Information and designers

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Information technology and information transfer are prominent among current preoccupations of the scientific research community. Parallel concerns exist in design research, and are as important as they are topical. Questions about the integration and application of knowledge to design begin in design education and continue in design practice. In this paper we discuss these assertions and review some of the research that has been conducted in the area with reference to building design. We go on to question whether the research is correctly focused, and conclude by emphasizing that the initiative for studies of information in design will come only from the research community.

Keywords: Design information, information transfer, research

1982 was designated UK Information Technology year, and a national campaign was launched by the government to promote a broader appreciation in industry and among the general public of the opportunities and benefits of the new technology. This growing development of information technology has been product-led, dependent on the current revolution in microelectronics. The potential of computer power to make more information more readily accessible to a wider audience than previously conceivable is clear.

Although the technology to improve information transfer is developing extremely fast, there is nevertheless rising concern about the transfer of information between the academic world and industry. For example, the SERC has recently commissioned a study to investigate the formal and informal mechanisms by which scientists and engineers in industry acquire technical information, with a view to determining the optimum way of disseminating the future output of academic engineering research to industry. In 1981 Appleyard at the opening ceremony of the first EEC seminar on 'The transfer and exploitation of scientific and technical information' stated:

> One thing is certain, we cannot afford to produce scientific and technical knowledge, an expensive raw material, without seeing that it is fully scrutinized for optimal use.

And in the 1982 Thompson Lecture at the Royal Institution, Bragg[1] drew attention to the differing attitudes of academics and industrialists, characterizing them as knowledge-orientated and product-orientated respectively, and to the communication gap that results from their differing perspectives. While he gave due recognition to the world of academic knowledge and freedom, he stressed the need to bridge the communication gap, and recommended that all academic departments prepare dossiers of current work. The instructions he had given to his research group in industry were unequivocal:

> Your work is completely wasted unless a designer draws a line in a different place as a result of it. And it is your job, not his, to tell him of your results and persuade him of their relevance.

Research into how buildings are used, how people act in them, react to them, and assess them, has been going on

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for at least the last two decades. Much research effort and increasing resources have been directed towards understanding the man/building system. As a result behaviour/environment researchers have a growing understanding of significant parts of the man/building system, which may contribute to improving designs. However, the relationship between this body of knowledge about building use and the design professions remains comparable to that described by Appleyard and Bragg; the information rarely seems to find its way through to architectural design and to exploitation by designers.

Design researchers are now recognizing that no matter how good information is from an academic, scientific or technical point of view, if designers do not choose to access it, cannot access it or cannot apply it readily, then it is of no value to them. This highlights the importance not only of generating the information in the first place, but of obtaining a better understanding of the design information transfer process. Such concerns are not entirely new in architectural teaching and practice; in architectural education the relationship between academic information and the design process is a topic of frequent debate, while information provision for designers in practice has itself become a topic for research. In the next two sections, we discuss the situation in both architectural education and practice. We then go on to question whether the present focus of research is the correct one, and conclude with a discussion of the implications for information transfer research.

THE EDUCATIONAL CONTEXT

Most of today's architectural courses have developed from the 1958 Oxford Conference on Architectural Education. In respect to the present paper on design information transfer, these courses all have one thing in common — their aim to integrate necessary specialist subjects, including science, technology and the social sciences (all subjects relating to a better understanding of designing for building use), into the more professional and design aspects of architectural education. The implicit assumption underpinning these courses is that such a scientific understanding is necessary in order to produce better design or at least avoid major mistakes. While these aims are laudable, a pilot study by Cardona *et al*[2] revealed that very few schools of architecture can show how these specialist subjects have been fully integrated into the architectural design aspects of the course. As Broadbent[3] pointed out,

> integration has to be demonstrated in the working methods of an architectural school

and not just appear in the formal course documents.

The conclusions of Cardona and her colleagues are confirmed by the stated worries of several architectural educators. Specialist architectural lecturers from a number of disparate areas, from acoustics through to history, have all indicated concern over the unsatisfactory nature of existing attempts at information transfer and integration of their specialist disciplines within generalist design. Many authors have documented their individual, and often unsuccessful, attempts to correct what appear to them to be the underlying problems (see review by Powell[4]). Clearly, end-of-year examinations in schools of architecture do indicate that some information has been transferred from specialist to student, but most importantly final portfolios often reveal the limited extent to which such understanding has made its way through to the students' design skills. Perhaps the wrong information is being taught in the wrong way. Over the years specialists have tried a range of educational techniques including laboratories, simulations, gaming and computer aids, with varying degrees of success, but the content of their message has remained very much the same. It may be this that is causing a failure of total information transfer for exploitation. It is our view that specialists may be putting undue emphasis on teaching the 'know-that' information of their discipline, rather than attempting to provide an educational context which will promote the architectural design skills of 'know-how'. The hope of these specialists seems to be that if students are made aware of a coherent and scientifically devised body of knowledge and are able to define units and make measurements, they will also eventually be able to integrate that knowledge into their design processes, and thence be able to solve design problems. All too often the student is left alone to work out how to perform this magical integration which most specialists seem to have difficulty in performing themselves.

Despite the occasional use of various educational media, many specialists rely entirely upon lecturing techniques to teach the elements of their discipline. Lecturing is often chosen because it appears cost effective, in a context where one specialist might be responsible for the education of 200 students. However these specialists' desire for elemental efficiency undoubtedly has two major disadvantages. First, it fails to provide educational contexts which promote the exploration of ideas to the extent that students will acquire the sort of insight necessary to enable the creative and original responses required in design. Second, the thorough going fragmentation of design, into the subdisciplines promoted by such teaching techniques, often forces the young designer into inappropriate and compartmentalized thinking about design. The young designer often finds it difficult to dissolve these subtle yet powerful boundaries surrounding the different parts of this compartmentalized knowledge. Such an education sorely limits young designers' design strategy, and their possible solutions.

It is easy to blame this situation on the specialist, but one has to remember that few specialist teachers have ever practised as architectural designers. As a result they may not have the confidence to educate from a design base. And they may lack the understanding to know how information actually fits into, and is used, in practice. The next section is a review of some research studies that have asked just that question.

INFORMATION AND ARCHITECTURAL PRACTICE

The 'rushing torrent of information' faced by architects was being written about in 1938, according to the Alwyn Lewis Memorial Lecture given at the RIBA by Dargan Bullivant[5]. Although efforts to standardize, coordinate and classify technical information appeared a substantial achievement by the profession in 1964 with the acceptance of the SFB classification system, the information explosion, and a phenomenal increase in legislation, make information quantity and quality a recurrent preoccupation in building design. Accordingly, a number of research studies have been carried out into sources of information and how information is used.

A major study completed in 1971 by Goodey and Matthew[6] at the Institute of Advanced Architectural Studies (IAAS) at the University of York, was commissioned by the Building Research Establishment (BRE) to improve the impact that BRE literature had on architects. The study had two parts: information flow in architects' offices, and architects' preferences among presentation styles. The sorts of questions answered by the study of information (literature) flow include:

- the circulation of incoming information to staff
- the means of exchanging information within the office
- the origin of decisions about retaining or throwing out unsolicited literature
- the form of classification of the office library

Attention is also drawn to the private collections of literature which individual designers keep separate from the office library. A rank order of sources of information (trade literature, journals, etc.) used by architects was compiled, with trade literature and journals being the two most popular. In the second part of the study, two BRE Application Papers were drawn up in different presentation styles:

- visual
- literary key words
- problem-solving
- matrix

They were sent to architects' offices and followed up by interviews or postal questionnaires. The researchers were thus able to comment on architects' reactions to presentation style in general, and on graphs, tables, photographs, and text in particular. From the results of the study the researchers made 20 recommendations for information presentation, emphasizing brevity, clarity, visual illustrations (well coordinated with the text) and architectural vocabulary.

In an interesting contrast with the previous study another BRE commissioned study at the IAAS was completed in 1982 by Mackinder and Marvin[7]. This stepped back from looking only at information to look rather at the interaction between the designer and information by studying design decision making in architectural practice. Twelve jobs were studied, in six design offices, covering all the stages of design from inception to working drawings. The researchers were able to follow the designers' daily activities, the development of designs from outline concept (usually by an experienced designer) to details (usually by less experienced designer), communications between staff, fragmentation of tasks and irregular progress of design schemes, and lack of recording of decisions. The researchers reported a remarkable unwillingness on the part of designers to consult written data, and a concomitant preference for relying on experience, in part because consulting written data was seen as time-consuming. Written references were mainly used to check points or to find solutions to ideas already generated by the designer. Technical references were more frequently used than general design references. Official literature was generally avoided unless essential, as were the Building Regulations. Clearer and better illustrated literature such as that produced by the trade associations was preferred. The recommendations of the first IAAS study about presentation were endorsed.

Lera[8], in a study sponsored by the BRE, monitored three intensive design exercises carried out under controlled conditions. Two were with multiprofessional design teams monitored by the presence of an observer. In the third, individual architects were video-recorded speaking aloud while sketching a design for a house. While in the third exercise a very personal design process was observed with the designer relying on his own preferences and values to guide decision making, the first two exercises revealed reliance on the brief and technical references by all members of the teams. The team members brought their personal reference collections to the exercise. Also interesting in one of the team exercises was a reversal of the traditional design process whereby the architect produces a sketch scheme which is worked on by consultants; here the architects waited to get information from the other professionals before drawing up their sketch plans. In addition to the brief, regulations and technical information, Lera noted a number of other influences on the design activity:

- the designers' personal repertory of designs
- previous experience
- published precedents
- stereotype solutions and imagery
- self-imposed goals
- rules of thumb
- simulations
- the effect of forms of representation
- the increasing levels of detail in which decisions are taken

Among the recommendations was the need for a means of keeping records of key communications, decisions and assumptions; matching information to varying needs of designers at different stages during the design process (approximate answers and comparative costs are required in the early stages); more detailed appraisals of buildings

in journals and possibly the introduction of comparatively analysed stereotypes e.g. cost and performance information in the publication of standard house plans.

Ritter[9] has proposed that there may be a series of seven factors which information needs to satisfy if it is to be successfully applied. They are:

- relevance
- quality
- designers' perception and acceptance of need
- identification (can the information be identified?)
- costs, resources and availability of acquisition, storage and retrieval
- understanding (presentation)
- applicability

Like Lera, Ritter has argued that designers need information in different forms at the different stages of the design process and suggests illustrations of a stock of model solutions (exemplars or stereotypes) or other images at the design concept stage. Ritter also catalogued sources of information for designers (official, publishers, promotional, inhouse, independent) and analysed the publications of some major sources of building design information, showing the different emphasis on background information, whole buildings, elements, supplied items and performance factors by journals, text books and official sources.

Reports on architects and information were prepared for the American Institute of Architects and the National Bureau of Standards by Burnette[10,11]. In his first report[10] he drew attention to the constraints on the architect's access to information, which derive from his status as a professional, his background, work habits and practical circumstances. He expressed the view that architects rely primarily on information and services provided by the AIA, but are largely unfamiliar with institutional services, poorly disposed towards formalized information search procedures and unable to support the cost of many desirable services. They also tend to perceive research as either inaccessible, unavailable or not in a usable form. In his second report[11], Burnette reviewed traditional forms of obtaining information e.g. journals, company representatives, catalogue files, and drew conclusions about:

- the need for updating information
- consistency
- conciseness
- use of operationally useful performance orientated description
- accuracy, precision and awareness
- indecision of feedback (about products)

He commented on the advantages and disadvantages of telephone reference and search services, tailored abstracts, digests, data sheets, checklists and pattern specifications.

Burnette described exemplary formats to assist search and identification, including telephone referral and search services, indexing and classification systems and directories. He also described exemplary formats for ready reference, covering tailored abstracts, digests, data sheets, checklists and patterns. There is a short section in the report on face to face exchange of information, self-help guides, learning packages and exhibitions.

While most of the above studies have been about the information available to designers, and its quantity, quality and form, there are also three studies of designers which emphasize a different relationship between designers and information. Asprino, Broadbent and Powell[12] reported a comparison between the design processes of a team of two architects and a final year student of architecture. The two architects and the student were designing schools. In defining the main objectives of the problem, the student designer concentrated on three principle areas:

- child psychology
- educational philosophy
- teaching methods

and consulted relevant sources in order to develop an understanding of how children learn and how schools function. In contrast to this, the professional team, though paying attention to general needs, seemed quickly to define their principle objective as the design of an adequate external enclosure to ensure effective environmental control. None of the sources of information they consulted appeared to relate to learning or education, and it is therefore questionable whether an improvement in presentation format of information about education would be likely to lead to more use being made of such information. If architects are predisposed not to consult information on a certain topic, it seems doubtful that altering the format will affect those predispositions.

Powell and Nichol[13] reported open-ended interviews with 30 practising architects or engineers to explore their information needs in the area of energy conservation, and to record their experiences in trying to apply technical information. Designers' opinions of research documents were critical of the scant regard apparently given to the way information is used in design, where problems are either dealt with quickly, parsimoniously (and, in the designers' eyes, adequately if not optimally) or simply ignored. Designers stressed the value of having confidence in the information through approval by a recognized official body or guarantee by a reputable manufacturer. 95% of the interviewees had a private library of information with which they had become thoroughly familiar.

Energy conservation transcends traditional professional boundaries, yet little evidence emerged of successful team collaboration or indeed any enthusiasm for it. Nor was there evidence of interest in formal continuing professional development (education); casual reading of technical journals seemed to be its extent. Lack of personal and financial incentives were cited as reasons. Only where a special commission stressing the incorpora-

tion of particular knowledge had been undertaken, was the necessary expertise gained. Changes in legislation might alter standards but without influencing strategies or expertise positively; tackling symptoms rather than causes.

The authors concluded by describing a proposal to develop a computer-managed learning (CML) system intended for the practitioner during the design process, managing the designer through information and technical issues and providing reinforcements and direction.

Cooper and Crisp[14] interviewed 24 architects and engineers responsible for designing award-winning buildings, in a study of barriers to the exploitation of daylighting in building design. For some of the interviewees the exploitation of daylight as part of an energy conscious design strategy appeared desirable; the provision of more information and better design aids would be relevant to them. Others, however, expressed indifference or even hostility towards the use of daylighting because of its variable quantity and concomitant negative influence on interior lighting and thermal balance. Cooper and Crisp noted the need for different approaches to designers with different predispositions about daylight. For some, better design aids will be adequate, but for those predisposed against exploiting daylight, promotional or educational campaigns are more appropriate.

It is to be expected that those organizations which publish building design information, seeing the failure of such information to be applied as extensively as hoped, believe the fault lies with the presentation of that information. However, there are many forces at work when architects are deciding on their information sources. Although such decisions can be represented as a simple equation relating value of information to time, cost and ease of retrieval, there may be belief systems and predispositions held by designers which have such an overriding effect on perceived value of information that the time, cost and ease of retrieval factors are greatly reduced in significance.

WHICH FOCUS FOR RESEARCH — INFORMATION OR DESIGNERS?

The studies reviewed leave much unanswered. Not least among untouched questions is the direct consideration of why attention is currently being focused on 'information' itself. Partial answers may be gleaned from what has already been said. Reference has been made to two factors — the rapid rate of technological innovation in the construction industry, in building materials and products, and the increasingly wide and complex range of information available about such developments — both of which are seen as causing problems for designers.

Likewise, it has been noted that technical failures in buildings which can be attributed to defects in their design, rather than their construction, could often be avoided if designers consulted existing and available information. Because of such circumstances, Powell[15] suggested that designers need to adopt 'coping strategies' which will enable them to deal effectively with 'information transfer'. But it could also be argued that focusing on information's structure, content and presentation, and on its storage, accessibility and use, is itself a coping strategy, a defence mechanism which works by directing attention away from designers themselves as well as away from the specific socioeconomic and political circumstances in which they operate. Once viewed from this perspective, it is then possible to suggest a particular explanation for present interest in information-orientated research.

An outline of this explanation would take the following form. In the decade that has almost passed since MacEwan[16] indicted the British architectural profession for having abandoned its social responsibilities and for having cut itself off from public opinion, public esteem of architects in particular (and of the construction industry in general) has not noticeably risen. Indeed, Saint[17] recently warned:

> Architecture is still a liberal profession and attracts people whose thoughts transcend self-interest. But if commercialization continues apace that can hardly be maintained for long. If the next few generations of architects cannot define some new relationship between the public and the process of building, they will lose that special sense of identity which the profession has treasured for so long.

Instead of attempting to redefine architect's social responsibilities, the profession's establishment has sought over the last decade to reestablish faith in its members' technical competence. To this end, it has sponsored a host of reports e.g., Royal Institute of British Architects[18], Powell, Napper and Territt[19]; Hedge[20,21], York Centre[22,23], RIBA[24]. This emphasis on technical competence is not unintelligible since technical failures in buildings have, in part at least, been responsible for the profession's low public esteem. The vehicle chosen to increase architects' competence was 'continuing education', later rechristened 'continuing professional development'. Recently Mackinder and Marvin[27] posited a direct connection between architects' use of information and their continuing education, when they remarked:

> Older designers are able to rely far more heavily on all types of experience than less experienced designers, who tend to spend a great deal of time seeking out and consulting a wide range of written information sources. Experience helps to reduce design time therefore, but may be seen as an alternative to the study of current literature and consequently continuing professional development may be neglected.

Two basic premises underpin the information orientated research described above. First, if information is well-structured and well-presented and has relevant content and if it is stored accessibly, then designers will use it. Second, if designers use such information, they will produce 'better' buildings.

These premises, in turn, seem to arise from a specific set of assumptions and beliefs. Among these can be identified a belief that past design practices were (and

current practices possibly remain) inadequate, and an accompanying belief that future practices should be better. This suggests that those who engage in information-orientated research agree with what MacEwan[6] argued was the public's verdict on the state of architectural practice in Britain when he wrote:

> It would not be difficult to fill hundreds of pages with quotations to substantiate the opinion that there is a crisis in architecture. This is widely accepted, although it is less generally accepted that the crisis has two aspects. There is the crisis of public confidence described by Sir Hugh Casson as 'a nation's disenchantment', which expresses itself in widespread criticism of planners, developers and architects — usually in that order. But there is also the internal crisis of the architectural profession, its own general loss of confidence in its ability to satisfy the public's craving for better environments.

And like the profession's establishment, those researchers seek a technical solution to these losses of confidence. If only designers will improve their use of information, it is posited, they will improve their competence and so confidence will be restored. In North America such reasoning has gone further. There, designers' use of information has been presented as the defining characteristic of their 'professionalism', as being the specific feature that sets them apart from those for whom they design. Thus, Burnette[10,11] contended:

> The essence of professionalism is judgement. What distinguishes the judgement of a professional from that of a lay person is the professional's access to relevant information, his accumulated knowledge and his ability to apply this information and knowledge appropriately. Traditionally, these capacities have been the result of the interests, education and experiences of the individual architect. Today the complexity of design and building problems requires more information, knowledge and experience than a single individual can possess. Well-balanced and informed professional judgement is therefore increasingly dependent on direct access to information and to the appropriate techniques for applying it rather than on personal knowledge and experience.

To stress this last assertion, Burnette quoted with approval McCue's[25] contention that:

> It is the awareness of its existence, the ability to call upon it and apply and make value judgements using the knowledge of the field, rather than the limits of his personal ability to store knowledge, which defines the professional.

These idealizations of professionalism stand in sharp contrast to Mackinder and Marvin's[7] description of how British designers actually operate. The latter, they stated

> . . . tend to seek written information as a 'last resort' when their own experience or that available in the office fails to give either an answer to a problem or the understanding to enable a solution to be worked out.

This tendency to polarize externally available information and experience (i.e. internalized and personally-stored knowledge) is also apparent in the quotation from Mackinder and Marvin cited above. Indeed, it is not simply that information and experience are presented as qualitatively different. Rather, in the case of the American writers cited, personally-stored knowledge is stigmatized: internalized experience is denigrated in favour of external sources of information. Patently, this judgement is compatible with, and a logical concomitant of, negative beliefs about the adequacy of past and current design practices. But this judgement also appears to have led some researchers to value, at least implicitly, (young and inexperienced) designers who consult external sources of information over and above (older and more experienced) designers who call upon their own internalized reserves. This tendency may be discernible in Mackinder & Marvin's first statement but it is more evident in Asprino, Broadbent and Powell[12]. As a consequence, significance is attached to the consultation of particular kinds of information rather than to the quality of judgements which designers make regardless of the kind of information on which they base their own. And, by such reasoning, information itself is raised to the level of a fetish.

However, decisions made by designers are not just influenced by the information they have available. Their decisions are also affected by, among other factors, their preferences and prejudices. In other words, what designers choose to do will reflect their attitudes, values and beliefs towards not only what is possible but about what ought to be done. And the significance of such predispositions can be judged from Mackinder and Marvin's[7] outline of the consistent pattern they observed in how their sample of architects approached design:

> . . . an initial concept for the building plan, form and general construction was developed rapidly using little information other than the client's brief, the site constraints and the designer's own experience. This initial concept was then developed and refined, using more deliberately researched information, and later modified as necessary in response to emerging constraints and changing requirements. In nearly all case studies the initial concept formed the general basis of the final design, only undergoing minor changes.

Such initial concepts would appear capable of crystallizing around surprisingly primitive value judgements made by designers. So, for example, as a result of studying whether in practice architects and engineers chose to exploit daylight, Cooper and Crisp[14] argued that when designers actually drew a connection between window design and interior lighting their decisions reflected their value judgements about the nature of Britain's climate and about the external environment in which their buildings would stand.

Designers who saw these as malign, as the source of harmful influences (particularly of thermal imbalances), sought to reduce window area in order to exclude them. Conversely, designers who regarded this country's climate and the external environment of their site as at least potentially benign sought to admit them selectively into their buildings. The effect of similarly basic value

judgements was also observed in the decisions which designers took about how to provide controls over environmental conditions in their designs, see Cooper[26]. Here their decisions reflected their attitudes towards people who would occupy their buildings. Thus designers who characterized occupants as lazy and uncommitted to conserving energy favoured solutions in which control over environmental conditions was centralised and automated. Conversely, other designers with a less pejorative attitude towards building occupants attempted to provide them with the means of controlling their own environment.

These two examples have been cited here simply to illustrate that, at each stage throughout the process of designing, the choices that designers make (including that of the types of information they choose or choose not to consult) are likely to be affected by their predispositions. And these predispositions, in turn, are likely to be grounded in deeply held, if largely taken-for-granted, sets of attitudes, values and beliefs. It is, perhaps, to these that attention needs to be drawn if attempts are to be made to understand why designers act as they do.

If this orientation is adopted, then we need to recognize that, because of their training, designers are taught to think and act in certain ways. Not only are they taught a specific language with particular vocabulary in which to express themselves but, in addition, they are trained to accept the beliefs and be loyal to the goals of their occupational group. They also learn what their group regards as problematic, how problems are to be defined, and how to solve such problems in terms of their occupational group's priorities and objectives. Beyond this, we also need to understand designers' social origins and allegiancies; the structure of, and the pressures in, their work places; and the often unexpressed values by means of which they choose to judge their own actions as well as the actions of others.

To sum up, information-orientated research is predicated on a belief that it is necessary to, and that the actions of researchers can, rectify the performance of designers. This reform is sought through a specific technical solution, by improving the information available to them and thus it is presumed the likelihood of their using it. As a result, such research operates within a particular and restricted definition of what is problematic about the ways in which designers function. In its extreme form this definition involves diverting attention from designers themselves and focusing, instead, on the structure, content, relevance, presentation and accessibility of information. But this research focus is of questionable value since it is based on two dubious premises. First, it is assumed that if information has the 'correct' characteristics, then designers will use it. Second, it is assumed that if they use it, their designing will improve.

A more fruitful approach might be to examine instead why designers act as they do, including their apparent reluctance to consult external sources of information. This alternative focus would involve scrutinizing designers' backgrounds, their training, and their belief systems. It would also entail examination of the connections between these and specific decisions made during building design. Viewed from this perspective, information would be treated not as a research topic in isolation, but simply as one factor among many which constitute the context in which designers act.

DISCUSSION: THE IMPLICATIONS

There is always a tendency in research to measure what is easy to measure and ignore the rest. We believe that in part this criticism applies to both building use researchers, educators and information providers, and also to those researching information transfer. The former group tend to believe in a rather simplistic and falsely rationalistic model of design, assuming that the design activity is primarily an intellectual process of gathering information, followed by some sociotechnical decision making. This has led to provision of over precise data about the 'true' state of selective parts of the man/environment system in the hope that the generation of more well justified scientific/technical information will somehow lead to better ideas, more effective decision making and thereby to improved building utilisation. Those researching information transfer wanted to improve the communication of ideas by exploring presentation and information accessibility, in the hope that this is the key to improvement.

While it is accepted that such areas of concern are essential, they may not be sufficient in themselves to ensure the exploitation of information. It is necessary to stress that decisions are rather complex, emotionally demanding human processes, not just individualized intellectual analyses. Designers operate in a climate of uncertainty 'amidst a mass of inchoate conflicting and shifting perceptions and problems'[27].

Designers also have predispositions to operate in certain ways, both as a result of their view of their role in society, and because of their attitudes towards the use of buildings. If information transfer to architects is to be improved, it will be necessary to gain some understanding of how their existing means of acquiring knowledge operate; what sort of information they feel really is informative — in the sense of enabling them to give form to an idea — and a deeper systemic understanding of the designer audience, its activity, its problems, its attitudes, and its needs.

On the available evidence, initiative for the undertaking of such studies will not come from designers, but only from the research community.

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