numbered 1, 2, and 3/4, respectively.

   This measure reduces several expenses, including materials and printing for covers and tables of contents; materials and printing for envelopes; costs of gathering, folding, stitching and trimming; and the costs of stuffing and addressing envelopes. These costs are reduced by about 25% per year by this measure.

   Postage costs are reduced by about 12 to 15 per cent per year by this measure, with three mailings per year instead of four, but with one heavier double issue.

B. The page format will be changed, incorporating more text per page at a slightly greater reduction.

   The past format has been two fifty-character columns per page, with seventy-two lines per column. This yielded a a total of 7200 characters per page.

   The new format, at a greater reduction, will be two sixty-character columns per page, with ninety-six lines per column. This will yield 11,160 characters per page, or 1.55 times the text per page.

C. The number of pages per year will be reduced from 240 to 192, distributed over the three issues at about 48, 48, and 96 pages, respectively. Given the greater textual content per page, and the newly reduced number of pages, we will in fact have a slight increase in yearly textual content despite the cost-cutting measures. To be precise, the new format will yield the equivalent of 297.6 of the old-format content, and do so within the reduced number of pages per issue and per year.

   The number of pages per issue, incidentally, will be kept in increments of sixteen pages, exclusive of covers, since our printer prints in sixteen-page signatures. Thus future issues will be 48, 64, 80, 96 or some other multiple of sixteen pages in order to achieve maximum economy at the printing and assembly stages.

We regret that the greater reduction rate may be a problem for some readers, but are pleased to be able to maintain our rate of output in terms of text without raising our subscription rates, despite the severe impact of inflation on our costs.

COMING ISSUES

Further issues this year will include several book reviews, including some new books on computer-aided design and a review of John Wade's ARCHITECTURE, PROBLEMS AND PURPOSES. There will be a group of papers from the Istanbul conference, including (tentatively) papers by Broadbent, Abel, Foque, Sanoff, and others (a possible total of 34 submissions), prepared and edited by Associate Professor Doctor Nigan Bayazit and Associate Professor Doctor Mine Inceoglu of Istanbul Technical University. Papers on economic methods in design and a lengthy article by Professor Horst Rittel are also in the offing.

AVAILABLE WITHOUT CHARGE

We are publishing a series of one-page (two sides) reference sheets for new students of design, which are available without charge to individuals, student organizations, and teachers who wish to distribute them to their students. Each sheet deals with one concept in a summary fashion, and are intended to introduce the student to the shared folklore of design in the absence of any standardized text or course that does so.

Available now are:
- Ref.Sheet 1, DESIGN METHODOLOGY AND DESIGN METHODS
- Ref.Sheet 2, PROFESSIONAL PRACTICE AS A SMALL-SCALE MASTER BUILDER
- Ref.Sheet 3, INFORMATION SOURCES FOR DESIGN METHODS

Coming are:
- INDUSTRIALIZED BUILDING: OVERVIEW, LITERATURE, EDUCATION PROGRAMS
- COMPUTER-AIDED DESIGN: OVERVIEW, LITERATURE, EDUCATION PROGRAMS
- ORGANIC ARCHITECTURE: DEFINITIONS, LITERATURE, EXAMPLES AND EXEMPLARS
- THE GOLDEN RATIO AS A DESIGN METHOD
- LE MODULOR AS A DESIGN METHOD
- SYNOPSES AND REVIEWS OF SEVERAL BOOKS (one sheet per book) INCLUDING BOOKS BY BRUNO ZEVI, JOHN SARGEANT, GEOFFREY BROADBENT, J. CHRISTOPHER JONES, JOHN WADE and others.

EDITORIAL

Robert A Fowles

'What happened to Design Methods in Architectural Education? Part One - A Survey of the literature'. was published in Design Methods and Theories, Volume II, Nos 1, 1977. It presented, through the use of quotations from the literature, a description of the evolution of design methods during the 1960's and early 1970's. A feature of the review was the identification of how in a very short time the optimistic advocates of design methods became doubters and critics, a result of which was the development of what became known as Second Generation Design Methods.

Many architects in the early 1960's, particularly those in academia, were enthusiastic about the capability of design methods to demystify the design process and so provide an ideal framework for the teaching of 'how to design'. The survey revealed a suprising lack of evidence of widespread application of design methods in Schools of Architecture, or was a more appropriate conclusion to be that those who were teaching and utilising design methods were simply not writing about their activities? It was considered that contact with the Schools themselves would provide the answer. This issue of D M & T constitutes Part Two of my survey.

The selection of Schools of Architecture in the U.K. to be approached followed this procedure: I requested each School to forward its current Prospectus. Of 38 Schools I received 29 replies. Of these, 12 included in their course description, a reference to 'design methods' or 'design method'. I then telephoned the subject tutor or Head of Department and these initial contacts suggested that sufficient contributions would be forthcoming from them to compile a full issue of D M & T and that the material would present a useful survey of the state of the art of design methods in U.K. Schools of Architecture.

It was inevitable that all twelve Schools would finally not be represented, and as it turned out this was the case. The resaons for this are various;

in a few cases other commitments of the potential authors took precedence.

design methods may be included only within a short lecture course (taking their place alongside other approaches to architectural design) and as such were not fundamental to the whole course. Both Oxford Polytechnic (one term of lectures in 2nd Year: 'Systematic Methods of Design') and Canterbury College of Art (a short course of lectures and exercises 'Design Method and Models' in the B.A. Introductory Course, Terms 1 and 2) refer to design methods in this way, and the tutors contacted felt they didn't have a great deal to say on the subject.

The North East London Polytechnic School of Architecture, formerly Waltham Forest Tech-

nical College, participated at Ulm and Attingham. They published, with the Department of Education and Science,

'Reporting back, Attingham Park 1967' which brought together a number of reports on the systematic design programmes which had been developed at Ulm, implemented in Schools, and reported on at Attingham. A PhD student in a written communication with me in February 1978 writes, "I have been attached to the N.E. London Polytechnic over the past five years, on a part-time basis, but 'design methodology' tends to be an obscene phrase in the School of Architecture. Indeed, for my own PhD study (on the application of design methods to practical 'live' architecture) I had to register with our Faculty of Art and Design, rather than that of Enviromental Design". He then continues, "As you are probably aware, the Waltham Forest School of Architecture was one of the participants at Ulm, and later, at Attingham Park, and this school later became the N.E. London Polytechnic. Suffice it to say that when I wanted to refer to these conferences, every vestige of reference had been exorcised from our library shelves. Today, when one mentions design methods, eyes frost over and there is an awkward shuffling of feet. This is a pity. Ulm and Attingham Park were obviously traumatic experiences for at least some of the schools, sufficient to have left their mark even to this day."

Although few state as frankly a rejection of design methods, it is probable that similar attitudes are prevalent throughout the U.K. However I should add with reference to the N.E. London Polytechnic School that my request for a paper coincided with preparations in the School for the RIBA's quinquennial visit and a CNAA submission.

Manchester University School of Architecture had pioneered the early development of design methods in architectural education, and both Derek Buttle and Geoffrey Broadbent (now head of the Portsmouth School), from those early days, contribute to this issue their own retrospective view and they look to the future in which Buttle hopes for a new impetus and conviction to consider process, whilst Broadbent is more optimistic.

I had hoped to include a paper from Dennis Thornley who had worked with, amongst others, Buttle and Broadbent and the present Head of the Manchester University School, Professor Bell, in the development of design method teaching, and who had contributed so much to the early literature. Thornley is not now involved in the teaching of design methods at Manchester and his work has taken him away from the subject. He felt that due to the distance both in time and interests that had opened up between his present activities and that of design methods he was unable to make a satisfactory contribution to the debate at this time. However from Manchester we have James Harris who shows that whilst events within a

School, such as the arrival of a new Head, a course reorganisation, a move to a new building, and a change in the length of a course, can all effect changes in the teaching of a subject, there has been a more fundamental change in that design method now finds itself established within a wider theoretical framework.

This absorption of design methods into a wider context of architectural theory and teaching is representative of the general scenario presented by this issue. One in which the hard-edged, objective, rational,quantitative and systematic form of design methods has undergone a variety of transformations to become variously accommodated in different contexts in the Schools of Architecture.

From the Mackintosh School, Professor Andrew MacMillan reports that "while design method is utilised and taught extensively it is not studied as a unique process, hence the need to look across the whole course to identify the state of the game as it were, of the subject in the School".

From Dr Brian Lawson in Sheffield we hear that design methods plays its part in enabling the student to develop personal philosophies within a four level framework of philosophies, methodologies, techniques and skills, but an emphasis being placed on the mental operations of the design activity.

In Huddersfield, which has a number of ex-Manchester University students on its staff, including one of the co-authors of the Huddersfield contribution, Jaki Howes, we see that the hard-edge has been removed by a jargon purge, and that design methods take their place with computers in the background to support the development of more personal approaches to designing.

At Portsmouth, Geoffrey Broadbent points out that the philosophy has always been, "You may be a brilliant designer, with no need whatever for formalised design methods. If that is so, then good, but most designers get stuck from time to time. If you do, then you may find these interesting and useful". More recent material at Portsmouth draws heavily on Karl Popper's method of Conjectures and Refutations which Broadbent developes in his second paper in this issue which gives optimism for the developing Third Generation Methods. The Portsmouth course includes a description of the relevance of systems analysis, operational research, computing, information theory and cybernetics, but it is through Professor Tom Maver at Strathclyde that we are presented with a very particular context for design methods, one which is dominated by the quantitative methodologies of computer based design methods.

My own contribution describes how real world change processes are being investigated and models of these are being brought into an extended definition of design methods. Since completing my paper the idea of participation in community architecture has been developed and projects in this area are now commencing.

So, design methods are alive and well. They appear in a variety of forms in a variety of contexts and indicate a healthy diversity in architectural education in the United Kingdom.

ATTITUDES TO DESIGN METHODS: 1958-78

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SALIENT POINTS

Taking publication as a criterion, Robert Fowles concludes that interest in design methods has shown a marked decline during the past decade. (1) He calls other critics to support that view, although conceding that work relevant to design methods may be set out under other headings. It is probable that methodological studies were driven underground by a combination of fashionable myths, allegations of restrictiveness, and intuitive expediency.

"What happened to design methods in architectural education?" poses and exposes a valid and topical issue. There is little in the text which can be questioned, although, as some of the statements concern me directly, I should like to add an observation or two, as well as suggesting why it is again imperative to return to the study of procedure.

I do not think that my personal interest in design methods and theories has waned. It may even have deepened. Post-graduate tutorials which impinge on that area take up some of my time, while under-graduate classes have the opportunity to discuss the more cogent of procedural and similar propositions uncovered in the advanced work. Elsewhere at the under-graduate level, I know of at least one school which places some emphasis on the nature of the design process rather than its products. Conceivably there are other instances of the continuity of and insistence upon operational ways of thinking. In short, if there has been a general loss of momentum there have also been some gains.

Hopefully the 1970's will prove to have been a time for reflection and maturation rather than quiescence. If that is so, it is inevitable that the insights will be of a personal kind: each in itself perhaps insignificant and barely capable of articulation, yet in aggregate and in time becoming important. The present educational scene does not lack those, even in some intellectual isolation, who are moving forward modestly but painstakingly, fully aware not only of their own predisposition but of the self-destructiveness of fashion. In seeking a total and conciliatory theory, such workers are also learning that human and hence architectural problems are never solved in a final and mathematical sense. They surmise that in the area of the humanities any proposal, whether about method, product, or content, serves only to modify the context and so to create another problem. And that is not a trivial aside, it is a factor of far-reaching consequence. The paradox which links imperfection and creation is enormously enriching, for it holds an essential clue to the self-motivation of man and thus of design. It enables us to see what 'fuels' and 'fires' technique and method. It draws attention to central, self-perceptive forces which seek to justify, to corroborate and confirm the rightness of the designer's own moral and consequent architectural position. Here, then, is a new or emergent skill with the power to add a valid personal dimension to the discussion - in Vitruvian language - of the 'propriety' of whatever is to be attempted. It is in this way that methods provide a key to knowledge first of ourselves and then of our works.

Robert Fowles's review of the exploration of design methods at Manchester during the 1960's is sympathetic, but might be more finely tuned. The staff initially involved supposed that their efforts were in their students' and thus in their own interests. They slowly evolved a teaching-learning pattern and shouldered their self-imposed tasks: they were not acting upon a general policy decision. It is also misleading to infer that a particular philosophy of history was a point of departure for design teaching in the School. One would like to think that history

now has a growing part in a comprehensive cognitive pattern, but the then most potent, extra-architectural determinant came from the current learning theories of educational psychology.

That first decade was exhilarating - a hard fight in a less than receptive climate. From within it is less easy to assess the effect of the past or of the present use of design methods in the School. Those directly concerned in the study of the architectural process could not fail to benefit, at least in the sense that themselves they felt engaged in a search for fundamentals. The under-graduate schedules of the School now exhibit few signs of developing that way of thinking. Perhaps because the underlying ideas were never sufficiently 'ritualised' and never became a 'norm' for the School as a whole - if those loaded words may be used in a positive sense - even the non-controversial features of procedural thinking have been somewhat eclipsed. Given consistent and persuasive leadership, the balance of opinion among newly recruited staff must be expected to waiver. With frequent changes and uncertainty of direction there is the possibility of devolution. For quite natural reasons, an overwhelming majority of the present staff have no first-hand knowledge of the circumstances and events before, say, 1966. Nevertheless, it is reasonable to think that eclipses are usually of limited duration, and that a respect for design as process persists as a considerable, if yet latent, force.

Thus, in Manchester as elsewhere, the enduring gains of the 1960's, like the hoped-for advances of the 1970's seem characteristically personal and isolated. The insights tend, as it were, to be locked away and held apart. Positive steps must be taken to draw them out. Clear policy decisions of a catalytic kind are now an urgent need.

FURTHER RECOLLECTION

Twenty years ago, by mutual consent, an attempt was made to introduce an orderly approach to design-education at Manchester. It was hoped to provide consistency in teaching and assessment. The aim was corporate stability in the overall turbulence and transitional values of the time. It sought a means to the end of a recognisable post-war architecture, then symbolised by such generic and consistent works as the Hertfordshire Schools and the Royal Festival Hall. Quality products existed: how might their standards be approached in a design-learning process?

There was no doubt that the 'uniformity' of such products was the outcome of choice, of skillful formative judgement in the negotiation of violent cross-currents. For instance, Bauhaus rationalism was abruptly opposed to the narrative, picture-making emotionalism of our native tradition; while vestiges of Beaux Arts formalism ran counter to the no less grandiose but contradictory asymmetries of Constructivism. In the area of philosophy, Professor Gilbert Ryle's investigation of the nature of theoretical Dilemmas had appeared in 1954, and something of its general spirit may have carried into Sir John Summerson's presentation to members of the R.I.B.A. in 1957 of 'The Case for a Theory of Modern Architecture', In brief, education in architecture faced two related questions - namely, was it possible to identify distinct strategies in design? and, assuming that that was practicable, was it feasible to prescribe ways of working through which they might be implemented? Denis Thornley's investigation of such questions was certainly in progress early in 1958.(2) Although independent of those set out in the Summerson paper, his ideas should be considered in their general ambience. Two of Thornley's sub-titles were "Training in Design" and "A Logical Method of Approach to Studio Programmes". His text had a realistic and direct quality: it was a prescriptive response to current didactic uncertainty and lack of resolution, but the study expressly looked ahead to the recognition of architecture as a true academic discipline and so to the longer-term possibility of a change of emphasis from the immediate needs of training to those of education. Indeed, a careful reading of the two appendices to Thornley's article will show that that process was well under way.

The attempt to widen the discussion is, I trust, implicit in the tone of my article, 'A Framework for Design-Learning' of 1966.(3) It was devised " ... to explain the attitude of self-observation and 'self-control' which the course as a whole attempts to promote". The notion of training gave place to more discursive, possibly digressive, procedures and suggested mutually interactive and parallel thinking inherent in the complementary ideas of 'programme' and 'theme'. In this way,it was hoped, method from 'above' would give way to methods from 'below'. Student motivation would spring from a realisation of the advantages of a generally methodical way of working. Thus learning would take-over from teaching, as an educational hurdle was overcome, and the affective consequences of individual intention, attitude, and imagination began to register. Design processes were now less stridently objective as the influence of such works as Rudolf Arnheim's, Art and Visual Perception, available in Britain from 1956, slowly gained acceptance.

Although mentioned here out of chronological order, possibly the most important single event in the history of the Manchester University School was the public exhibition of its work, entitled Education for Architecture, held at the Whitworth Art Gallery in the Autumn of 1961. A leaflet expressed the hope that consistency would be found " ... for instance where the effect of a rationalised design process, as introduced in the Second Year, is progressively revealed ...". First Year work, it may be added, was based largely upon a sequence of linear, planar, and volumetric explorations, while later Years engaged in conventional building-type exercises.

The staff attitudes revealed were a microcosm of the polarised 'two-cultures' debate then being conducted by C.P. Snow and F. R. Leavis. That thought brings to mind the over-riding memory of the early 1960's - in brief, a growing recognition of the need for a complementary and comprehensive philosophy for design-learning. More specifically, it is doubtful if the 1961 exhibition provided real evidence either of consistent development or of Mr. Fowles's more emphatic claim that design methods had " ... influenced the entire curriculum at Manchester". On the other hand, there is little doubt that by the end of the decade something of the procedures taught in the Second Year were being used by students in their later work and, in particular, in the Final Year. The positive methodology which they had explored at a formative level of their course was available. It could be and was employed by those who wished to do so, although no further formal teaching of procedure was attempted.

Comprehensiveness of a kind was offered concurrently by L. Bruce Archer in his series of articles 'Systematic Method for Designers' which began to be published in the magazine Design from April 1963. Although not purposely intended for architects, Archer's material undoubtedly reached and influenced both practitioners and students. The articles were more readily available than the Conference on Design Methods volume, and the majority were published before the book appeared. The subject of design methods was changing rapidly. It was already becoming somewhat partisan.

Space does not allow a review of all the seminal texts of the early 1960's, but that thought-provoking compilation, Christian Norberg-Schulz's Intentions in Architecture (1963) should certainly be mentioned. It attempted to construct a general theory for architecture from a wide academic base. Also published in 1963 was the first edition of the R.I.B.A. Management Handbook. The Handbook included a brief section on the process of design. It was a professional practice and 'official' version, but from the standpoint of education the text may be said to have taken a step backwards, for it failed to acknowledge the parallel programmatic and thematic strands of cognition, the importance of which we have already noted.

The presence of a U.G.C. sponsored Educational Research Project at Manchester during the second-half of the '60's facilitated a programme of team-work with the School of Architecture staff. This produced a number of inter-disciplinary studies. The first of these was published under the title 'The Measurement of Ability in Architecture in The Builder periodical in September, 1965. Reports of other enquiries, including 'An Experimental Investigation of Some Basic Concepts in Architecture' appeared in the International Journal of Educational Science in 1969. Through these and similar topics, psycho-philosophical ideas and concepts were brought closely to bear on architecture and its processes. Examples included J. P. Guilford's taxonomy "The Structure of Intellect Model", and his reminder of the need for a tolerance of ambiguity in creative work. These notions were correlated with our own more introspective conclusions about design methods. Liam Hudson's criticism of Guilford's theories and his own on convergent and divergent production, were also related to design skills and to the question of student selection.

The insights gained from this collaborative work influenced two enterprises of 1966. The first was the article, previously mentioned, 'A Framework for Design-Learning', which offered an updated summary of procedural fundamentals, the consequences of their use, and methods of assessment in the Second Year. The second undertaking was more outgoing and comprehensive - a residential course, Design Procedure in Architectural Practice. Generously supported by enthusiastic practitioners, that course was the first of its kind. It involved two members of the Research Project and seven members of the School of Architecture staff.

ATTRITION, MOTIVATION, AND FURTHER DEVELOPMENT

Robert Fowles is rightly concerned both about the loss of experimental vigour and about the failure to apply design methods in education during the 1970's. Why, for example, did not Manchester make greater us of its formulations of 1963 and 1966? Perhaps they were premature. Perhaps they were misunderstood. Perhaps they succeeded as far as they could without radical modification to the overall course structure. No doubt all these explanations are partially true. But above and beyond these possibilities was and is a continuing problem - in short, the lack of an effective communal language for architecture. With rare exceptions during the 1960's and 1970's there has been an inadequate level of communication not only between those in schools of architecture but also, and more significantly, between architects and other academics. Ten years ago the link subject - design methods and theories - had no 'linguistic' unity. For that reason alone, architecture was unable to establish durable educational alliances: it could not grow. The objectives and potential of the architectural process were neither recognised nor understood. To many outside the field, architecture and its methodology still remains a scholastic mystery, and this predicament has unhelpful results of many and vital kinds.

The effect of the 'boom' in architectural practice must also be mentioned. It was then less obvious, but it is now very clear that by the late 1960's the professional climate had become 'torrid'. In regard to the consequences of the work-load of the period, Sir Leslie Martin has used a contrary metaphor, " ... the floodgates were opened and the situation became disasterous". (4) The architectural profession was, or was becoming, over-employed. Many designers were too extended to give time or thought to the subtleties of method or motivation. Why should they? If egocentricity and intuition were enough,

presumably they would always suffice. But as that attitude gained credence even in education, cracks appeared in the professional edifice. Covert ways of thinking were isolating the designer alike from his client and his fellow professionals. In common with the academic, the practitioner increasingly found himself in need of explicit methods and of the communal language upon which they depend. 'High-rise' became an inexcusable symbol: and a decade has slipped away. Maybe the necessity for an adequate rationale has finally been established. Maybe the theoretical pendulum is swinging back. Hopefully procedural topics will again colour the literature of architecture - more mature and more determinded than before.

But this is too important an issue to leave to chance. The change will be neither automatic nor immediate. Education must ensure that effectively self-critical attitudes are developed and applied in that enriched methodology. As we know, vanity is incompatible with true team-professionalism. Although it is natural for the architect to represent himself as a practical man, he must resist the posture of anti-intellectualism in so doing. His functions as artist and theorist are unique and vital: they do not need to be excused. Among the processes of self-recognition, the corollary linking inhibition and compensation invites study for this is a likely barrier to the further evolution of design methods in architecture. Knowledge of methods, theories, and thinking processes are totally inter-dependent threads in the tapestry of architectural education.

Sufficient of the elementary principles and techniques of design methodology were, I contend, already understood ten years ago. It was the breadth of knowledge and thus the conviction to use them which was lacking. Design hitherto had been about tangible products, whereas design as process involved unfamiliar dimensions of mind. Design as process faltered because the paradox of its intrinsic subjectivity and self-motivation was not grasped. There was inadequate recognition that the essential function of design was a process of confirmation, of demonstrating the morality and propriety of personal choice. The prior test of excellence was therefore in the working of the process. The quality of the product - the old criterion - had become dependent.

When the leadership of a school is conversant with and determined about such issues they can become infused into the whole of its design teaching. This will require an adequate procedural structure, exercises which derive directly from it, and staff deployed to complement eachother in full awareness of the cognitive and motivational principles entailed. With that measure of assurance, the philosophical bases of different people will be reconcilable, and they will be eager to explore new paths.

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DESIGN METHODS AND ARCHITECTURAL THEORY

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Although not previously directly involved in the subject at Manchester the opportunity occurred in 1964 for me to compare a sample of the British and American approaches to the study of architectural design during a six month period in the University of California. At Berkeley at that time the members of staff concerned with design methods included Christopher Alexander, Joseph Esherick, Horst Rittel, and Henry Sanoff, presided over with urbane wit and interest by Charles Moore. Other interested members included Richard Peters, Sym van der Ryn, and Richard Whitaker - indeed the general atmosphere of the school was alive with discussion and debate about the development of design methods.

It was interesting to compare the bases of these discussions with those of the experiments already in progress in my own school. The approach at Manchester took as its starting point the study of the operations which an architect appeared to carry out in producing a design, and the attempts to devise teaching programmes for their improvement have been discussed in papers by Denis Thornley (1) and Derek Buttle(2). The American approach proved to be quite different. Horst Rittel and his colleagues more positively reflected the influence of the new, science-based disciplines of systems analysis, information and decision theory, cybernetics and computer science. They proposed to use the concepts and techniques of those disciplines in the analysis of the design process and the production of designs for buildings. A timely stimulus to the debate was the appearance in the bookshops surrounding the University campus of the first copies of Notes on the Synthesis of Form.(3) This was shortly followed by an impressive series of staff seminars conducted by Horst Rittel, which revealed multi-disciplinary knowledge in depth. Before returning to England I was able to transcribe the tape recordings of these seminars. There was a limited circulation of typescript copies and I have come across commentaries in which they have been referred to from time to time.(4)

On my return to Manchester I became more deeply involved in the study and development of design method. It proved difficult however to combine the American science-based ideas with the pragmatic design teaching of a school still largely based on traditional building-type studies and conventional architectural practice. The Mancunian methodological pragmatism may be seen as having the limitations of a self-justifying system. In the prosperous 1960's the approach was based on what architects did, and what they did was still successful and accepted. There was little need for new concepts and techniques from disciplines with which, in any case, the majority of the staff was unfamiliar. Moreover whilst there was a good deal of money to be made in personal private practice there was little immediate financial return in the development of design methods. During the second half of the decade the Manchester school passed through an unsettling period of having to move from place to place and the design, construction and commissioning of a new Architecture and Planning building was an additional distraction. Amidst these upheavals the cohesive and mutually supporting group of Second Year staff which had pioneered the development of design teaching in Manchester was divided and distributed over several years of the course. Thus separated, their interest and experience failed to bear fruit in neutral environments and momentum, and penetration into the subject was lost. I found myself with an M.A. thesis to complete on an historical topic, unrelated to design method.

The six years from 1964 consequently comprised a disappointingly fallow period in the development of design thinking in the University of Manchester school. But lying fallow implies and permits replenishment and consolidation and whilst the principal design methods course - that of the Second Year - was ticking over it did so against a background of investigative reading in psychology, sociology and philosophy by the staff concerned. Moreover the monitoring and appraisal of the many relevant publications, conferences and symposia was itself an important and time-consuming task. One way and another there was a good deal going on beneath the surface.

In the teaching programme of the Second Year a significant division gradually came to be made, that between "Dimensions of Architectural Thought" and "Processes of Architectural Action", to use the course titles of the time. The former lectures dealing with the nature of the academic disciplines associated with architecture and their potential contribution were presented by Derek Buttle; the latter, dealing with strategy and methods in design, by myself. Regrettably the only tangible evidence of our speculative thinking during this period is a set of internal memoranda and course content synopses which remain unpublicised. The question "What is Manchester doing?" was often asked, but went unanswered. It can now be seen that design methods were maturing.

A further three years of virtual non-direction were to pass before two events occurred which "broke the ice" and encouraged and made possible a significant expansion. The first was the installation of a new Director who preferred to centre the school around excellence in architectural design rather than around architectural history or day-to-day architectural practice. The approach was of an artistic and intuitive kind at the expense of the more academic and intellectual procedural studies - which were initially largely eliminated - but the general intention was ultimately helpful. The second change was the replacement of the 4 year/1 year degree course pattern by the 3 year/2 year structure common to most British schools.

The latter was particularly important because the design theory and method studies of the Second Year had hitherto been given little didactic, intellectual development in the later years of the previous course. For example, the Fourth Year "Theory of Architecture" course was optional, not examined and consequently not of high status. The pressures of pseudo-professionalism which characterised a final "year" of only eight months allowed deeper considerations of design theory and method to go by default. There was a shortage of time and, as usual, of theoretically informed staff. It was clearly less easy to ignore the issues in a second degree course extending over two years. There was thus the challenge and the opportunity of developing the earlier theory and method teaching to the advanced levels which it had previously lacked. A theoretical continuum now required to be formulated.

In setting out the more advanced, second degree teaching programme which was to begin in 1977 there emerged, I believe, a change of emphasis from design methods as such to a need for architectural theory in a more comprehensive sense.

From 1960 to perhaps as late as 1974 most questions of architectural theory had been generally interpreted as questions of method. Indications of the limitations of this view emerged first in the U.S.A. as the thinking of Horst Rittel(5) and Melvin Webber(6) amongst others found written expression.(7) The application of the new, broader concepts in design led into politics, political theory and ultimately philosophy. The hierarchical structure of professional/political activity became evident and exposed the limited range of influence of architects when working as architects. For example, to attempt to change the British Housing Cost Yardstick system which has almost eliminated quality in housing(8) would involve architects in activities of a political rather than an architectural nature.

The conceptualisation by Horst Rittel of "wicked problems"(9) of this kind made it plain that many architectural design problems could not be solved at an architectural level. Some broader theoretic framework capable of relating architecture to other areas of disciplinary activity was becoming necessary. More than a decade of emphasis on design methods seemed to have ignored the essential complement of basic architectural theory. It had become imperative to remember the principle that the two are unavoidably complementary for theory needs method in the testing of its hypotheses whilst method demand theory on which to base its modes of activity.

In developing this theme the pendulum of interest seemed to me to have swung away from those science-based disciplines which had provided the initial stimulus to American thinking, and back towards the traditional disciplines which most earlier theorists had neglected. In a review of the nature and possibilities of a theory of architecture the philosophy, the concepts and the relationships between history, economics, and politics, and the nature of philosophy itself again became central considerations. It became evident that the "Theory of Design" and "Design Methods" as areas of study had been explored, surveyed, mapped and virtually worked out: their future development lay in other directions. It was thought to be desirable to separate the treatment of the theory of architecture seen as a subject discipline from the theory and method of architectural design seen as an activity. Such distinctions inevitably overlap but it had become educationally useful to keep apart the extensive literature concerning design and design methods in architecture from that relating to its philosophical study.

The redefinition of architecture thus became a primary issue in formulating a syllabus concerned with a consistent basic theory. Many questions have presented themselves:

If we believe that architecture ought to be a discipline which is comparable with others, what then does this imply? What is the nature of an academic, intellectual discipline? Is architecture in fact a discipline, and if so what is its subject matter? Or are we, as Sir Karl Popper has argued(10), not students of disciplines but of problems? It seemed to me to be important to correlate the philosophies of science, technology and art if a valid philosophical theory of architecture was to be discussed.

The group of lectures, reading assignments and course work currently presented under the title of "Theory of Architecture" develops these themes and comprises the first of the two teaching elements which deal with theory and method in the second degree course.

The second element comprises a longer, formative "Option" in "Design Theory and Method", offered as one of a series of specialisms extending over the greater part of the two years of the second degree. In deciding the content of this Option it seemed to me to be important to bear in mind that most of the findings of the previous decade of studies in design methods would be likely to be introduced to the students earlier in the course. This in turn seemed to imply some kind of differentiation at the advanced level - a small number of related issues capable of being studied in some depth in the time available. Consequently four key aspects of the development of design theory and method have been selected and represent my own views about the most useful further cultivation of the field for students at this level.

Details of these current elements follow. It is not possible yet to assess their impact or value, and the all-embracing nature of theory in respect of other aspects of architecture deserves further recognition and integration with other Options. Expansion into an M.A. programme with associated publications and experimental buildings is something we expect to be able to provide in the future. Comments and suggestions from educators and designers are always welcomed. It is firmly believed that these kinds of developments are essential if Architecture is to continue as an effective, formative discipline.

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Appendix 'A'

"THEORY OF ARCHITECTURE" Course:
10 lectures plus course work: Fifth Year.

DETAILED SYLLABUS.

The differing historical frameworks for human knowledge in the ancient, medieval and post-renaissance worlds; intellectual disciplines, their criteria and grouping; institutionalisation in the modern university; the key categories of the natural sciences, the social sciences and the humanities; the associated worlds of art, and technology; the differing aims and natures of these primary areas of thought and action.

The emergence of new disciplines, and interstitial disciplines; some alternative orderings in terms of problems, and in terms of the 'natural' and 'artificial' worlds;

the problem of the location of architecture within these ordering categories; architecture defined as a subject discipline, as a set of problems, or as an activity.

Theory: its etymological origins; some definitions: the broad and narrow senses of the term. The differing roles, nature and methods of theory in the natural and social sciences, and in the humanities; their degree of precision and practical validity.

Method: in general - how might we go about things; rationalism, empiricism, and experience; deductive, inductive and hypothetico-deductive systems; the debate over the unity of method in the natural and social sciences; is there a general architectural method? Some positivist and relativist views. Method in particular: strategies and tactics in analytic and creative processes.

Structure: the etymology of the term, and its modern developments; structure as a product, and as constitutive internal relations; relations and relationships; other distinctions between form and content, and between functions and processes; some critiques of the concept despite its fruitfulness; its overlap with 'system'; some generic organising structures and their relevance to a possible architectural theoretic structure.

Concepts: their nature and definition; origins, and formulation; the roles of analogy, metaphor and imagery; the possession of concepts leading to the ability to generalise; the function of concepts in theory; conceptual schemes and constructs; some primary organising concepts in architecture; examples of secondary organising concepts in architectural design.

Footnote
An extended description of this course, including reading lists and course work exercises was presented to the Design Research Society/Technical University of Istanbul Conference in May, 1978 in the paper The Teaching of Architectural Theory to be published in the conference proceedings. Xerox copies are meanwhile available from the author.

Appendix 'B'

"DESIGN THEORY AND METHOD" Option:
Five terms over two sessions: Fifth & Sixth Years.

OBJECTIVES AND CONTENT.

The experimental studies in this Option emphasise the nature and context of design and designing. Processes in design and the methods by which we seek solutions to design problems are exemplified and tested in particular situations. The aim is to explore a range of issues and techniques - for analysing problems, developing solutions and using advanced graphics and other models within an overall framework which can be shown to be valid in professional and academic terms.

The first session consists of an examination of the theoretic background to four key aspects of architectural design theory and method:

1. Further studies in design methods related to an actual problem:
   Aspects of Briefing, Programming and the Assessment of Feasibility; the General Study of the problem, and the generation and reduction of variety; design themes and concepts; the use of analogy and metaphor; psychological studies of creativity and some operational techniques; the nature and art of problem-solving; (Four weeks).

2. Architectural criticism and the problem of value:
   A survey of current architectural criticism and critics; the nature of criticism and the function of the critic; some problems in architecture; the concept of quality and the nature of value-judgements. (Two weeks).

3. An introduction to computer-aided design:
   Historical background; general principles; the University's Regional Computer Centre, its services and facilities; applications software; issues in architectural computing; practical experiments. (Two weeks).

4. An introduction to architectural research:
   Definitions; the organisation of architectural and building research in the U.K.; public and private sectors; knowledge and design; stages in a typical research project and practical examples. (Two weeks).

The second session makes possible a wide range of professional and experimental projects. In the context of normal architectural activity many of the aspects of the design process introduced earlier may be studied and tested further in relation to problems for real clients. There are particular opportunities in "Buildings for Industry" and the architectural task of creating a work-place which enhances human labour no matter how uncongenial the circumstances.

Less conventional aspects of design theory and method offer possibilities for study and publication, for example:

a. The study of a particular architectural

type, based on its formal and non-formal characteristics, used as an introduction to architectural systematics and the design - in general terms - of an actual example.

b. The study of the description and modelling of industrial and other processes as a basis for industrial design.

c. A study of the concepts used in architectural competitions, linked to the generation and handling of concepts in an actual competition.

d. The study of the concept of 'innovation' and its occurrence in architectural design and construction, linked to the deliberate seeking for innovative ideas in an actual design project.

e. The use of film to demonstrate the progress of a design and the graphic and mathematical models used in designing.

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Harris, James B. "Designing the Future Foundry: academic/industrial collaboration". The British Foundryman, Vol. 70, Part 5, May, 1977. pp. 136-145.

DESIGN METHODS AT THE PORTSMOUTH SCHOOL OF ARCHITECTURE

Geoffrey Broadbent

Portsmouth's reputation as a Design Method school dates back to the Symposium of December 1967; Geoffrey Broadbent had taken over as Head of School and when Tony Ward arrived as Research Fellow in Design Methods on 1st October of that year, the latter suggested that, rather than surveying the literature, he should bring "the literature" - or rather its authors - to Portsmouth to present their latest views. The results, of course were published as Broadbent and Ward, Design Methods in Architecture, (1968).

So Design Methods have been on the syllabus since 1967, and like most subjects in the School of Architecture, they are presented as a combination of lectures, discussions, design projects and written work. Yet there has never been any suggestion of the Portsmouth method, to be used by all students, for all projects. Our philosophy always has been: "You may be a brilliant designer, with no need whatever for formalised design methods. If that is so, then good, but most designers get stuck from time to time. If you do, then you may find these interesting and useful."

Lectures and Discussions

The formal courses on Design Methods are presented in lecture courses by Geoffrey Broadbent to First and Second Years. Syllabuses read as follows:

Year 1 : Architectural Communications To acquaint students with the importance of good communications in architecture, with reference to perception studies and information studies in psychology. Communications media in architecture and their effects on design: drawings, models, written and oral communications. Coding and classification, data storage, retrieval and the use of information services.

Year 2 : Design Methods An introduction to systematic design methods; analytical and creative techniques, concepts of briefing, analysis, synthesis, evaluation and implementation, relationship of design in architecture to design in other fields.

To describe the relevance of systems analysis, operational research, ergonomics, computing, information theory, cybernetics, and the new mathematics as sources of design methodology; to review the literature of design methods; to trace the development of environmental design processes; the conjectures and refutations approach.

Design Method concepts also come into a number of other lecture courses, including:

Year 1

Environmental Science	
Movement Systems	D. Parham
Building Elements	P. Stewart
Philosophy	T. Llorens
Psychology	R. Mathews

Year 2

Systems Designs	B. Russell
Design Theory	D. Ottewill
Form and Function in Architecture	M. Trpkovic

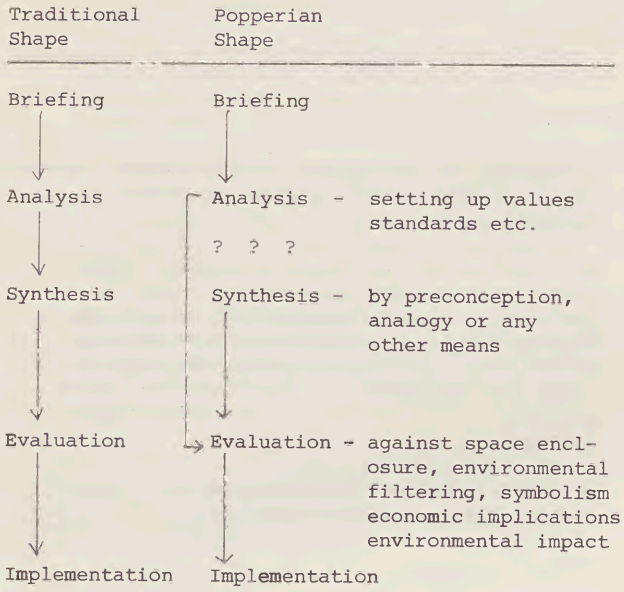
And certain optional courses in the Fifth Year, notably Barry Russell's Systems Theory.

The original lecture presentation has been somewhat condensed since the publication in 1973 of Geoffrey Broadbent's Design in Architecture; students are expected to read up the detail for themselves, but more recent material as outlined in Geoffrey Broadbent's review paper (also published in this issue) is presented in lectures and discussed. This new material draws very heavily on Karl Popper's method of Conjectures and Refutations - an approach which clarifies a great many problems both in design and, more specifically, design education.

Design is seen as a matter of generating ideas and then testing them, modifying and improving where necessary. So, design education becomes a matter of learning how to generate ideas and

learning how to test them, thus solving a lot of problems as to the shape of the design process itself.

DESIGN PROCESS



This Popperian shape, of course, admits the practical facts of design education in which students generate design syntheses which fellow students and staff then attempt to refute.

The examinations for lecture courses in these areas normally consist of open-book essays, to be written over a period of weeks. In such essays, students typically will be asked to relate the concepts of Design Method as discussed in the lectures to their own design practice in the studios. Most students find - under these circumstances - that real and useful links between theory and practice have been formed, although these may not have been apparent without the use of the examination itself as a teaching/learning device.

Project Work The project work for each year of the course is co-ordinated by a mixed group of staff, including architect(s), design scientist(s) and other specialists, such as historians, artists and others with an interest in the general context of design. The general aims are stated within the preamble to the course:

As far as possible projects are related in content and timing to the relevant theory, design science and context studies. Specialists from these fields take part in project planning, studio tutorials and reviews of finished work, whenever this is appropriate.

First Year Project Work: Project work in the first term encourages the development of graphics and model-making skills; this is followed by anthropometric and ergonomic studies, related analysis - subjective and objective - of buildings in use; analysis of historic buildings in terms of planning and elementary design, etc; the effects of materials construction and environmental control requirements on space enclosed in simple building designs.

Second Year Project Work: In general the aim in Year Two is to provide students with closer understanding of all the specialist subjects in the curriculum by projects which give emphasis to these, with the expectation of achieving a general working knowledge and a satisfactory level of competence in a limited range of special aspects.

Third Year Project Work: In the first two terms of the third year particular consideration is given to the building fabric in detail as well as to the problems involved in the design of groups of buildings, as in housing. In the final term of the degree course, the objective is to develop further and to round-off the preceding year's design work by requiring the student to acquire and demonstrate an adequate understanding of all the factors involved in a building of moderate complexity and size.

Within these general aims, individual staff have developed a number of projects with a specific Design Method content. The most successful, curiously enough, are based on certain concepts from Design in Architecture where Geoffrey Broadbent describes four Types of Design:

Pragmatic Design in which the materials of construction (at real or model scale) help determine the form by trial and error.

Typologic (formerly Iconic) Design in which the designer draws on an established type.

Analogic Design in which the designer draws visual or other analogies - in the matter of synectics from outside his problem to form the solution.

Canonic (Geometric) Design in which the designer uses two or three-dimensional geometric systems in the generation of form.

Actual projects usually include:

Year 1 : Building Appraisal (R. Day) In which students decide for themselves, through their own analyses of existing buildings, just what criteria will be appropriate in building evaluation generally.

Year 2 : Formal Organisation (M. Trpkovic, D. Ottewill) A project which combines a Popperian (Conjectures and Refutations) approach to design method with Canonic Design as described

above. Each student starts with a design conjecture - usually for an Exhibition Pavilion. This is then modified, week by week, against a series of geometric concepts which include planning by route and zoning, dominance, division, clustering, contrast, planning about a point, a line or a geometric system, scale, proportion and so on. Each of these is introduced by slide lectures (G. Broadbent) and once students have understood them, they analyse examples of their use in existing architecture, then modify their own designs accordingly. Thus each student generates some 40 to 50 possible solutions to the problem (design conjectures) and is helped to use appropriate criteria from Building Appraisal (design refutations) in choosing the best. Every student has at least one good one - which is a tremendous psychological benefit at the beginning of a career in design, whilst by its very nature, geometric design needs very little previous experience or understanding of architecture; it is therefore the most appropriate for First Year students.

Year 2 : Pragmatic Design (H. Klaentschi) The form-generation in this case is building construction, taking from Design in Architecture the idea that four, fundamentally different types of construction are available:

Mass Construction:	that is pyramid-like construction in solid masonry, brick, concrete, etc..
Plate Construction:	in flat or curved plates of stone, brick, concrete, timber, etc., to form walls, floors, vaults, partitions, etc..
Frame Construction:	in timber, steel or concrete.
Skin Construction:	forming inflatable or suspension structures.

The project in this case is at the scale of a house, play school etc., and each student chooses, or is allocated, one of the constructional types which, considered for its supporting, space-separating and environmental control properties (or lack of them) forces the generation of varied forms, which can then be compared against suitable evaluation criteria. This project, of course, presupposes that by Second Year, the students will have acquired a basic knowledge of how various kinds of structures work and in a good year, this generates the most amazing variety of design-types.

Year 2 : Pragmatic Design 2 (H. Klaentschi) The exercise in constructional pragmatics has been followed up by some equally successful exercises in practical construction. In one case (1974/75) students build half a boat to full size in the studio, with all furniture and fittings in place and in another (1977/78) they built the living spaces of a two-storey house within a building shell that was due for demolition.

Year 3 : Typologic Design (R. Khalid, C. Abel) This has been run in several forms, but in a typical case, students will choose an individual architect, study his work over, say a ten year period, in great detail and once they have understood his working methods, use these to design, usually a house, to a brief determined by their tutors. Having worked say "in the manner of" Frank Lloyd Wright or Le Corbusier, some students continue in the style for several projects, whilst others react immediately against it. In either case, the project proves to be of considerable educational value and its implications have been analysed in an M.Phil study by M. Sempere.

From all this it should be apparent that Design Methods are alive and well in Portsmouth within a specific Popperian orientation which has all kinds of further implications for the full involvement of a multi-disciplinary staff, for example, in community participation (that is, community refutations of students' conjectures) and many other things, for which there is no space here.

METHODS AND MODELS: ALIVE AND WELL AT STRATHCLYDE

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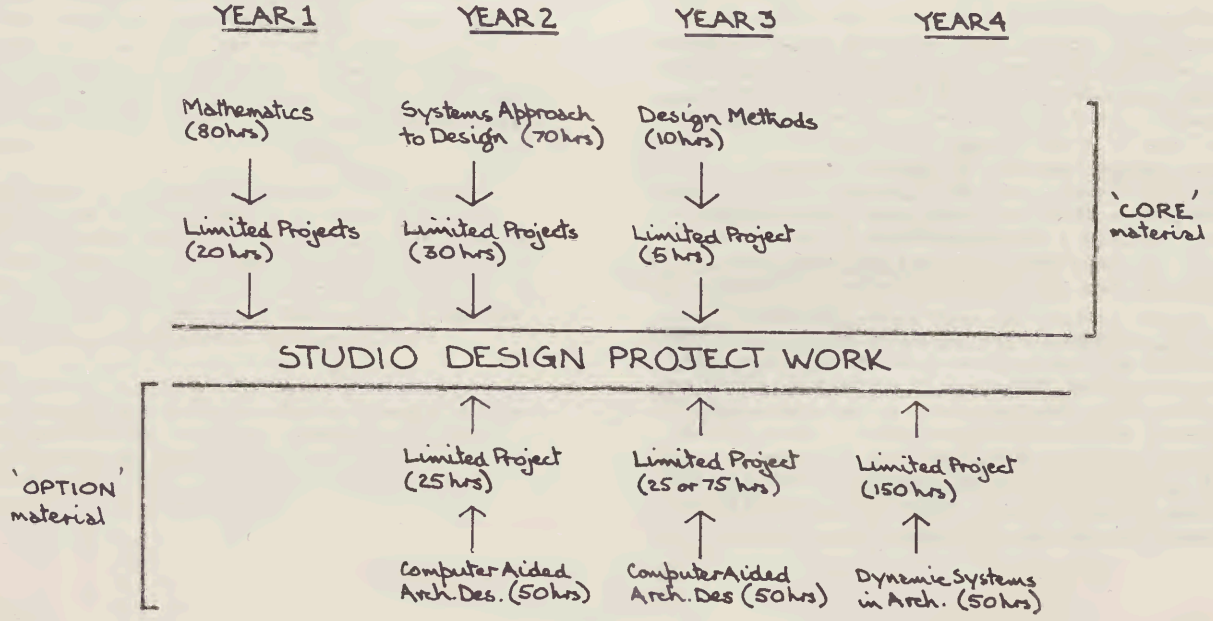
1. INTRODUCTION

Students currently in Schools of Architecture will be at the peak of their careers around the year 2000. The pressure on the Schools to provide an education and training which will stand the student in good stead between now and then is considerable. In the Department of Architecture and Building Science at the University of Strathclyde, importance is placed, within the course, on the concept of modelling: i.e. the development and use of models of the operational behaviour and aesthetic character of design proposals which will allow prediction of how real building will perform in the real world. The belief - supported by a growing quantity and quality of evidence - is that access to and use of explicit models of the future built reality promotes:

a) retention of studio project work as the core synthesis discipline within the educational environment.
b) an appropriate degree of independence from the prevailing corpus of factual - but highly perishable - information on materials, constructional detail, etc., and
c) a focussing of attention on the value judgements (and hence the morality) which always have - and properly always will - pervade architectural design decision-making.

2. COURSE STRUCTURE

Strathclyde operates a 4 year/1 year pattern of studies. The first 4 year period of continuous study results in an honours BSc degree; within the first three years of the BSc course the vast bulk of the core material required to satisfy Part 1 of the RIBA requirements is covered, leaving in the fourth year, the opportunity to take a selection of topics to an advanced level. A year out, in practice or in research, completes the requirement for entry to the 1 year BArch course.



The education activities which relate to design methodology are structured as shown in Fig. 1. It will be seen that the intention is to effect an integration of formally taught material whether 'core' or 'optional' into Design Project Work via sets of carefully constructed Limited Projects.

3. COURSE CONTENT

3.1 'Core' Content

All students entering the Department are required to have an 'A-level' (GCE) or an 'H-level' (SCE) qualification in Mathematics. The first year mathematics course of 100 hours, which builds on the entry qualification, is taught by mathematicians to a unique syllabus specified some 3 years ago by the Department of Architecture. This syllabus which replaced the standard maths course offered to technology students throughout the University, is intended to expose the 'structure' of the mathematical theory which forms the basis of the topics relevant to architectural design. The topics include Boolean Algebra (sets, dendograms, etc.); Probability Theory; Finite Markov Chains; Matrix Algebra; Linear Equations; Affine Mapping; Perspective Geometry; Graphs and Networks; and, of course, Calculus. Occasional lectures and half-day projects are contributed by members of the staff of the Architectural Department (3 have dual architectural/mathematical qualifications) to illustrate the applicability of the theory.

The issue of applicability of the mathematical theory to modelling in design decision-making is rigorously developed in a 100-hour 2nd year course 'Systems Approach to Design Decision-Making'. Organized around a set of 10 Limited Projects, each occupying a half-day, the instruction material covers System Concepts; Graph & Network Theory applied to layout generation; Probability Density Functions applied to facility provision; Economics applied to cost-benefit and cost-effectiveness; Combinatorial Programming applied to location/allocation and distribution networks; Markov Chains applied to accommodation provision; Simulation applied to movement studies; and Significance Testing applied to model validation.

The 10 half-day projects in the Systems Approach course are all limited objective design exercises, mostly computer-based: for example students are required, in one such Limited Project, to arrive at a balanced and economic level of provision of facilities in a Ferry Terminal by iteratively simulating the flow of passengers and vehicles through the terminal complex.

In third year a shorter (10 hours) course on Design Methodology orientates the student away from the mathematically based methods which tend to be drawn from other disciplines, towards the increasing repertoire of 'home-grown' methods and models which are altogether more heuristic, pragmatic and multi-variate. The course is structured in terms of the Objective System (- the planning phase), Variety Development (- the synthesis phase) and Variety Reduction (- the appraisal phase). Case examples are used to assess the applicability of each method.

The pass rate in these three core subjects is high - 80% and over. This figure compares favourably with other subjects in the curriculum and compares very favourably with the 50-60% pass rate which prevailed when the standard, but no more rigorous, 1st year maths course for Technology students formed part of the curriculum.

3.2 Option Content

In 2nd and 3rd year the core material is supplemented by 75 hours of option time. The option most closely related to design methodology is Computer Aided Architectural Design.

The CAAD option, taken first time round, is divided into three sections:

a) A set of lectures describing the nature of the design decision-making activity, including details of some of the processes and techniques involved. Where it is possible the processes or techniques are described with reference to the computer and indeed in most cases programs exist which are described and/or demonstrated to the students.

   Since a major part of both design decision-making and computer-aided architectural design is concerned with the objective appraisal of design alternatives a fair proportion of these lecture/demonstrations are devoted to it.

b) A set of lectures, prepared from past experience, in teaching programming, has been produced using a simple sub-set of FORTRAN IV. This subset which has been produced for three computers (GE415, NOVA 820, UNIVAC 1108), contains sufficient information to allow a student to begin writing elementary programs without any other reference. Included is a set of exercises with possible answers.

c) A Limited Project in which the student is required to identify a methodology appropriate to some sub-problem of architectural design, set down the logical sequence for implementation of the methodology, and write, compile and debug a program which other students may easily use.

Students opting for the CAAD option in the subsequent year devote the full 75 hours to a more ambitious Limited Project around which instructional and tutorial sessions are arranged. Outcomes from the project work make a significant contribution to the repertoire of programs available to the student body. These include:

a) program for determining the minimum cost strategy for stepping and staggering terrace housing on a contoured site.

b) program for automatic scaling of computer-generated perspectives to fit photo-montage prints.

The 4th year of the BSc course consists largely of options with students selecting three honours level subjects from the ten on offer. Methodology and modelling is the theme of one of the subjects offered - Dynamic Systems in Architecture. Dynamic models relevant to the flow of materials, the flow of energy and the flow of information are discussed and tested in this subject and, if they so elect, students may proceed to a 5-week project within which they themselves construct a dynamic model of some building sub-system. A recent example of the outcome of a 5-week project was a computer-based method of movement simulation applicable to evacuation of a building following the outbreak of fire.

4. DESIGN APPLICATION

The acid test of the 'core' and 'option' inputs to the course is the degree to which students are motivated to draw on them in the Design Studio. Increasingly in the 4 year BSc course and the 1 year BArch course students at Strathclyde take advantage of the variety of design methods known to them. Advantageously, the majority of these methods are embodied in computer software which is readily accessible to the student body via a number of interactive graphical terminals sited within the Department.

It is increasingly common for students at all stages in the course to use the computer facilities as they might use their drawing board or the Information Room; the difference is that the facility is not simply a device, like the drawing board, or a knowledge base, like the Information Room. It represents, rather, access to design methods which allow exploration of, and insight into, the causal relationships between the design variables over which the student has control and the performance variables which will characterise the product.

Worth detailing, perhaps, is the recent experience of making Design Method the central theme in one of the BSc final year studio design projects. The project extends over five weeks and must culminate in a set of design drawings for a small hotel. The stages in the project are as follows:

1. Analysis:

   Conventionally, in a project of this scope and scale, the brief issued to students would include a definitive schedule of accommodation. In this case, however, students were not provided with an accommodation schedule but with basic data on the unit areas of the various functional spaces within the hotel - single bedrooms, double bedrooms, function suite, restaurant, grill and lounge bar - together with the tariff structure, unit profitability and a probabalistic statement on occupancy at different seasons of the year. Additional data covered square metre costs for construction, rates and maintenance, administration and heat, light and power.

   Using a specially devised program known as INVEST - based on a linear programming algorithm - students were able to establish that schedule of accommodation which maximised profit, subject to a set of administrative and planning constraints expressed in the brief. The program output included not just the optimum schedule but the corresponding generalized figures for capital and running costs. These costings thus formed 'targets' to be met in the design.

   As the occupancy data provided was probabalistic and seasonally dependent, each studnet, by the end of the first week of the project had to submit to the client (i.e. to the tutors) a proposed schedule argued on the basis of the analysis procedure. Over the weekend the tutors considered the submissions and agreed a common brief for all students.

2. Synthesis:

   Armed with an accommodation schedule and 'target' costs the students were given a week to generate, by conventional means, one or more 'outline proposals' as to the form of the hotel.

3. Appraisal:

   The computer program SP3HOTEL is an integrated appraisal model intended for use at the Outline Proposals/Scheme Design stages. Students were able to input their design hypotheses by digitizing their layout drawings and by choosing from a file of constructional elements. The output from the program provided a check of

accommodation areas, predictions of environmental conditions and a prediction of how any particular scheme compared, in capital and running costs, with the 'target' figures of the brief.

Typically, students would interactively explore alternative geometries using a standard construction then begin to 'fine-tune' the scheme in terms of constructional decisions.

It was also possible to automatically produce perspective views of any scheme, using the program BIBLE, at a scale appropriate for immediate photo-montage on photographic prints of the site.

Submissions had to include the conventional plans and elevations and a clear account of the process of search and trade-offs which had led to the final scheme. Conclusions drawn by the tutors from the presentation and debrief sessions were as follows:

a) deploying a methodology to generate a functionally appropriate brief (in this case one based on maximum profitability subject to planning and administrative constraints), rather than accepting one 'ready made', greatly increased the students' motivation to meet the brief requirements.

b) ready access to an interative appraisal methodology motivated almost all students to explore a wider range of alternatives than would otherwise have been the case.

c) different students benefited from the rigour of the methodology in different ways: those considered 'weak' in design started with a mundane scheme which was close to the requirements of the brief and then used the appraisal program to become progressively more innovative within the envelope of feasibility; those considered 'articulate' in design started with an innovative scheme which broke the requirements of the brief and then 'tightened up' to meet the brief while preserving the innovative concepts.

d) the outcome, in all but one case, was a 'better' design than would have been expected from a conventional project. The single exception was a student openly hostile to any form of design methodology.

5. TEACHING PACKAGE

The CAAD aspects of the Strathclyde course have now been put into a teaching package which can be acquired by other schools. The main feature of the package, which includes lecture and project material, is a piece of software known as PIGLET (Package for Interactive Graphics Layout Evaluation in Teaching). The user graphically inputs the plan form of a building; PIGLET 'interprets' the form by taking off all the fundamental geometrical measures which are then stored in a strictly pre-arranged order in a file (Figures 2 and 3). The data in this file can be accessed by a 'CALL' from any applications routine devised by the user. Consequently, students can be encouraged to devise a method for predicting, say, daylight levels and to write into their sub-routine the appropriate calls to the geometry file. Thereafter any plan-

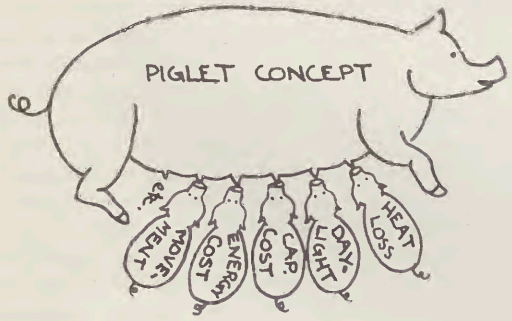


FIGURE 2

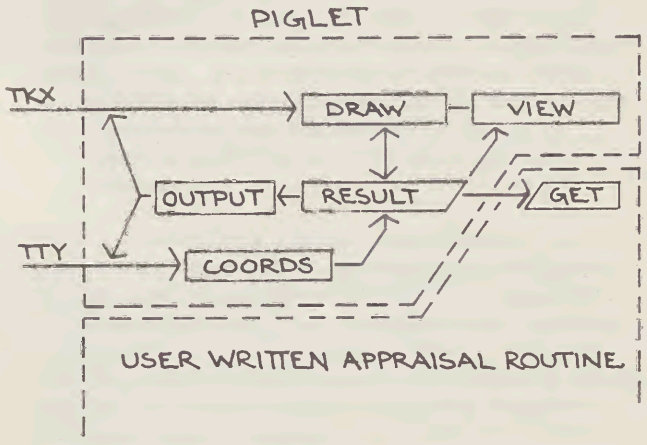


FIGURE 3

form and any exploratory variations of it proposed by the user can be appraised in terms of daylight levels. In this way, using PIGLET as the armature, an increasingly comprehensive and integrated appraisal package can be constructed.

6. CONCLUDING REMARKS

In response to Bob Fowles question, 'Whatever happened to Design Methods in architectural education', the Strathclyde answer would be: 'They are alive, well and living in the cores of an increasing number of computers. It is my view that the future credibility and survival of the architectural profession will depend in large measure on familiarity with, access to and development of computer based design methods. It is vital therefore to introduce the concepts and practice in Schools of Architecture; this has been possible at Strathclyde only through the committment, ability and vision of a large number of research workers and teaching staff whose contribution I gratefully acknowledge.

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ARCHITECTURE IS NOT A DEGREE GAME, OR NEVER MIND THE BALL, LET'S GET ON WITH THE GAME

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Mackintosh School of Architecture

The rosy view of the future of design methods & procedures held in the 50s and 60s by the practitioners and advocates of the discipline (so many of whom, themselves, were so soon to abandon it) related to the then current attitudes to and in architectural education; the belief that it should become academically respectable, scientific, research orientated, that it should occur ideally in a University, and provide prospective graduates with an 'education' rather than training, which was a sort of ungentlemanly activity found in Art Schools and Technical Colleges and such like places.

The products of Schools of Architecture during those decades became graduate students, the better of whom went on to be post-graduate students, and the best, of course, remained in the educational system as doctoral students pursuing further studies (research) eventually to be established in a tenured teaching position. Emphasis in the system shifted from the product, a neophyte architect trained in the skill of architectural design, knowledgeable about building and buildings, habituated to the idea of a professional calling; to the process, education, to an idea of academic study, and a role habituation related to educational mores.

The nature of the teaching altered also, curricula were composed of a number of discrete subjects believed to be susceptible to 'academic discipline' - equated in almost every case with 'scientific rigour', and similarly expected to yield topics of 'research' capable of being studied in the educational establishment, resulting in a proliferation of expertise; practitioners of each area of study seeking to advance their special knowledge as a legitimate function of academic activity, each claiming the right to examine the student at a 'proper' level of academic achievement and, incidentally, also to fail him, even should his achievement in the studio area of study be of a high order.

Diagnosis of process was substituted for exercise in skill in a belief that from such diagnosis would come a formula for a solution which would unite programmatic needs, with operational techniques, to produce an appropriate form.

The overweening interest in process, in means and not ends, could have had a totally destructive effect had not the raw material, the students, persisted in remaining interested in architecture, and the problems it could solve, and in becoming architects and designing buildings.

Practitioners, engaged in grappling with live and relevant problems of exacting demand were alienated by the School's seeming disregard for the traditions and accumulated knowledge vested in their professional status as architects.

The breach between the schools and the profession and the mutual distrust between students and practitioners were the consequence of differing habituation and expectations, not necessarily related either to the more, to the Universities or the desire for a proper academic study of architecture.

There was a failure to understand that architecture as an old and evolved discipline, like law or medicine, has its own rules and its own body of precedent, knowledge arranged in relation to its modus operandi, knowledge susceptible to study on its own terms; as a mode of order, architecture embodies concepts deeply rooted in human existential needs, and architectural studies must necessarily be concerned primarily with values and rationalisations not normally subject to quantitative analysis or discrete fragmented examination.

The comparatively simple environmental pressures which operate on building allow solutions largely determined by social choice rather than by parameters of force of engineering, making both the deterministic applications of building science and the employment of the limiting design method appropriate to the relatively constant forces present in engineering solutions, inadequate as generators of building forms and architectural solutions.

In particular, the emphasis on mathematical modelling popular in both cases was unfortunate in that such models are designed to reduce complexity and aim at simplification while much architec-

tural activity aims, as in art, at generating a richness of interpretations, not necessarily rationally connected, i.e., science tends towards the general, art (and architecture) towards the specific.

Mathematics has always played a part in architecture, but architects, traditionally and sensibly, have been interested in both its qualitative and its quantitative attributes, i.e., the magic and the utility of number, number as a potent abstract link between the order of man's built environment and the ordering of the universe, a notion easily lost sight of, in an era which utilizes number largely as a tool of bureaucratic administration or industrial consumption.

But perhaps the greatest mistake was the failure to recognise the primary need for highly developed visual sensitivity and considerable manual dexterity in the belief that the creation of form and the ability to draw were not 'proper' academic subjects; studio work, the central activity in every school of architecture was concealed, or justified, in the obscurantist jargon, believed to be appropriate to university regulations, and serious attempts were made to derive and justify architectural form by analysis of non form programmatic sources based on misplaced ideas of scientific rigour.

Finally, the need for holism in architectural study was not appreciated. Architectural design, the central discipline in almost all courses calls for the simultaneous consideration of a hierarchy of social and technical factors, and is often a balance of logical but conflicting demands. It is frequently conditioned by knowledge of and liking for particular formal precedents, design proceeding as a modification of a recognised stereotype.

It is in this context that Design Method as adopted from engineering sources proved oversimple.

The foregoing description of the context in which design method initially developed, suggests that in the desire to upgrade the academic respectability and quality of architectural education, the nature of vocational education was misunderstood, and inappropriate educational models were used in the profession, and the profession's and students' expectations were disappointed.

In retrospect, certain basic needs can be seen to have been of much more significance than realized at that time, particularly in the school situation.

The need for a goal orientated education and in particular, for training, in a vocational subject like architecture.

The need for involvement in 'real world' problems as a means of motivating learning and the development of skills.

The need for a holistic approach to architectural studies.

The basic need to re-establish the centrality of architectural design with its concomitant need for visual sensibility and manual skill; qualities recognised as fundamental requirements in the student, and the recognition of the authenticity and relevance of existing professional mores as well as of the need for change.

The need to develop appropriate methods of teaching and learning, to facilitate development of skills, judgement and the power of invention, as well as the growth of knowledge.

These needs suggest the continuing necessity for the best architects in practice to be involved creatively in education, for the selection of students and staff with a scientific and an artistic bias, for the work in the schools to be addressed to the central issues and problems in our society today as they affect the environment, and as they can allow the architect to make a meaningful contribution to the welfare and pleasure of life of his society; a contribution which students will be motivated to share, in the expectation of a worthwhile lifestyle.

The following quotations indicate that even in the 50s and 60s a wider awareness of these needs existed in the educational community.

'....the school should be a miniature workshop and a miniature community; it should teach through practice, and through trial and error, the arts and disciplines necessary for economic and social order.'

John Dewey, American Educator, 1958

'I assume at the outset that training can mean education. I assume that the process of architectural education should entail a stretching of the mind and an enlargement of experience through the exercise of intelligence and judgement in the solution of problems.....What I am suggesting is that the education should be directed towards a more concrete end. That end should not be an abstraction - such as the ideal concept of 'the architect' - but the common solution of that problem (the power to control the form of our environment) in which all architects should feel themselves virtually involved.'

Leslie Martin, British Architect & Educator, 1964.

Design Method in Context
Method Teaching in the Mackintosh
School of Architecture

Having outlined a personal view of the educational climate of the last two decades, which seeks to shed light on the growth and the failure to flower of design method, as a major curricular influence, the following account of the recent restructuring of the MSA course, hopefully, will suggest that nevertheless, design method has and can fertilize current developments in teaching, although it may not appear as an overt examinable subject or discrete discipline.

After a period of experimentation following the adoption of a Degree and Diploma structure, the MSA has firmed up its course to take cognizance of its location in Glasgow and the comparison of its staff. Historically, the school is situated in the Glasgow School of Art (with its Mackintosh building) and has a bias towards design and history as core areas of the course, and, perhaps because of its part-time course (recognised since 1907) a tendency for preponderance of practising architects (and engineers) among the staff. Acceptance of professional norms therefore tends to be habitual although not ruling out dissatisfaction with current standards at any one time. On the other hand, the School has deliberately recruited staff whose main interests lie in teaching and in teaching techniques, in the belief that effectiveness in this area can help achieve one principal aim of the School, the training and education of architects.

Another major aim is to stress the study of architecture (a subject if one judges by published research, not always central to architectural studies) an aim which informs the structure of the course as does the consideration of the nature of the architectural profession.

The course was consciously influenced by Bloom's Taxonomy of Educational Aims and related to Abler, Adams and Gaudi's model of a profession as modified by the author using Schein's analysis of a profession in respect of innovation.

Within the course framework there is an area where architectural knowledge, traditions, philosophy, history and theories are specifically taught by lecture and seminar. There is another area where interaction with these theories is sought by brief specific exercises, and a major area where the learning vehicle is project work involving interpersonal skills, with an open ended approach allowing individual development in relation to these theories and objective situations.

Diagram I is intended to indicate how the field of architecture can be considered as lying between vernacular building, conditioned by shelter and availability of building materials, and engineering where parameters of force are the major conditioning elements.

Diagram II illustrates a generalized view of the profession which has been used to structure, with Diagram I, a framework into which curriculum subjects can be logically arranged in relation to a real-world abstract bias which bears particularly on how method and design teaching is operated in the School.

Diagram III, the course structure, outlines a four year teaching content related to the (Scottish) four year Honours Course (year four is also year one of the Diploma Course and is a foundation course for non MSA Degree entrants).

The main relevance of this diagram is to show how the location of subject headlines indicates the emphasis in methods teaching in the MSA. The teaching of method is implicit in all of the course areas: abstract and philosophic aspects of method are examined in Architectural Science, current methodology in a wide range of building skills are taught in Methods and Procedure, cultural and typological models are exposed through History teaching, as are economic and societal interactions in the Built Environment course, while learning through specific example, often in relation to real life constraints and values, is sought in studio simulations and live projects.

In this way, while design method is utilized and taught extensively, it is not studied as a unique process, hence the need to look across the whole course to identify the state of the game as it were, of the subject in the School.

In reconstructing the course, the aim was to create a learning situation in which the student would be motivated to acquire necessary skills and knowledge in order to solve design problems relevant to his level of understanding, ability and interest, and his desire to become an architect.

The intention was to make the student effective. Studio work is central to the course, many aspects of each area of the course, methods, architectural science, environmental and history studies, are taught and tested therein in the interests of developing the traditional holistic approach to the solution to architectural problems.

Specifically in restructuring the course, the content of architectural science and design methods and procedures was re-assessed and re-distributed in order to achieve a better relevance to studio activities; the word 'design' was dropped, the subject becoming 'methods and procedures' with

a view to extending the idea of method as a principle generally applicable and perhaps more importantly, a skill necessary to and utilizable by the designer aiming at achieving an integrated product such as a building.

Diagram III indicates a division of subjects into (a) Cognitive, and (b) Affective and Psychomotor areas. This sub-division is based on Bloom's Taxonomy of Educational Objectives which defines these areas as follows:

Cognitive Domain:	Objectives deal with recall or recognition of knowledge and the development of intellectual abilities and skill, i.e., what you know, the development of a personal vocabulary of knowledge.
Affective Domain:	Objectives which describe changes in interest, attitudes and values and the development of appreciation and adequate adjustment, i.e., how you use it, how do you change it, the development of attitudes.
Psychomotor Domain:	Objectives deal with the development of dexterity and manipulative skill. Bloom does not expand on this area, but it is suggested that in architectural studies it might include the development of holistic comprehension and action, i.e., what you need to be able to do to use it, knowledge, the development of graphic skills, the ability to visualize and draw.

Bloom's further sub-division, given below, is intended as an aid to understanding the scope of each of the two main sections:

Cognitive:
1. Knowledge
2. Comprehension
3. Application
4. Analysis
5. Synthesis
6. Evaluation

Affective:
1. Receiving
2. Responding
3. Valuing
4. Conceptualization
5. Organisation
6. Characterisation

The purpose of the allocation of subject areas within these sub-divisions relates to a belief that teaching aims and methods tend to be different in each area, and the suggested redistribution of curriculum subjects between Architectural Science and Design Methods & Procedures in particular is intended to take cognizance of this.

Cognitive inputs tend to be formally taught, by lecture courses, by block teaching programmes, science unit studies, regular half-day exercises or integrated projects. Ad hoc individual tutoring by request is being developed and reading programmes are outlined in support of all cognitive teaching.

Affective and psychomotor skills on the other hand, tend to utilize project based teaching methods, both in the traditional 'Design Exercise' sense and in the sense described in SRHE Monograph 24, i.e., a teaching mode relating to (a) involvement; (b) skills for independent work; (c) skills for group work; (d) skills for effective communication; (e) knowledge; (f) personal development.

Studio work in this context extends beyond the teaching of architectural design, which has traditionally been orientated towards studio work as 'a fictive simulation of real life activity', the term as used here is seen as an extension of the traditional usage into subject areas, normally taught by lecture course and examined by written papers. This is in line with an increasing use of this method by other disciplines, perhaps related to the need now to adjust methods of higher education to meet the demands of students who have grown up with modern activity based (child centred) methods in primary and secondary school.

Studio work is directed towards integrated learning and continuous testing and evaluation in as many course areas as practicable. It facilitates the setting of exercises which involve the development of psychomotor skills, i.e., drawing, design, etc, and of conceptualizing and communication skills, by the mechanism of the briefing and debriefing sessions (programme setting as a problem seeking and 'crit' sessions as a teaching method) involving follow up and process evaluation, thus emphasising the holistic approach and judgement so necessary in architectural activity.

Studio staff co-operate with specialist staff to initiate relevant projects, and a consultancy team is being built up to provide support on call in a variety of associated disciplines during and after the 3rd year, and students are encouraged to recognise and act on the need for such support.

Built environment studies provide a useful starting point to consider the overall course structure. A primary aim of this course is the identification of the area within the environmental field which can properly be described as architecture; a secondary aim is to provide a wider understanding of environmental phenomena and strategies affecting architectural activity.

These studies are organised as an examination of the various physical determinants of built form in the environment in the first year, followed by a broad study of social and economic interactions and strategies in the second; third year studies taking the form of relevant optional studies under the tuition of specialist staff. The fourth year course in Urban Studies provides a basis for the entire year's work and a vehicle for a holistic examination of the built environment, intended to incorporate and integrate the work of the three previous years.

Related to these studies, the History of Art and Architecture course examines broadly the emergence and evolution of architectural concepts in the first year, focuses more closely on the formative periods of contemporary art and architecture in the second year, and offers an optional study of texts and themes in selected periods of architecture in the third, after first term, when contemporary issues and ideas are examined. Commencing during this year and continuing over the summer into the fourth year, the Honours students undertake a special study which is normally, but not necessarily, historical.

This course is taught in conjunction with the Department of Fine Art in order that students develop awareness of the disciplines of scholarship and art history. It is, however, primarily used as the basis of the study of architectural theories, form and typologies, and practice as a skill, a discipline and an art form. Deriving from a view that judgement in architecture is strengthened by knowledge of precedent, together with the Built Environment Studies it provides the intellectual rationalisation for a related strategy for the science and method courses.

The reshaping of the present curriculum in the field of architectural science was undertaken to remove from this course all specific design methodology and strengthen it instead as a study of the basic scientific principles involved in the conceptualisation and description of the built environment and the field of architecture. The intention was comprehensive, the field being held to provide a theoretical basis for the strategies for action, taught as methods and procedures, as well as a conceptual framework for understanding of the phenomenon of architecture in the built environment.

The method and procedures course correspondingly was extended to include all explicit design methods, environmental and servicing, in addition to methods of communication and control. The need for evaluation and judgement is stressed. The intention was that methodology could be seen to derive from the conceptual framework established in the various cognitive areas. It is hoped that a deeper level of understanding of method will result and that more effective action will follow.

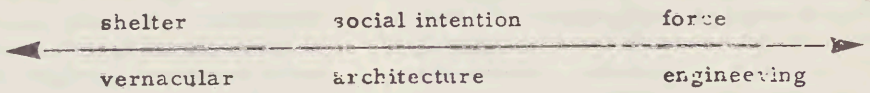
In thus arranging the course, the teaching of Methods as a subject was widened and narrowed to cover current practice in methodology in many fields, and the concept of design is presented as a continuum, a systematic process whereby the aims of the designer are able to inform not only the primary system (of the building) but the sub-systems also, its construction, environmental performance, servicing, etc, and the same general and cultural factors seen to operate in what are often treated as hard design areas (i.e., susceptible to internal parameters only, usually parameters of force).

As a corollary, the science course is used to discuss the abstract or philosophical aspects of method, to relate architectural design to basic scientific principles which underly phenomena in the physical world, and to examine how mathematical ordering concepts can be and have been utilized to rationalise choice in the design process.

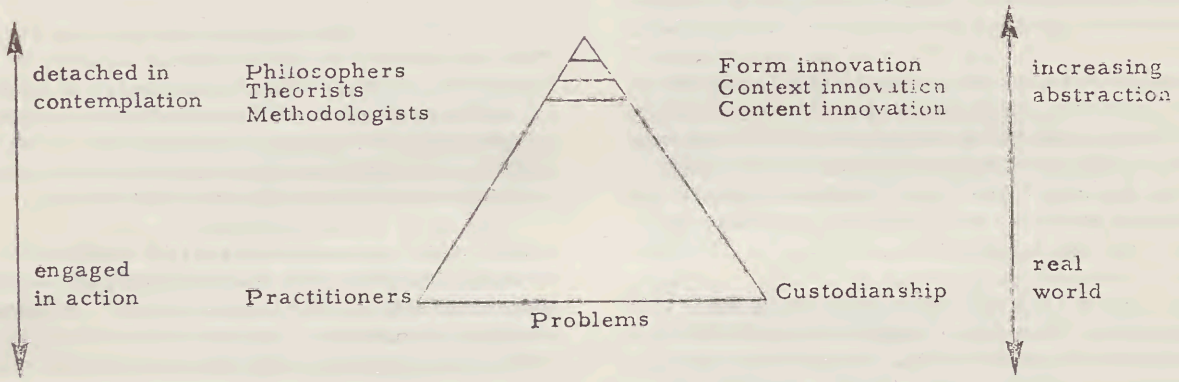
Studio work, although necessarily orientated towards a product, the finished design, at certain stages, nevertheless, is also used to develop and examine processes. Projects range from simple staff directed design, and search, identify and utilize exercises; through community-involved live projects to complex, multi strategy open ended activity, often with a high 'real' content in the later years in the core area of the course, to which all other subjects are related, and assessment of competence in particular is made in relation to the level of skill and caring demonstrated therein.

Responsibility for Architectural Science and Methods teaching in the MSA lies with John O'Keefe (late of Portsmouth) and he has played an important part in the formal reconstruction of the course, particularly in organising his subjects in such a way as their relevance and utility can be appreciated by the architectural members of the staff and student body alike.

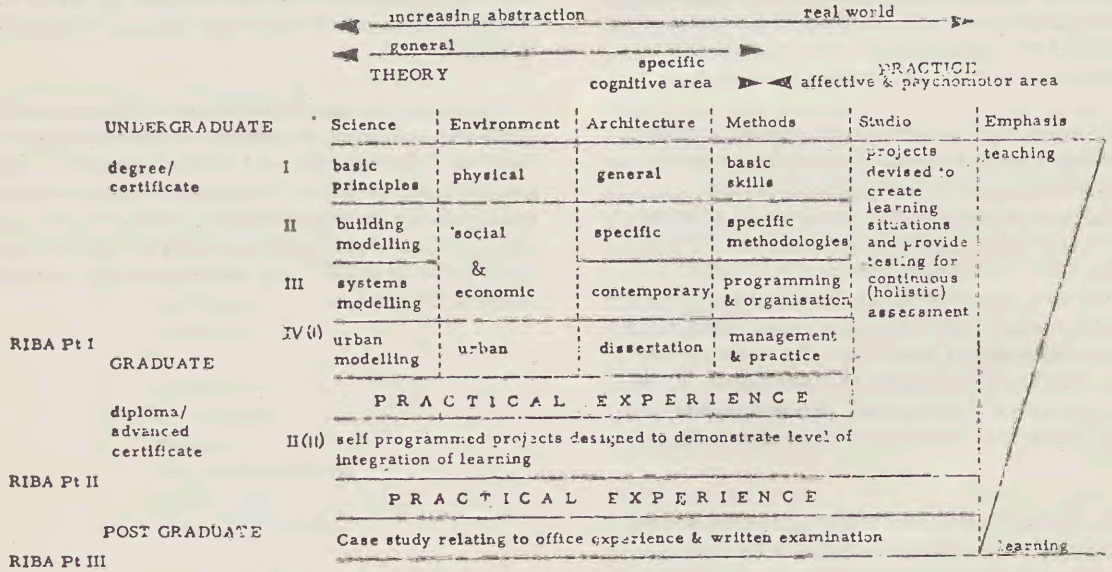
I FIELD OF ARCHITECTURE IN THE BUILT ENVIRONMENT



II STRUCTURE OF A PROFESSION



III STRUCTURE OF PROPOSED COURSE



THE ACT OF DESIGNING

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Fowles (1977) has reminded us of the recent history of conscious design methodology and posed the rather interesting if slightly curious question; "what happened to design methods in architectural education?" Certainly Fowles is right to point out that little has been published in the last ten years along the lines of the publications which promoted design methods during the previous decade, but does this change in research and publishing fashion serve as an accurate indicator of architectural education? I rather doubt it. The simple answer to Fowles' question is that design methods in architectural education continue to be as many and varied as they were and probably always will be. There must be some method in the apparent madness of the architectural design process and we must presume that some how or other students continue to learn it. But just what does Fowles mean by "design methods". Does he mean the methods designers actually use or those which others devise for them to use? One suspects the latter. The wealth of literature on design methods in the sixties which Fowles so usefully reviews was largely generated by a relatively small group of whom few were full time designers and hardly any were active architects.

In fact as we all know most of those authors are now amongst the many who have criticised first generation design methodology. That they changed their minds cannot be expected to have influenced architectural education any more than the initial publication of their ideas. The body of architectural academics comprises many people with many views who specialise in the many subjects taught in the schools of architecture. They together with their academic and professional institutions provide a inertia easily capable of defeating the first generation design methodologists.

So the reality of change in architectural education tends to be rather slower than the image portrayed by enthusiastic, even crusading, publications. As Musgrove (1973) has pointed out courses in architecture differ more in terms of structure than content. Because the subject of architecture is not a classical discipline unlike physics or mathematics it has no obviously apparent structure by which it may be taught. In our schools of architecture we argue endlessly about the structure of our teaching programme. Design methods like any other course topic must thus fit into that structure and cannot be isolated.

Indeed it is probably this very lack of appreciation shown by first generation design methodology for the context of design which is responsible for the paucity of architectural applications. By contrast contemporary thinking about design has moved much closer to the designer himself. At Sheffield University we approach design methods through the minds of designers rather than from a purely theoretical or ideological standpoint. The basic assumption implicit in much early design methodology was that, by and large, the practising designer, particularly the architect, is something of a bumbling idiot scratching around without really knowing what to do. The departure point for our research is that, while there are undoubtedly many poor designers and much poor design, architecture is not universally bad and we should try to learn something of the design process from those who excell at practising it as much as from those who preach new methods. Thus our research is rather more descriptive than prescriptive and we have come to be more interested in the structure of mental operations in design rather than the old obsession with a sequence of events.

In order to explain something of our current ideas about the design process it is probably helpful to draw a distinction between four levels of thought in design which I shall call philosophies, methodologies, techniques and skills.

The role of ideology in design has been sadly neglected by methodologists but it would be absurd to maintain that the designer can or should entirely divorce his thinking on a specific problem from his general more philosophical beliefs. Clearly throughout the history of architecture designers have sought

to explore ideas which transcend the particular problem in hand as well as attempting to meet the immediate brief. Darke (1978) has recently completed a fascinating study of the way six well known and distinguished architects tackled the problem of public sector housing in London. While interviewing the architects she asked them to describe the evolution of the design and their approach to the problem. Alison Smithson simply referred the researcher to her already published books. Clearly these architects feel they have a definitive statement to make on mass housing and their methodology can only be meaningfully interpreted in the light of this fundamental philosophy.

Watkin (1977) has shown how strongly architects may hold views as to the appropriateness of styles or movements of architecture. He quotes James Stirling as describing his time at the Liverpool School of Architecture as "furious debate as to the validity of the modern movement.... I was left with a deep conviction of the moral rightness of the new architecture". (Stirling 1975) Perhaps this certainty about the modern movement has now largely evaporated, although similar sentiments have been expressed recently by Lasdun (1976) for whom "buildings are motivated by ideas.... (which) do not constitute a systematic philosophy but rather certain deeply felt maxims". But if the modern movement is no longer the driving force in architectural thought there are plenty of competitors in the race for succession. Beliefs in conservation and rehabilitation or in ecology and ambient energy, in flexibility or in deprofessionalised participatory design all have their adherents. Indeed the design methodology movement itself constituted a more or less coherent ideology in the early sixties, with its notions of the moral rightness of rationality and of quasi-scientific proceedures.

At Sheffield the first year lecture course in the theory of architecture tries to present a mosaic of such architectural ideologies. The students it is argued will, indeed must, develop their own attitudes towards what is important in design. The methods they use will inevitably be strongly influenced by these wider considerations.

It is in the discussion of design methodologies themselves which we see the greatest shift of emphasis from prescription to description. The attempt to lay down overall design methodologies seems to have failed due to the complex and diverse nature of architectural problems. The shift from the Alexanderian notion of the totally describable design problem to the more recent view of design problems as intracibly "wicked" in Rittel's sense is mirrored by our research at Sheffield. In the early days of my own interest I was already unconvinced that designers actually thought in terms of the sequence of events used by so many methodologists of analysis, synthesis, evaluation and so on. Laboratory experiments reported elsewhere (Lawson, in press (a)) showed that designers do indeed integrate analysis and synthesis to the extent that it is no longer operationally useful to seperate them. So our attention has been turned towards the nature of architectural problems and the way they are perceived by architects. Using audio-visual recording techniques to observe group design sessions Agabani has been studying the way architectural students develop and manipulate their image of the problem and its solution. The data is being analysed using a new model of design problems, soon to be published by the Architectural Press (Lawson, in press (b)), which identifies the sources, functions and areas of influence of the constraints which comprise design problems. (see Lawson, 1978 for an earlier version).

Evidence gathered from both verbal and written accounts of their work by architects and from more controlled laboratory studies reveals that one of the most crucial skills in design is the ability to adapt the methodology to the problem. Thus in these studies and in our teaching we now concentrate on the way the designer controls and directs his attention from one aspect of the problem to another. Methodology is thus seen as part of the creative act itself rather than as a rigid recipe to be taught or learnt as a correct response. As de Bono (1970) puts it 'the purpose of thinking is not to right but to be effective" or, in our context, any method is allowed if it proves successful. This approach requires the student of design to be much more introspective and self monitoring, and in this respect perhaps Matchett (1968) with his Fundamental Design Method was the nearest of all the first generation methodologists to our current thinking.

Design techniques which are ways of handling parts of the design process rather than the overall method of control have been most usefully and thoroughly explored in the literature. Jones (1970) well known book on "Design Methods" is actually largely a catalogue of such techniques as is the more recent "Design Methods Manual" of Cross and Roy (1975). Unfortunately I think that this is the area of design research which has been most disappointing in terms of application. In retrospect many of the techniques were too generalised to be of any real value. For example Cross and Roy cover the techniques of "User Trips" and "User Research" in two or three A4 pages each. The advice is so blindingly obvious that one hardly dare suggest that intelligent students should read it. The real problem here of course is that of the way architects build images of users and their needs in their minds, and that is a much more complex issue. Darke's work already quoted is an attempt to discover more of the way this works in the specific context of mass housing design, and that will fill a doctoral thesis not just two or three pages! Of course this issue then raises problems at the level of the design philosophy where it would be more legitimate to ask, because of the difficulties raised at the technique level, whether should we continue with the mass housing programme with the designer in his conventional role? This seems often to be the way with generalised design techniques, either they are too obvious and superficial and thus boring or even insulting to teach, or they prove too blunt an instrument in the specific application. In my experience good design students soon develop their own combinations of techniques which rapidly become

integrated into their own methodology as part of their normal education on the studio drawing board.

Two specific sets of design techniques however have proved generally useful and successful as teaching instruments. On the one hand the use of gaming and simulation techniques and on the other computer-aided design packages both seem to be liked by first year students at Sheffield and offer distinct educational advantages. Gaming techniques can often usefully illuminate the personal and interpersonal factors in decision making so sadly lacking in the conventional design studio. In particular, when video recorded as at Sheffield, the post-mortem reveals much of the effects of personal role and viewpoint in group deliberations. Computer-aided design programs, are capable of revealing to the student the complex, multivariate and interactive nature of many architectural problems. The computer, like any good teaching machine, offers immediate feedback and knowledge of results, does not criticise mistakes and allows students to work at their own pace. The new generation of cheap micro-processor, graphic systems seem to have enormous potential in architectural practice and education (Lawson, 1978a).

However it must be said that there is little systematically gathered evidence as to the real educational effects of such techniques. The department at Sheffield has however just been awarded an SRC research grant to evaluate computer-aided design programs in both private practice and post-graduate architectural education. Perhaps we shall be able to say more on this in a few years time.

The last level of thought in design, that of the basic mental skills is by no means the least significant in a consideration of design methods applications in architectural education. It could be argued that basic thinking skills are neglected by educational programmes generally. Architecture demands such a range of skill from rational evaluation to imaginative ideation; we must be capable of analytic thought and creative thought; we must be able to find and solve problems. The architect needs the divergent thinking skills normally associated with the artist and the convergent skills of the technologist and he must be able to think in verbal, spatial and mathematical languages. All these cognitive skills do not necessarily come easily to one person and like any highly developed skill they must be practised (Bartlett, 1958), and modern writers such as de Bono (1970), Adams (1974) and others have outlined ways of obtaining such practice.

We have seen in studies of the creative mind such as Mackinnon's work on architects how important and central is the role of self motivation. MacKinnon (1962) found that his group of judged-to-be highly creative architects "in courses that failed to strike their imagination.... were quite willing to do no work at", and "they were unwilling to accept anything on the say so of their instructors". Design techniques which are presented in the manner of a rigid recipe or set of instructions do not tend to "strike the imagination" and we must concentrate our efforts not on what may seem logical or attractive to the design methodologist but what appeals to the students. (Hedge and Lawson, in press) Students of architecture at Sheffield are encouraged to question the attitudes and techniques of others rather than to slavishly copy. It is hoped that this promotes a creative approach to the building of a personal design process founded on considered philosophies, flexible methodologies based on an understanding of problem structure and the development of techniques from the basic building blocks of a wide range of well practised thinking skills.

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DESIGN METHODS : THEORY TO PRAGMATISM

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SUMMARY

A chart which identifies aspects of design methods currently within the syllabus of the Welsh School of Architecture (the WSA) is preceded by a description of the author's initial encounter with design methods and his ensuing teaching activities. Through this description is revealed the author's transformation from what may be described as an early over enthusiasm for the theory of design methods towards a more pragmatic study of design and change processes.

CHRIS JONES AND DESIGN TECHNOLOGY

Following a brief introduction to design methods from Stuart Sutcliffe in the early years of my architectural education at the Cheltenham School of Architecture, I later encountered, at the Oxford School, a more traditional philosophy in which quality of 'product' was emphasised with little attention given to 'process'. Three years in practice confirmed a need to be re-equipped with tools to aid my investigation, comprehension and ability to design within the political-social-technological change processes of society. So, it was in 1969 that I encountered design methods in the wider context of J. Christopher Jones' inter-disciplinary M.Sc., Course in Design Technology at the University of Manchester, Institute of Science and Technology.

Design Technology comprised the subjects of History of Innovation and Designing, Systems Engineering, Design Methods, Ergonomics, Statistics and Computing, Simulation and Gaming and Design Research. The impact of the course was far greater than the sum of the subjects. Most students left with a new attitude and determination supported by tools for tackling, as we believed, any problem in any discipline, at any level. Architecture, I was convinced, and architectural education would benefit immeasurably by incorporating philosophies, methods and techniques from the course.

DESIGN TECHNOLOGY APPLIED

Having an open brief at my first teaching post at Manchester Polytechnic, I aimed to cover a broad range of Design Technology through lectures and project work in the early years of the School of Architecture. This was a four year course leading to Intermediate RIBA with the third year spent in an office.

Outline of subject as taught by the author at Manchester Polytechnic, School of Architecture.

Years One and Two

Lecture Course	Description of a range of systematic procedures and techniques (as Jones 1970, the 'Strategy and tactics' approach of 1st Generation design methods) design process - simple models describing the design process as a systematic procedure of staged activities. systematic design techniques - literature searching, brainstorming, morphological charts, interaction matrix and net, formulating design objectives, checklists, etc, each related to a particular stage of the design process (as Cross 1970 and Jones 1970).
Design Programmes	The application of lecture material to Studio design programmes, mainly through the structuring of the students design time in relation to a general (analysis, synthesis, evaluation) model of the design process (a time-table/design strategy diagram was issued with each written programme which the student was expected to follow) plus the use of systematic design techniques where appropriate (usually as a studio group activity).
Analysis Programmes	Two of the more successful were: - A systems approach to an analysis of the Manchester conurbation. An ergonomic study of the student's own living space (with implementation of suggested improvements.

Other Design Method Activities	Design analogue games to indentify problem solving stratagies and interpersonal behaviour patterns in group problem solving situations (e.g. Rae 1969, 1971).

Year Four

Lecture Course	Introduction to operational and research techniques : - statistics, queuing theory, simulation methods, game theory, network analysis, linear programming (This area of the subject was later taken over and considerably developed by Geoffrey Calderbank. As co-author of the paper on the Huddersfield School, in this issue, he identifies the nature of the course I ran at Manchester as a 'soft-edged methods course' whereas his dealt with the more quantitative methods leading on to computer applications), data collection and analysis, questionnaires, interviewing users, observation, taxonomy, literature searching, report writing.

Apart from the Analysis Programmes and the Games the course outlined above was dominated by a presentation through lectures of a catalogue of techniques. This method of teaching often resulted in a student coming to me in confusion with a plea for help. "I've done your matrix. Now, my problem is I've got this building to design". The utilisation of the interaction matrix, where appropriate by a few students, to investigate the multi-variate relationships between, say, a set of functional spaces, is now handled with far more success.

My main conclusion from this first teaching experience of approximately three years was that design methods was not a subject which should be presented solely through lectures and left to be applied by the student in his design work. Design methods must be fully integrated with the physical and mental activities of designing. As a consequence of this experience I eagerly took the opportunity when presented to me to run the First Year at the WSA. My aim was to design and implement a course which would integrate the teaching of design technology, and in particular design methods, with the major content of the year, the studio design programmes.

PRAGMATISM

The teaching pattern of the course, now referred to as Design Method , which has evolved over the past five years at the WSA, contains two main elements. These are - a) Systematic Design Procedures and techniques and - b) Alternative Design Systems.

a) Systematic Design Procedures and Techniques

Although agreeing with the doubts and criticisms of the early 1970's concerning the 1st Generation Design Methods, summarised by Fowles 1977, I see much of the material as being a useful educational tool in that it provides a framework for the student to commence his investigation of the process of designing. However, within this framework there has been a change in emphasis 'from a process that is highly regimented to one that integrates certain general approaches with the individuals personal style ; from a linear process incorporating loops to one in which methods stress the silmultaneity of problem formulation and solution finding'.

b) Alternative Design Systems

These have their roots in aspects of Jones' Design Technology syllabus, and echo the characteristics of 2nd Generation Design Methods as outlined by Rittel, 1972. The aim is to bring the student into face to face contact with the political-social-technological change processes of real world design systems.

Outline of subject as currently taught by the author at the WSA : -

Year One

Lecture Course	Much of the material on design procedure and technique has been compiled into a Design Method Handbook which is distributed to students at times considered to be most relevant and useful to their on-going studio design programme. The bulk of this material is concerned with 'systematic' procedures and techniques. Designing is examined from a variety of standpoints, and techniques referred to extend beyond the range of 1st Generation design methods to embrace the more subjective and intuitive methods.

The use of the Handbook frees some of the lecture time to be devoted to describing inputs to forthcoming programmes, discussing progress of on-going programmes, and evaluating procedures of completed programmes.

Design Programmes

In the WSA as a whole there are few ' limited objective programmes', e.g. a structural design exercise. Nearly all cover the total design process and emphasise the integrative nature of the discipline of architectural design. As a result, in their first year, students design five or six buildings, each following a different design approach or method. These are identified in the chart.

Other Design Method Activities

At least one in-depth study of an aspect of design method is carried out during the First Year linked to a design programme and with the participation of the whole year. These have included : -

1. Modelling the design process; in which students present a written description of "How I designed my building" and then transform this into a diagramatic model of the design process followed. These are then compared with models from the literature.
2. Hierarchical analysis of design information; in which students list on prepared sheets their design objectives within a number of problem areas of their design problem : identify conflicting and compatible objectives both within and between problem areas : and identify the use of value judgements and other criteria in resolving the conflicts.
3. Variety generation in design ; students participate in Brainstorm Sessions on "What are the main parts of the problem for which alternative 'solutions' exist". The output is classified and becomes the input to a Morphological Generation of sub-solutions. The design information is manipulated throughout by the use of index cards on a studio wall.

Years Two and Three

The theme that runs through the 2nd and 3rd years of the Design Method course is that the design process is part of a larger process of technological change, and that technological change is initially bound up with social change. This intimate relationship of technology and society provides the environment in which designing takes place. In this context the effect of designing is to initiate change in man-made and natural things.

A lecture course is presented prior to the student embarking on a short research project. A report is prepared which places some emphasis on designing, describing, and evaluating the 'process of finding out', whilst the main emphasis of the project concerns the nature of 'change' in the particular area chosen. The student chooses to work within one of the six study aspects outlined below :-

DESIGN PROCESS-ONE	STRATEGIES AND TACTICS e.g. the use of design methods in an on-going studio design programme.
DESIGN PROCESS-TWO	THE DEVELOPMENT OF DESIGN METHODS e.g. the historical use of 'method' in architectural design. e.g. evolution of the modern discipline of design methods.
ON-LINE ONE	CRAFTSMANSHIP products and processes of pre-industrial societies.
ON-LINE TWO	PEOPLE AND THE HOUSING PROCESS e.g. personalisation, self-build, housing action groups.
FUTURES ONE	FUTURES FORECASTING forecasting techniques
FUTURES TWO	ALTERNATIVE FUTURES e.g. the process of technological change, alternative technology, future role of the professional.

With regard to my teaching activities in Design Method at the WSA a clear distinction has emerged between ;

- a study of the theory of the design process based on systematic procedures and techniques with some application to studio design programmes and,
- a practical study of the design process utilising real world projects , with some application of systematic procedures and techniques to real-world change processes only

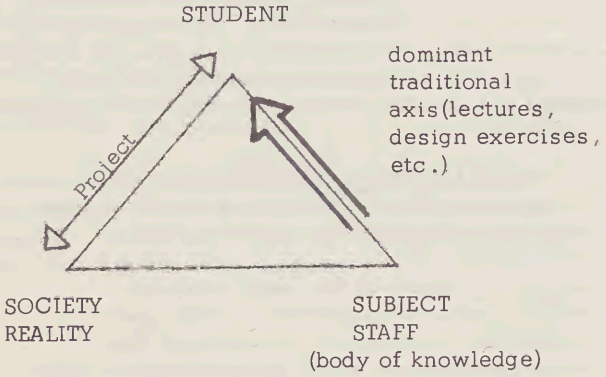
where appropriate. (The real world change or design processes encountered may be added to the catalogue of design methods).

This distinction relates in many respects to that made by Rae 1978, in which he differentiates between the 'design exercise' and the 'project'.

> design exercise -"in which practical competence in the designing of buildings is acquired, often in step-by-step sequence; and by means of which exercise the student receives instruction"
>
> project - "in which the student is left largely to his own devices to locate the problem where he wishes and to solve it by whatever means he considers to be suitable ".

Most programmes followed in the WSA have been, in general, hypothetical. At best they have incorporated some information from the real world, e.g. from a client or a site. Few, if any, have involved action in the real world such as the implementation of a design proposal. These programmes can mostly be classified as 'design exercises'. They have their roots firmly within an established body of knowledge and skills which the student is expected to acquire by carrying out the programme. The subject, the method, and to a large extent the solution, are pre-determined by the author s of the programme i.e. the tutors.

On the other hand, the main aim of the 'project' is to place more responsibility on the student for his/her own education. In a project we are not necessarily concerned with an architectural end product but more with the process passed through by the student. The emphasis is transferred from the quality of the end product toward the changes which take place in the student. The characteristics of the project are that it is firmly based in the real world, and requires both physical and intellectual action by the student. This learning from experience or 'learning by doing', involves the student in choosing the subject, defining the problem, and effecting action.



The programme in the First Year of the WSA which most satisfies the 'project' criteria is the BUILD PROJECT which in 1978/79 will enter its sixth year. It was first suggested by Mike Harries as part of his course in Construction and Assembly to give students first hand experience of construction by actually erecting a building. As Year Tutor I was involved with the programme from the beginning, and together we have developed the Build Project from the erection of a simple farm building to embrace a variety of building situations which now involve the students in the full range of activities of the design-build process.

The chart identifies the extent of involvement of the author in the WSA and hence of the nature of the subject of Design Method covered. The programmes noted comprise the major part of the First Year 'studio' work. Student's interest is aroused in formal procedures and techniques following their first attempt at 'original' and 'trial and error' designing in their first design programme (week one) which this Session simply requested "A design for a building in Cardiff'. Succeeding programmes are being followed in the order indicated at the foot of each column.

CONCLUSION

Design Method at the WSA can be observed to have its roots in the subject content of J. Christopher Jones' course in Design Technology at UWIST.

As Year Tutor at the WSA I have developed the First Year of the B.Sc. Course in Architectural Studies around the distinction which has been described between the 'design exercise' and the 'project'.

From the chart it will be seen that in practice there are a range of activities bridging the design exercise / project spectrum in which Design Technology and in particular design methods play a supportive rather than a deterministic role.

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DESIGN METHOD AT THE WELSH SCHOOL OF ARCHITECTURE

	⇐ DESIGN EXERCISE					PROJECT ⇒
EDUCATIONAL ACTIVITY	study of the theory of the design process based on systematic procedures and techniques	application of systematic procedures and techniques to studio design programmes			observation and investigation of real-world design systems.	participation in real-world change processes.
YEAR	1 and 2	1	1	1	2 and 3	1
METHOD	Lectures. Design Method Handbook.	One or Two design programmes in which the use of systematic procedures and techniques are used by the student if desired.	Utilisation of a systematic procedure with some application of techniques.	A programme based on a systematic procedure.	Project and Report (with some lecture support on socio-technical change)	BUILD PROJECT Summer Term with preliminary investigations, feasibility study, and some design work in early Lent term.
NATURE OF THE DESIGN PROGRAMME		Architectural design exercise : single or 2 storey building e.g. private house, craft workshop, small museum, information office.	Architectural design exercise, with real client and site, incorporating a specialised user group. e.g. short stay accommodation for jockeys, half-way rehabilitation houses for psychiatric patients.	The design of a single cell shelter for one or two persons, which is then built, used and evaluated.	See list of Study Aspects for Years 2 and 3.	The following are areas in which students have operated :- Energy supply and building in alternative technology communities. Farm buildings: framed and traditional construction. Community aid building projects. Walling in cob and stone.
COMMENT ON DESIGN METHOD CONTENT	Lecture material is related to design programme work where possible. Additional 'Design Method Activities' explore aspects of the design process: e.g. modelling the design process. Hierarchical analysis of design information. Variety generation in design.	Emphasis on spatial organisation and room planning, and their relationship with external form and site considerations	Highly structured design procedure incorporating a range of design techniques; e.g. investigating user behaviour, interaction matrixes, check lists.	Introduction to procedure : the design-build process, problem identification, brief formulation, transformation to alternative solutions, using models and drawings, solution choice, communication, build, use, evaluate.	Research Methods are related to Design Methods in the design of a research strategy ; Data collection techniques such as; questionnaires, observation, interviewing, literature searching. Analysis of research data. Presentation of research objectives, strategy, findings, in a report.	Aims to experience and relate to theory the processes of change and methods of decision making of the client, group or community with whom the students operate
SEQUENCE OF PROGRAMMES IN 1st YEAR.		Third Fourth	Fifth	Second		Sixth

ATTITUDES TOWARDS DESIGN METHODS AT HUDDERSFIELD POLYTECHNIC SCHOOL OF ARCHITECTURE

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The authors of this paper could be considered as 'second generation' teachers of design methods. Geoffrey Calderbank graduated from Strathclyde University in 1970; until that time, at this establishment, design methods had been inextricably wrapped up with advanced research projects. Students got to hear of design methods piecemeal 'on the grapevine' and applied them on an ad hoc basis.

Jaki Howes graduated from Manchester University in 1969. Undergraduates were not exposed there to an integrated course on design methods, but were required to observe rigid methods of working towards a design. In many cases these were found to be stultifying by students who were expecting a freer, more intuitive approach.

After some years, Calderbank, teaching at Manchester and then Huddersfield Polytechnics, and Howes, at Huddersfield, found that students expected some element of design method teaching to be included in the course.

Interaction matrices and and nets were discussed and used in design projects by students at both schools and a course on numerical techniques, including linear and dynamic programming, was introduced at Manchester as a follow-on to a 'soft-edged' methods course, given by Fowles. Some elements of what are now considered as design methods, e.g. planning grids, were taught at Huddersfield although not explicitly as methods.

During preparation of the Degree course at Huddersfield it was thought advisable to formalise the teaching of design methods, as a necessary but not overimportant component.

In this course the first year includes six hours of formal lectures and seminars which introduce the student to the range of design methods available. It is found that an approach as thoroughly purged of jargon as possible is necessary in order to promote a balanced assessment of opportunities on the part of the students; the message is 'methods are tools, not magic'. Subjective methods are included and given equal emphasis in order to promote consideration of the relative merits of intuitive and formal approaches to design. In the Design course emphasis is put on user requirements, fitness for purpose and ways of assessing these. There is an introductory lecture where students are induced, seduced, or reduced into listing all the criteria involved in the successful performance of 'a vessel for conveying hot liquids to the mouth'. The criteria are then categorised into what can be described loosely as 'commodity, firmness and delight' and then ranked.

The Second year course includes ten hours of computer studies as a basic familiarisation exercise with the aim of either removing fear of the machine or to remove overconfidence in its abilities: 'computers are tools, not magic'. The design course in the same year begins with an exercise in which students are given a series of problems with areas defined by letter and their relationships given either by proximity, adjacency or number of journeys. These problems are analagous to 'real' building problems with the names of rooms or activities removed. The names of these are provided afterwards so that students can compare their solutions with those which they would have produced, given recourse to their preconceived ideas about building types.

Each of the subsequent design programmes in the year is preceded by visits to, and critical assessments of, buildings of the type under study,

with particular reference to user requirements and reaction.

There is no formal teaching of design methods in the Third year of the degree course, but in the final programme of the year students are expected to check their progress against a modified form of the RIBA plan of work.

The First year of the postgraduate course is knowledge, attitude and technique oriented. Design methods are taken for granted and used as required by individual students. Indeed, it seems that even by this stage of their careers many incipient architects have developed an ambivalent attitude towards design methods. On the one hand they have a healthy wariness of method for its own sake and a massive impatience with pedantic imposition of 'logical structure' upon what they see as beautifully illogical problems. Set against that there exists a latent and easily aroused interest in the 'latest clever idea' for problem solving. Perhaps here we see one of the roots of fashion in architecture?

In the Final year of the course it is expected that the final Comprehensive Design project will be carried out using the RIBA Plan of Work checklist, as this is the way in which most of the offices in which students will shortly find themselves process jobs.

Numerical planning and layout techniques are considered to be at a relatively crude state of development and are therefore introduced as a foretaste of 'what might possibly be'. The impetus of any computing work is intended to be either towards an extension of the slide rule, rapid evaluation of environmental physics factors and the like, or towards the more 'feely' end of architecture, i.e. visual exploration and presentation. It may be interesting to note that the preparation of this brief paper brought to the surface niggling doubts on the part of both authors as to the final value of computer techniques in the teaching and training of architects. We are especially concerned that systems designed to exploit the visual capacity of the machine as an aid to visualisation may in fact produce too many props for the student, thereby increasing his dependance upon outside sources rather than increasing his visual awareness. Perhaps, we may look forward with dread to a generation of "Computer Graphics Junkies".

Towards the 'softer' end of design methods both authors feel that students should be exposed to a wide range of available design methods early in their careers, but consider that the more experienced a designer becomes, the more able he is to search unaided for acceptable solutions. This brings up the question of what, if any, design methods are used by 'real' architects, as opposed to students who operate in a rarified environment.

From observation as students, practitioners and teachers, we conclude that design methodology is not a discipline which will fundamentally change the architectural world. The initial heady excitement is over, as is the inevitable overreaction against it. What we now seem to be left with is a useful exchange medium for bright guys about potentially useful techniques, but perhaps what we most need is an investigation of what sort of formal methods of working are now essential for REAL architectural problems.

THE DEVELOPMENT OF DESIGN METHODS - A REVIEW

Geoffrey Broadbent

This is a shortened version of a paper published in Bauwelt, Vol. 47/48, 23 December 1977 and is also to be included in a forthcoming book, The Nature of Architectural Revolutions

Most of the pioneer design methodologists discussed the nature of design as a science before proceeding to their personal descriptions of techniques which, hopefully, designers would be tempted to adopt in practice. And, almost without exception, they took a Cartesian view of designing; breaking the problem down to fragments and solving each of these separately before attempting some grand synthesis.

Each theorist used a different terminology, there were differences in the scale and the level of abstraction at which they treated the parts of a problem, but to quote only the best-known examples, Asimov (1962) with his design elements, Jones (1963) with his factors, Archer (1963/64) with his sub-problems and Alexander (1964) with his misfit variables were all clearly trying to apply Cartesian methods in design.

One fundamental tenet of the design science which thus began to emerge was that the designer should abandon, absolutely, any question of preconceived design solutions. Chermayeff and Alexander had spelt out in some detail (1963) just why it was that concepts such as structure, acoustics and so on carry residues of past attitudes to architecture. It would be necessary to abandon those if one was to take a fresh view of design problems.

There is no doubt that by the early 1970s a new and potentially powerful approach to design had emerged, based on analysis, quantification, computer aids and so on. Horst Rittel (1972) called this 'First Generation' Design Method. Yet asked to catalogue its achievements, in terms of buildings built, cities designed and so on, most of its advocates find themselves in difficulties. Of course, there are fragments of design - a transportation analysis here, an actual building plan there, which do owe something to such an approach. But the most striking example of all is usually overlooked because it simply does not look like the kind of functionally efficient building which - or so its proponents thought - should have been the product of such processes.

More than any other example also it emphasises the "expert knows best" attitude which permeated so much design theory at this time. I am referring to the most carefully calculated piece of architectural and urban design that has ever been built; Disneyland at Orlando, Florida. Disney's aim in commissioning Disney World was not so much to repeat the commercial success of Disneyland at Annaheim in California as to develop an Experimental Prototype Community of Tomorrow (EPCOT) which would be funded from the profits of his second "Magic Kingdom". The whole process of finding a suitable location, buying a tract of land some 14 miles by 7 (27,433 acres) in a carefully planned sequence of small lots - so as not to alert the local community and thus push up prices - of draining the central Florida swamp whilst retaining certain nature conservancy areas - all this was planned with meticulous precision.

Among other things, Disney World represents the most comprehensive application of queuing theory anywhere in the world. On first arrival, having parked one's car, one is picked up almost immediately by a motorised train and transferred to the monorail systems - where a system of ramps, barriers and chains ensures that waiting passengers are distributed evenly along the station platform before the train arrives. From this, through the whole vast system of interrelated "people movers" to the simple act of queuing for a meal (one walks to a counter, to be served immediately by a Disney-programmed girl, rather than walking along a counter and thus being delayed by other hesitant customers) one is conscious of being subject to the most subtle manipulation. There is indeed an Automatic Monitoring and Control System - designed by RCA Victor - by which visitors are constantly monitored (see Haden-Guest, 1971) all of which is consistent with Disney's personal philosophy.

One must remember that Disney's reputation was made by Mickey Mouse and other cartoon animations. Having eventually got them to move and speak as he wanted them to, his interests then extended to real live people. The workers - and the paying consumers - of Disney World indeed are controlled as Disney wanted them to be; EPCOT is merely intended as a further stage in this people-animating process. It is conceived as an integrated Electronic City with a central, 35-storey commercial centre surmounting a Transportation Lobby and surrounded by totally enclosed shopping malls which in turn would be surrounded by theatres, offices, surgeries and high-density apartments. Disney conceived it with cable-tv for instance, screening educational programmes which actually showed people how they "should" live.

There is much more to it than that, but the crucial point is that in terms of techniques and more particularly in terms of those attitudes in which the "expert" knows best, Disney World represents the most complete realisation of First Generation Design Methods applied to the built environment anywhere in the world.

Horst Rittel suggested some ten years after the first major publications that this First Generation approach seemed to have died. Its major exponents certainly had withdrawn from the field and suggested in doing so, that the whole thing was a terrible mistake.

Chris Alexander of course had published his elaborate retraction from his former position (1971) suggesting that design methods as originally set up actually: "destroy the frame of mind the designer needs to be in if he is to design good architecture". He cited an example in which he and his colleagues actually went out on to a site and drove posts into the ground to indicate where the corners of a building would be - as an aid to knowing whether it was the right size or not and went on to suggest that one could describe this as a design method - the 'post' method perhaps, but that would sound very pompous. Actually it is the Pragmatic Design which I described in Design in Architecture (1973). Much of this disenchantment stems, I think, from the Portsmouth Symposium of 1967. (Broadbent and Ward, 1969). Tony Ward set this up, in part, as a confrontation between behaviourists such as Markus and Studer, who in particular, were cast in this role and those who took a Marxist-existentialist view, notably Tony Ward himself and Janet Daley. The behaviourists were characterised as latter day functionalists wanting to observe human behaviour by empirical methods, to quantify it, to set up models of man/environment interactions and to use these as a basis for designing. The existentialist spoke much more about the individual, responding to his environment with feeling and free to manipulate it as he felt necessary. They drew heavily on the literature which had become required reading in student activist circles, particularly Ronald Laing (1959) implying that the schizophrenic state which he describes so forcibly offers richer and more profound ways of being "human" than the ordered linear, one-dimensional thinking which the early design methods were designed specifically to foster.

This, no doubt, was old stuff even then to veterans of the Berkeley Free Speech movement. But it predated Nanterre by several months, not to mention the other European manifestations of cultural shift which took place in 1968. This shift, clearly, has had profound repercussions on the pioneers of design method so we shall have to look at it more closely if we are to put into context what actually remains of design method.

It is hardly surprising that many of these existentialists also subscribed to the Marxist idea of alienation and looked to Marxism to change the society which they found so intolerable. They hoped - with Marx - that capitalism would be overthrown, yet increasingly it seemed clear, as Marcuse put it (1966) that capitalism was sapping their creative energy with its "repressive tolerance". The workers were content because they could afford and were conned into buying the fruits of their own labour.

Designers had a particular role to play in this; their ingenuity ensured a constant increase in the efficiency of factory production methods, thus increasing the capital available to capitalism. But as the production of goods increased so demands for them also had to be stepped up; designers contributed to this by styling new models, intended to make the old ones obsolete. Increasingly also, they associated with, or even became, market researchers, media planners, copy writers for advertising and so on. Another, Jones (1969), called them "technicians" of production and consumption, adding also a third group, the "technicians of consent" - journalists, editors, television personalities, film-makers and so on whose job it was to indoctrinate the public with values which make them into willing and contented consumers.

It is hardly surprising, that some designers - including some architects - should shrink from prostituting their skills in these ways. They refuse to be a party to any activity which inhibits the potential of other people to grow into what they conceive themselves to be. So increasingly we find designers who do not want to make design decisions, who believe, at most, that their task is to encourage other people to determine what they themselves want. That explains much current interest in citizen-participation (Burke, 1968), advocacy planning (Davidoff, 1965), and even charette, in which interested parties are brought, and kept together, sometimes for weeks if necessary, until they have thrashed out a design solution amongst themselves. (Shelton, 1971). Design method seems quite irrelevant in contexts such as these. Or, worse

still, it is seen as a "skill" which the "expert" will bring to bear in overriding the wishes of those he is supposed to be designing for.

Horst Rittel (1972) suggested that such methods were leading to a Second Generation of Design Methods, based on a number of premises, especially

1. "The assumption that the expertise is distributed ..... all over the participants ..... nobody has any justification is claiming his knowledge to be superior to anyone else's ..... we call this the 'symmetry of ignorance' ....."

and,

2. "The argumentative structure of the planning process ..... Thus the act of designing consists in making up one's mind in favour of or against various positions on each issue"

He wanted to heal the "artificial separation between the expert who does the work and the client (whose problem) the work is supposed to deal with". Rittel's Second Generation designer therefore is no longer an "expert" telling people what they should want as much as a "midwife or teacher" who "shows others how to plan for themselves".

At first sight, the record of Second Generation design methods is somewhat more impressive than that of the First Generation. A vast literature on Participation indeed has built up, from the first, theoretical statements (Davidoff, 1965) through Government legislation such as the (British) Skeffington Report of 1969, through a series of conferences held by the Design Research Society (Manchester, 1971) and with the Design Methods Group (London, 1973) and the American Environmental Design Research Association (EDRA). But theory is one thing and application quite another. In most places where it has been tried, participation actually works in the prevention, or at least the delay, of planning proposals which are going to harm people's interests. Perhaps the most spectacular result so far has been that of the anti-motorway lobby in Great Britain who - after a series of skirmishes with authority at the Archway in London, at Winchester and elsewhere - actually persuaded the Government to delay and perhaps even to cancel its entire motorway programme.

But when one looks for actual designs - that is the projection of new building (and planning) forms arising out of participation, they prove to be thin on the ground. The most publicised example worldwide probably has been Lucien Kroll's buildings for the University of Louvain. Kroll got the job because he wanted medical faculty and students to "participate" in the design. He "conducted" various groups who were given slabs of coloured plastic representing apartments, students' rooms, dining, social areas and so on. The groups then shuffled these around on a contoured model of the site and whilst the "dining" group kept insisting on a separate restaurant block, the others traded-off space within a series of building blocks so that each became an intricate, multi-use structure. One group devoted its attention to circulation routes, measuring distances within the various proposals with pieces of string. There is no doubt that given a framework of this kind - as to what the planning of buildings actually constitutes, non-architects could work within it and have great fun doing so. But the framework itself, of course, was set up by an architect, who also determined the division of the building into structural bays and hence the division of the facades into a grid, each square of which could then be filled in with the participation of future users and in certain cases, by the craftsmen who constructed the buildings.

The resultant buildings are amazing collages of rubble, brick, tile, asbestos sheeting, glass and glass-reinforced plastics, whose random appearance obviously expresses the ideal of participation. Visually they are most exciting, but at a more objective level, they present a great many problems. The study/bedrooms themselves are inordinately small, the circulation is extremely complex and above all, the building fabric itself is perversely opposed to any concept of sensible environmental control. One section of La Meme is covered with Miesian curtain wall (is called - for that reason - Les Fascists), but it faces south-west, the worst possible orientation for such a facade in terms of solar heat gain. The famous "solid" wall of l'Ecole has almost exactly the right amount of glazing for a south-facing facade in these lattitudes, yet it actually faces due north! All this results in gross discomfort for those who have to use these buildings. Yet the rich and intricate forms in which they are conceived could have been turned by Kroll himself to maximum environmental advantage - if he had possessed and insisted on exercising the necessary expertise. Instead of that - his insistence on total participation - for the best of possible motives - has resulted, sadly, in buildings which are less acceptable to their users than they could have been if a well-informed architect had exercised his personal skill.

Here, in Erskine's Byker and elsewhere, the Community could not participate until some vehicle was available for them to participate over. There are very good reasons for this, which show at their clearest in that participationist dream of how people should take responsibility for designing their own environment - the self-build squatter-housing of the Third World. This, naturally varies in detail from place to place, but in a typical case the laws of squatting are such that anyone who

succeeds in getting a roof over his head between 7.00 p.m. and 7.00 a.m. may keep it. So - having collected together bits of wood, cardboard, corrugated iron, asbestos and so on - the squatters take possession on the appointed day and quickly assemble their shacks. They work, of course, according to certain known typologies in terms of the size and shape of the spaces they enclose, methods of construction and so on.

Some squatters have no further aspirations, they establish a certain life-style, equating the work they can find (or want to do) with the resources they need for subsistence. Others see themselves as unwardly mobile and once they have got the necessary resources, begin to "harden up" their dwellings with concrete floors, brick or hollow-tile walls, corrugate asbestos roofs and so on. Those with even higher aspirations then cover the walls with stucco and paint them in pastel colours. They make them look - on a much smaller scale - like the architect-designed villas in the richer parts of the city.

This has many implications. They do not - be it noted - ever aspire to build for themselves the kind of multi-storey apartment slabs which Government agencies used to think suitable for them. But, given that they have small houses on the ground yet cannot reproduce the traditional house forms from their villages, they simply do not know what to do, nor do they have the imagination to see what is possible within the (meagre) resources available to them. So they derive at second-hand from what architects have offered; try to do for themselves what architects would have done.

So, in the last analysis, whilst functionalist/ behaviourist techniques cannot possibly work, citizen participation, advocacy planning and "charette" cannot work either. At best, they may identify a "highest common factor" of user needs, but, compounded by the existentialist designer's needs to become himself, they may mislead him into thinking other people want the same things. Marcuse, after all, wanted his workers to revolt, even though they seemed quite content. One wonders how he would have defined their needs.

So, both extremes of this particular spectrum First Generation or Second Generation - behaviourist or Marxist/existentialist clearly are deceiving themselves. It is quite impossible for either of them to avoid feeding their own preconceptions and values into the solution of design problems.

It is hardly surprising, therefore, that Landau (1965), Hillier, Musgrove and O'Sullivan (1972) have drawn attention to the parallels which may be drawn between the methodology of science - in Karl Popper's version - and the methodology of design. The scientist in deciding that certain phenomena are worthy of his investigation has, according to Popper (1963), also committed himself to them. He will start with hunches, guesses, conjectures about these phenomena and will tend to collect data which support his conjectures. It will be easy for him, in many cases, to make them self-justifying, but his prime responsibility under the circumstances, will be to test his conjectures as rigorously as possible and to disprove them if he can. He should also encourage others to do the same, so that if his conjectures survive all these attempts at refutation, he has a right to hold them, provisionally, as a theory, until a better one comes along. The designer can work by conjecture, as we saw in the case of the functionalists, who actually generated three-dimensional built form on the basis of their preconceptions, whilst with rare exceptions, the pioneer design methodologists failed conspicuously to prove that their Cartesian methods would actually work to produce real design solutions.

Once we adopt a conjectures and refutations approach - we can also admit again that there is no symmetry of ignorance. I may be ignorant of your lifestyle, but if I know my job as a designer I shall at least know more than you do about the technical aspects of your problems. If I use them as the bases for my design conjectures, then because these are based on what I know there is some chance, at least, that you will find them acceptable. And if they seem to conflict with your lifestyle, then of course, you can always reject them.

It seems to me, therefore, that Rittel's Second Generation of Design methods is now giving way to a third which takes a Popperian view of designing whilst recognising that within it there are people, experts, whose job it is to make the design conjectures. Their expertise most surely is needed if architecture and planning are to emerge from their present malaise but unlike their predecessors; from Le Corbusier to Disney - they do not know how people should live. They merely offer possibilities which people can take or leave.

Rittell obviously felt that the First Generation of Design methods was wrong. And so, as we have seen, did many of its exponents. The Second Generation was seen to be right - not to say self-righteous but that also had its limitations as we have seen. But the fact is that certain First Generation Methods actually work - and clearly have a useful working life in front of them. And certain Second Generation attitudes were based on the best of intentions. Freed from the cant and humbug which permeated the way they were presented, these too are well worth developing and incorporating into the Third Generation. This also, no doubt, will have its faults and its successes, but its emergence suggests that, in spite of everything, Design Methods are alive and well.

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DESIGN METHODOLOGY AND DESIGN METHODS

This is one of a series of reference sheets on topics of interest to the new student of design, published by the Design Methods Group as a service to the design professions. Copies are available without charge from:

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DESIGN METHODOLOGY

The term "Design Methodology" refers to the study of methods of designing. The study of designing may be a scientific activity, that is, design as an activity may be the subject of scientific investigation. However, most opinion among design methodologists and among designers holds that the act of designing itself is not and will not ever be a scientific activity - that it, that designing is itself a non-scientific or a-scientific activity. Persons who hold this point of view would describe the expression "scientific design" as an absurdity.

DESIGN METHODS

The term "Design Methods" refers not to the study of designing, but to procedures for the act of designing itself.

Design Methods are step-by-step, teachable-learnable, repeatable and communicable procedures to aid the designer in the course of designing.

There are several schools of thought about design methods, and each of these schools of thought is based on some underlying theory of what design is and how it is done.

One school of thought about designing is that it is problem solving in the general sense, and that methods for problem solving in any field are potentially methods usable by the designer. Methodologists and designers who hold this point of view would look for and use methods common to architectural design, city and regional planning, landscape architecture, product or industrial design, information system design, and even more distant areas like business management, criminology, library science, information science, operations research and systems analysis. This approach relates closely to General Systems Theory.

Another school of thought views each specific area of design, like architecture, product design, or landscape architecture, as being unique in many ways and as being amenable to treatment most effectively by methods that have grown organically out of each specific field. Methodologists and designers who hold this point of view would concentrate on tasks of developing and using field-specific methods.

One common thread that connects several points of view and several schools of thought is the analysis of designing into three fundamental types of act. These are:

Problem definition, problem formulation, or transformation

Variety generation, divergence, or idea production

Variety reduction, convergence, or selection

Specific design methods for use in the process of designing can be described in terms of these three phases or stages. An evaluation system, for example, would be a system or method that included stages one and three, that is, problem definition and variety reduction.

Some methods encompass all three of the stages or phases listed above. Such methods would provide for the three activities of problem definition, variety generation, and variety reduction. An example of such a method is the dual graph approach to floor plan generation and evaluation. This approach provides procedures for defining the design problem in terms of relations among spaces being planned and among these spaces and characteristics of the exterior environment. The method then goes on to specify a procedure for generating many alternative floor plans that satisfy the same program or problem definition, and finally it provides step-by-step procedures for evaluating any floor plan, including those generated using the method, against the specified program or relationships. A method like this would be described as a comprehensive method, dealing with all three stages of the design process, that is, with problem definition, variety generation and variety reduction.

Some general methods that are taught in courses on design methods are described below. For each method, the stages or phases of the design process are described as they are dealt with by the method.

Evaluation methods

Evaluation methods are basically methods combining problem definition and variety reduction. Evaluation methods may be used to compare various alternatives with each other, or to compare individual items with some independent standard or norm. The normal outcome is a ranking of alternative courses of action, or a decision to accept or not accept some specific proposal.

One evaluation method is cost-benefit analysis. This method defines a problem situation in terms of monetary costs and benefits associated with various courses of action, and evaluates alternative designs or courses of action in terms of excess of benefits over costs. Many designers feel that this approach is inappropriate to situations in which important human values are involved.

Another evaluation method is the "Design-by-Objectives" method, which has appeared under many different names. One name is the "Alpha-Beta Model." Another is "Multiple Attribute Utility Theory", or "MAUT." There are several other names as well.

A third evaluation method is based on the psychological technique called the semantic differential. The design use of this approach is referred to as "image profiling." This method deals with matters of image, feeling, mood, and symbolism.

"Creativity" methods

These are basically methods combining the phases of problem definition and variety generation. Many such methods have been published and promoted during recent years, partly due to the fashionability of being considered "Creative."

One "creativity" or idea production method is the morphological approach, developed by Fritz Zwicky, a famed astrophysicist. This approach is based on the forced bringing-together of ideas in the manner described by Arthur Koestler in his book, THE ACT OF CREATION.

Another group of idea production methods includes the brainstorming approach developed by Osborne and a related technique called Synectics developed by Gordon.

Problem Definition Methods

Some methods focus primarily on the problem definition stage, although it is inevitable that in defining a problem one also begins to specify criteria for evaluating potential solutions.

One problem definition approach was widely discussed and published in the 1960's, stimulated by Christopher Alexander's book NOTES ON THE SYNTHESIS OF FORM. This approach uses a matrix format to display efforts of hierarchical decomposition of programmatic components in a design problem. A great deal of activity, energy and effort produced very little that could reasonably be called designing, and the approach is little used now, Alexander himself having declared that it was not a valid approach. Unfortunately, the book still circulates to trap the efforts of the unwary who have not yet gotten the word that the method has been disclaimed.

Scenario writing is another approach to problem formulation.

Task-oriented methods

Many methods currently taught and used in design are defined by the tasks that they address, and include all three phases of the design process.

Some task-areas that have generated methods are space planning, scheduling and allocation, and information and data handling.

Some representative space planning methods are the traditional overlay method typified by Ian McHarg's work, up-dated overlay models that allow weighting and encourage re-iteration, traffic-based space planning methods such as CRAFT and CORELAP and related methods, and the dual graph approach.

Space planning methods deal with such tasks as floor planning, the planning of neighborhoods, urban and open spaces, and even cities and regions.

Scheduling and allocation methods are typified by PERT (Program Evaluation and Review Technique), CPM (Critical Path Method), and related methods. The entity allocated is usually time, as in PERT-TIME, but may also be money as in PERT-COST.

An Overview

Some of the things that design methods accomplish are:

1. Encouraging thoroughness in considering all the parts of a problem
2. Exposing value judgments underlying environmental design decisions, so that persons whose interests are affected can consider whether or not the value implications of planning and design decisions are acceptable to them
3. Making understandable the bases of design and planning decisions, so that:
   a. Teamwork is facilitated
   b. The delegation of tasks to employees or consultants is facilitated
   c. Communication with clients is facilitated
   d. Defending decisions against challenges and lawsuits is facilitated
4. Recording the ways in which design and planning decisions are made, so that:
   a. The experience gained on a project can be recalled for use in future projects (either as a model or as something to avoid)
   b. The reasons for decisions can be reviewed for purposes of later remodelling and modification projects
   c. Both the designer and his firm can review past work as a means towards continual professional growth, learning and improvement

Design methods are useful both in learning to design and in dealing with problems of greater complexity, novelty and scale than could be successfully dealt with on a purely informal, implicit, intuitive manner.

One of the major topics of discussion in the field of design methods is the direct participation of users or clients in design decisions. This grows from a reaction against professional arrogance on the part of the designer, especially with regard to attempts to prescribe how people ought to live, or what their values ought to be.

Some things that design methods DO NOT do are:

1. Solve problems automatically in a "black box" fashion, saving the designer/planner the trouble of exercising intelligence or judgment.
2. Pre-determine the solution(s) that will be reached in any given problem
3. Replace or restrict the exercise of intuition or human judgment
4. Force design or planning decisions into quantified or numerical forms - one major school of thought in design methods is based on the judgment that quantification is not a suitable mode of thought for many design and planning decisions.

A thumbnail description of design methods is that it is "organized common sense" for designers and planners.

The main periodical in the field is DESIGN METHODS AND THEORIES, published quarterly by the Design Methods Group.

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PROFESSIONAL PRACTICE AS A SMALL-SCALE MASTER BUILDER

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BUILDING VALUE AND CAPITAL

The Components of Building Value

The components of building value are land, labor, materials, and surplus value created by combining land, labor and materials. The surplus value referred to is that at the level of the building itself; materials, once they are processed or moved, include surplus value in themselves, but this is included in materials cost at the building level.

The components of surplus value at the building level are contractor's overhead and profit, designer's overhead and profit, value added by design, market appreciation, and unique supply-demand factors in addition to market appreciation.

Value-added-by-design is in the form of increased market value due to two general areas of value, aesthetic and functional. Aesthetic value-added-by-design includes such matters as conformity to fads and fashions, surprise value, and taste. Functional value-added-by-design includes such matters as efficient use of space, materials and energy. Efficient use of materials obviously covers the period of construction, but might also be extended to include questions of recycling, modification or demolition. Efficient use of energy must include at least the periods of construction and use, but might also be extended to consider matters of recycling, modification and demolition.

Market appreciation must include at least two distinctly different components. One component of market appreciation is the inflation/deflation component, and the other component is absolute changes in value aside from the inflation/deflation component.

Supply-demand factors may increase or decrease market value completely aside from general market appreciation.

The Uses of Capital

Capital is useful for the purchase of land, the purchase of labor, the purchase of materials, and the purchase of services falling within the category of surplus value. The amount of capital required in a given project can be manipulated to some degree by bargaining and negotiating over the prices of land, labor, materials and services, and to some degree by providing such things as labor and services with one's own effort instead of purchasing them. The amount of capital required can also be reduced by using materials containing less labor and surplus value, and making up the missing processing and movement through one's own efforts.

Sources of Capital

Capital can be accumulated by adding labor to materials and/or land in order to create surplus value, which can then be either consumed or invested as capital; by working for wages and investing the difference between the wages and survival costs; by borrowing; or by holding property during periods of market appreciation. In all these instances, capital is derived from existing or predicted surplus value.

When obtaining working capital through borrowing, the lender usually requires some form of security or other basis for his confidence in the borrower. Some loans might be made purely on the basis of confidence. Two examples of confidence-based loans are a "signature loan" and a loan made on the estimated value of a design yet to be realized in physical form. Examples of loans made on the basis of some security are loans for which the legally-encumbered collateral might be land, buildings, furniture, automobiles, etc. When a security-based loan is made, for example on a building, it is usually based on the net worth of the security. The total value of the security is its asset value and the liens or encumbrances on the security are the liabilities associated with it. The net worth of the security is the asset value less the liabilities.

DESIGN AUTHORITY AND LIVELIHOOD

Two factors are prominent as basic sources of frustration (or even ruin) to the contemporary designer. These are the inability of the designer to carry out his design intents, and the inability of the designer to derive a livelihood from his chosen work.

The frustration of not being able to carry out one's design intent can be traced to the sources of authority in design decisions.

The frustration of not being able to derive a livelihood from designing can be traced to the way in which building value is distributed over the participants in the building process.

The Sources of Authority in Design Decisions

Design decisions ultimately rest with the person who has some legal right to make them. The legal right to make design decisions is traceable to two sources, legislated regulations and the ownership of capital. Legislated regulations dictate design decisions in the form of zoning laws, building codes, and other forms of regulation in areas such as fire safety, energy use and so on. The decisions dictated from these sources are more often than not minimum standards rather than specific decisions.

Decision authority resting on the ownership of capital may be exercised directly, or delegated. Delegation may be directly to a designer who has persuaded the owner of capital to delegate such authority, or delegation may be indirect, through paid employees or consultants to the owner of capital who intervene between the designer and the owner of capital.

Sources of Livelihood in the Process of Design and Building

The potential ways in which participants in the building process can derive a livelihood from it can be analyzed out of the components of building value. The finished building is a marketable product for which money can be collected either for its sale or its lease. The ultimate source and test of building value is quite simply the question of what the market will pay for its purchase or its use.

Livelihood can be derived from the building process by the ownership or providing of one or more of the components of building value, assuming of course that the market is ready to pay for the building and to cover the value of the components of building value in question.

Thus, it can be seen that livelihood can be derived from the process through the ownership of land, the providing of labor, the ownership of materials, and/or through the ownership of the various components of surplus value.

The contractor normally makes his livelihood through the ownership of the components of building value referred to as "contractor's profit and contractor's overhead." He gains ownership of these components of surplus value through a contract with the owner of the building.

The designer normally makes his livelihood through the ownership of "designer's profit and designer's overhead." He gains ownership of these components through a contract with the owner.

The owner normally gains his livelihood through the remaining components of surplus value; that is, value-added-by-design, market appreciation, and supply-demand factors. The owner's livelihood may take the form of sale profits, lease income, or his personal use of the building.

Other participants in the building process derive their livelihoods from the sale of labor, the processing, movement and sale of materials, and the sale of land. The seller of land derives his particular part of building value from market appreciation and from surplus value created by working to improve the land.

The designer's problem is that his share of the value created in the building process is often rather small. In most building, indeed, there is no separate designer as such, but low-level designer's profit and overhead is hidden in some other fee, such as contractor's overhead.

During a period of market appreciation, most of the value to be derived from the building process will be in the form of appreciation as a part of surplus value. Contractor and designer usually collect their fees based on a contract price that does not include market appreciation, even for the period of construction. The owner "owns" appreciation, value-added-by-design, and supply-demand factors. It is in the ownership of these components of surplus value that the major source of livelihood in the building process is to be found.

The Frustrations of the Designer

The design frustrations and financial frustrations of the designer can be traced to his position with respect to the components of building value, the uses of capital, the sources of capital, and the sources of authority in design decision.

With respect to the components of building value, the designer practicing as the architect now practices has limited access to only a very small part of the value of the buildings that he designs. First off, he sells services for a fee rather than selling a product to a user in a supply-demand market situation. Indeed, the nature of the building market now makes it quite feasible to dispense with the services of the designer in most projects. The architect contracts for his services in return for a fee that must cover his overhead and his profit. This fee is as often as not a percentage of the contract price of the building, not including land, and sometimes not including such things as utility systems that may make up half the cost of the building. There is scarcely ever any contract provision to reward the designer for the value that he adds by design, and the designer certainly has no legal claim on the appreciation of the building in an appreciating market, since it is the owner who "owns" such things as value-added-by-design, appreciation, and supply-demand factors. The dispensability of his services and the small part of the building's value that he "owns" are the sources of the designer's financial frustrations.

The ultimate source of authority in design decisions is the ownership of capital. The designer normally owns none of the capital beyond his agreed upon fee; therefore, the designer has no access to authority in design decisions beyond what he is able to obtain through persuasion and delegation, and that is always second-hand and by-the-leave of the owner of the capital. That is the source of the designer's design frustrations.

Costs Incurred by the Designer

Two major areas of cost incurred by the designer are the costs of communication and control between owner and designer and the costs of communication and control between designer and contractor.

The costs of communication and control between designer and owner take the form of information gathering about the owner's wishes and needs, the presentation of the designer's intents in forms the owner can understand, and the production of a sufficient number of proposals to gain the owner's approval.

The costs of communication and control between designer and contractor are in the form of construction documents in sufficient detail to stand up in court as being legally binding on the contractor. Such documents are often an order of magnitude more costly than the set of documents that would be necessary simply to carry out construction.

The costs of the two activities described above are in the form of money (the designer's overhead) and can also be in the form of stomach lining and coronary arteries. A common lament is that the above activities become so all-consuming that the architect who hoped to be a designer never has time to design.

The Tradition of the Master Builder

In past centuries, there was a specific professional role titled "master builder." The exact arrangements varied in time and place. One example of the master builder is described at length in Henrik Ibsen's play, THE MASTER BUILDER. Ibsen's master builder was a professional who designed and built buildings for a client who was the building's owner. This version of the master builder would be referred to as the designer-builder. This version is proscribed (forbidden) by the current code of "ethics" of the AIA (as of this writing, in early 1978). This proscription by the AIA is ostensibly based on the fear that the designer and the builder being combined in one person or firm might result in decisions favorable to the designer-builder and unfavorable to the client, in such areas as quality control, materials, etc.

The designer-builder version of the master builder is in a position to avoid some of the frustrations and costs of the designer that were described in the preceding section. This master-builder sells a product in the market, rather than selling a service for a fee; however, he still does not own the capital involved in the process, and therefore is limited in his access to design authority, and he would normally provide his product for an agreed-upon fee that did not reflect the surplus value factors "owned" by the building's owner.

The ultimate freedom to be found in the master builder concept comes from taking the arrangement one step further and practicing not as designer, not as designer-builder, but as owner-designer-builder. This approach overcomes most of the frustrations of the designer, both design frustrations and financial frustrations, and helps the designer to reduce communication and control costs to those directly necessary to the building process. The design frustrations are overcome to the degree to which the designer can own the capital involved. The financial frustrations are overcome by the designer's ownership of all the components of building value, and most especially by his ownership of the surplus value components of appreciation, value-added-by-design, and supply-demand factors.

The difficulty is, of course, gaining ownership of the necessary capital. Two factors open a path to the ownership of capital by the designer; both factors would probably be found shocking by our grandfathers: easily-obtained credit and rapid market appreciation in an era of inflation.

By intelligently manipulating credit and appreciation, the designer can start small, work hard, maintain his independence and gradually accumulate capital with which to finance his own projects. The key to capital accumulation is the same for the starting master builder as for a developing country: combine land, labor and materials to create surplus value, and then avoid consuming the surplus value created in order to channel it into investment capital. The formula is a nearly child-like platitude: maximize production, minimize consumption, and re-invest the difference. This course of action, efficiently carried out in a period of easy credit and rapid market appreciation, is the key to a mode of professional practice in which the designer can gain the independence that most designers claim to desire, while at the same time managing to earn a living. A corollary to the approach is that it works in a situation in which one starts small, and in which one may well choose to stay small, both in the scale of operation and in the scale of the buildings produced. This suggests a related topic that the reader might wish to explore, starting with E. F. Schumaker's SMALL IS BEAUTIFUL: ECONOMICS AS THOUGH PEOPLE MATTERED.

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THE DESIGN METHODS GROUP

The Design Methods Group, founded in 1966, exists for purposes of communication and education in the subject areas of theories and methods of design.

The topics included in the DMG's interest areas are:

Design Methodology, or the study of methods of designing

Design Methods, or the development and application of step-by-step procedures to aid the designer in the process of designing.

Theories of Design and Planning

The membership and publications of the DMG center primarily in the environmental design and planning professions, but this is not an exclusive focus, and engineering, industrial and information system design are represented among the membership and among recent articles published in the journal.

The DESIGN METHODS GROUP is a non-profit organization with tax exempt status in the U.S.A. through the Internal Revenue Service and in California through the Franchise Tax Board.

The DESIGN METHODS GROUP has members in 38 countries and in most states of the United States. The journal, *DESIGN METHODS AND THEORIES*, goes out to a majority of the environmental design schools and libraries in the world.

The primary activities of the DESIGN METHODS GROUP are the publication of the journal *DESIGN METHODS AND THEORIES*, the holding of international conferences on design methods and theories, and the conducting of competitions on various subjects of interest in the fields of design methodology, design methods, and theories of design and planning.

CURRENT OFFICERS OF THE DMG

Donald P. Grant, Ph.D., Professor of Architecture and Environmental Design, California Polytechnic State University, San Luis Obsipo
Chairman of the DMG; member of the Board of Directors

Jean-Pierre Protzen, Associate Professor of Architecture, University of California, Berkeley
Editor of the journal; member of the Board of Directors

Elisha Novak, Department of Architecture, University of California, Berkeley
Associate Editor of the journal; member of the Board of Directors

Horst W. J. Rittel, Professor of the Science of Design, University of California, Berkeley, and Director of the Institute for the Foundations of Planning, University of Stuttgart
Member of the Board of Directors

Elizabeth Falor Bexton, Berkeley, California
Member of the Board of Directors

PUBLICATIONS

The DMG began a sequence of publications in late 1966 that has continued through the present, with several title changes. The title changes are a little bit confusing, we confess, but have moved in the direction of the permanent title now used, DESIGN METHODS AND THEORIES, as being descriptive of the subject matter of the journal rather than of the identity of the publishing organization.

The publications of the DMG have been:

THE DMG NEWSLETTER Vol. 1 (1966-67) - Vol. 5 (1971)

THE DMG-DRS JOURNAL:
DESIGN THEORIES AND
METHODS Vol. 6 (1972) - Vol. 9 (1975)

DESIGN METHODS AND
THEORIES Vol. 10 (1976) - present

In addition to the above regular publications, there have been two irregular publications at various times during the past twelve years. These were the DMG OCCASIONAL PAPERS Numbers One and Two and the DMG. BULLETIN, published irregularly from 1972 through 1975. These publications have been discontinued under the pressure of budgetary limitations in an inflationary period.

CONFERENCES

The DMG has sponsored three conferences on design methods and theories.

The first conference was held in Cambridge, Massachusetts, in 1968. Proceedings of this conference were published by M.I.T. Press under the title EMERGING MEHODS OF ENVIRONMENTAL DESIGN AND PLANNING, edited by Gary Moore.

The second conference was held in London, England, in 1973. Proceedings of this conference were published by the University of Strathclyde, Glasgow, Scotland, and are unfortunately now out of print.

The third conference of the DMG was held in Berkeley, California, in 1975. Proceedings of this conference were published partly in the journal during that year and partly as separate publications which are now out of print.

The next conference of the DMG has not yet been planned, and is an open topic.

COMPETITIONS

The DMG has sponsored two competitions, each with a prize of $1,000 for the most outstanding paper submitted on a specified topic.

The first competition, conducted during 1972-1973, was on the topic, "The application of systematic methods to designing." The winner of this competition was Professor Hanno Weber of Washington University, St. Louis, Missouri. This competition was supported by a grant from the Graham Foundation for Advanced Study in the Fine Arts.

The second competition, conducted in 1974-1975, was on the topic, "Design Methods for Energy Conservation in Buildings." The winner of this competition was Professor B. Paul Wisnicki of the University of British Columbia. This competition was sponsored by the National Bureau of Standards.

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