# Information and the Design Process

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Information has, of course, always been the lifeblood of the design process, but the first specific study reported seems to have been in 1979.[1] A panel of information experts was formed by the Council of Industrial Design (C.O.I.D.) to evaluate submissions from industry, industrial research bodies and the technical press. Selected submissions formed part of the 'More Value by Design' exhibition at the Design Centre, London, in early 1971 and were reported in one of the papers at the First Symposium on Information Systems for Designers held at the University of Southampton later that year. Two further symposia followed in 1974 and 1977. Amongst the many interesting papers presented at the Second Symposium were those by Nordström on 'Designers information problems'[2] and Wall on 'The Education of Design Engineers in Information Retrieval'.[3] The Third Symposium also covered a very broad range of issues, but most significantly the first impacts of the Information Technology revolution were reported. A new sytem, DIALTECH, was described[4] which had been made possible by the installation of a minicomputer and communications equipment at the Technology Reports Centre of the Department of Industry. This system allowed designers to carry out literature searches by using ordinary telephone lines at their own computer terminals.

As the new design information system emerged designers began to evaluate and speculate on their potential. The issues of technology transfer and the bridging of the 'invention push' — 'demand pull' gap in relation to the new information systems were explored in an article in Design magazine in July 1977.[5] In the same issue of Design magazine Professor Bruce Archer is quoted as stating that 'The serious designer is going to be more and more dependent upon design information' and this appears to have been what prompted the request to professional designers, Nick Butler, Tony Gibbs and Martyn Rowlands to conduct the user tests on the new information systems reported in November and December of that year.[6] These reported comments on Dialtech are perhaps most telling:

'Butler: I found that I did the equivalent of six months' research in 90 minutes. The system is totally convincing, and I shall recommend it to a number of my clients'.
'Rowlands: Dialtech is astonishingly helpful. One of its assets is that it presents information which is not strictly technical but provides a useful background. I tried to determine the pros and cons of replacing spray cans with pumps: AEROSOL(S) AND/OR CONTAINERS gave me a summarised reference which read "Author reviews controversy on upper atmosphere ozone and discusses spray pumps etc.," — what could be more appropriate'.

A similar sequence of events running almost in parallel, but perhaps, a year or two behind, occurred in relation to design education. Project Technology and the development of the modular resource books on topics such as Electronics, Materials, Energy, Mechanisms and Instrumentation took place at the end of the 60's and the beginning of the 70's and characterised the desire to provide design students in schools with information.

The same issues have also been addressed in Higher Education — notably by Wingfield in organising Industrial Design courses at the Royal College of Art[7] and Rhodes and Smith in relation to the supporting material being produced by SEED (Sharing Experience in Engineering Design) for teaching Design in undergraduate engineering degree courses.[8] The guide produced by Wingfield brought together considerable information on materials and manufacturing processes as well as beginning the process for other key areas, such as components and constructional details, costs, ergonomics and human performance etc. The guide for lecturers produced by Rhodes and Smith emphasises the process of information retrieval, and particularly in relation to the use of the library resources normally available for undergraduate engineers.

The drive towards the use of information technology in schools occurred as a result of the Microelectronics Education Programme (MEP) during the late 70's and early 80's. By January 1986 Secondary Schools had one microcomputer between 60 pupils and Primary Schools had one between 107 pupils.[9] The MEP also commissioned a special database, SIR (Schools Information Retrieval), to run on the BBC model B. This had originally been developed to run on the RML 380Z as a result of a study conducted through the British Libary.[10] In November 1979 the British Library Research and Development Department had brought together a number of educational practitioners, policy makers and advisers to discuss the potential of the use of computers in secondary schools. A number of grants were awarded by the British Library between 1980 and 1982 to the SIR Project. The potential of this database for use by Design and Technology students was assessed by Garner and Norman in 1986[11] and was found to offer many positive features.

Such a wealth of background studies has led to a very rich context for the discussion of information and the design process. The needs of the professional designer and the design student are in many ways the same, but there are particular features of the school or college situation which will result in different approaches. This becomes particularly apparent when the impact of new high technology approaches such as Prestel, the Times Network or Expert Systems is considered. The school or college context and the relevance of high technology are considered separately following the short summary of the kinds of information designers need and use.

**The Designer's Information Needs**
Consider the following quotation from Phil Gray, the design group manager of Loughborough Consultants, which appeared in Design magazine in 1979[12]:—

'Few designers can claim to have an all-embracing grasp of current technology. The results of r & d in plastics and other materials, in manufacturing processes and techniques, in ergonomics and in microelectronics lie beyond most people's speciality. An attempt to gain expertise in one particular discipline is feasible, but to expect any in-depth understanding of all possible areas is unrealistic.

So today, when the volume of information is growing at a rate which makes access to it more and more difficult, designers are faced increasingly with the problem of getting hold of data. Not knowing how to do this means the designer cannot perform what I see as his main role — the interpretation of information and its incorporation into a product.

In general designers would seek the technological know-how indicated by Phil Gray from recorded information or from non-recorded sources, such as expert advice or user questionnaires and experimental tests. As it is estimated that 40% of a designer's time is spent searching for information[1] it is clear that professional designers will be prepared to pay a considerable price in order to accelerate the process.

Of the categories of written information needs identified by the COID Committee[1] 45% of the effort was estimated to be associated with manufacturers' literature. British Standards and other design handbooks were also found to be key documents. The remaining categories concerned in-house experience in the form of company codes/manuals and past drawings.

**The School or College Context**

Information is undoubtedly as big a potential problem to student designers as it is to professionals, but there are major differences in the consequences of poor information retrieval.

Professionals are totally concerned with the product and its market performance. It takes very little to change a potential market success into a failure and selecting the wrong components could, by itself, be enough. They might be more costly, perform less well, be unreliable in service or there may be difficulties in supply. Any of these in any sub-system might well be enough to result in the product's market failure however good the market research, conceptual or aesthetic aspects of the design. Professional designers need to have all the information required available and it must be right up to date.

Project success for school and college students is as much associated with the design process as with the end product both in terms of the educational value and the examination outcome (if they can be differentiated!). Time is, of course, still a major factor, but it is not necessary for the information to be exhaustive or right up to date. It is more important that the information is applicable in the local environment i.e. relevant manufacturing processes are those which are available in the school or college workshops or through approachable companies, relevant components are those which can be obtained singly or in small batches, and relevant means of analysis are those which can be handled within the capabilities of the particular student.

Information for school and college students has traditionally been provided in written form and the language used and the form of presentation must be appropriate for the ages and abilities of the students intended to use it. In these respects the providers of the information are required to shoulder more responsibility for the effectiveness of the communication in schools and colleges, than is perhaps either necessary or appropriate outside the educational world. Consider two examples — choosing materials and selecting a beam size — which indicate the different kinds of approach which will be needed. Materials for design projects are normally restricted with lower school pupils because it is necessary to organise the activity around a specific and limited provision. For an 'A'-level project it would almost certainly be possible and necessary to buy in specific materials once the need had been identified. For the lower school pupils materials selection may not even be one of the issues which is being emphasised and the materials may be 'given'. For older students lists of the normal stock held and the catelogues of the normal suppliers would need to be available. Similarly, lower school pupils trying to select a beam size are likely to adopt a purely empirical approach and need guidance on conducting experiments, whereas older students might calculate the size required in various materials and select on criteria such as cost, weight, life in service etc.

Members of the Design and Technology Department at Loughborough have written and are currently involved in writing several new textbooks which reflect these necessary

**TABLE 1: Conventional books by members of the Design and Technology Department**

| Book: | Author(s): | Publisher: | Age Range: | Publication status: |
|---|---|---|---|---|
| Micro knowledge | J.S. Smith | Ladybird | 12-14 | Published in 1984 |
| Design and Plastics | M.J.D. Hall | Hodder & Stoughton | 14-16 | Published in 1988 |
| Product Design | E.S. Atkinson | OUP | 14-16 | In preparation |
| Systems Design | J.L. Riley C.D. Mockford | OUP | 14-16 | In preparation |
| Design & Ergonomics | S.W. Garner | OUP | 14-16 | In preparation |
| Advanced Design & Technology | Prof. S.A. Urry E.W.L. Norman J.L. Riley | Longman | 16-18 | In preparation |

differences in approach. These are listed in Table 1.

In the very long term it is possible to imagine this wealth of information contained on a computer database, but not within the currently available technology. The graphics capability associated with Prestel or The Times Network would not facilitate the kind of approaches used in any of these publications, although the Advanced level text will be significantly less dependent on the graphics style than those for the lower age ranges. It is also hard to imagine current database structures or searching strategies facilitating either storage or retrieval of the information.

Databases are likely to be most relevant when used in the manner of DIALTECH, i.e. to search for and locate relevant literature, materials or component suppliers. In these areas they have the advantage of being easily updated and if developed locally or within the school of providing relevant information. The application of the SIR database evaluated by Garner and Norman was the searching for relevant articles in Design magazine. It is not hard to imagine similar applications in individual schools or departments. The SIR package requires the use of a double disc drive, but otherwise only occasional access to a BBC micro. It is worth noting that even if it were technically feasible, the cost of providing sufficient pupil access if all the required information were computer based would be phenomenal.

**The Relevance of High Technology**
National databases like Prestel and The Times Network will only be able to usefully provide information that is of general interest, although they will still have a significant role to play. NERIS — the National Educational Resources and Information Service, funded by the D.T.I. aims to bring together information about teaching and learning materials that are currently scattered about the country, and is as relevant in Design and Technology as in any other curriculum area. There are, of course, also Local area projects such as the OVERTURE project developed by the Southern Science and Technology Forum at the University of Southampton to make

available resources concerning Mathematics, Physics, Biology and Chemistry.[13]

The use of online databases and other new forms of Information Technology, such as interactive audio and video and expert systems, will ultimately depend on the cost the school or college has to pay. There is likely to be some initial hardware capital costs which schools will find difficulty in meeting, but recurring charges for access to databases may be just as hard to bear. Efforts to use expert systems in design go back many years and most of a recent issue of Design Studies was devoted to their potential. Amongst the interesting articles was a detailed study of the problem of knowledge elicitation from designers[14] and a note on the logic of design.[15] A preliminary investigation of expert systems in relation to design decision making was also recently reported by Norman[16] and there can be little doubt that they will soon become relevant in Higher Education alongside more conventional CAD systems. Their use in schools may take longer to come about, although the necessary computing power is now available and its cost is falling rapidly. The key point about the use of expert systems in that they not only allow a non-expert to get on with a task, but teach them how it is done at the same time! Within a few months the system becomes no more than a useful reminder. In the school or college context, expert systems should probably therefore currently be viewed as a means of enabling non-experts to perform operations, such as electronic circuit fault finding or computer system operation, which require expert knowledge. There is therefore already a significant role which expert systems could play in INSET programmes. Computer-aided learning was probably the dream of the '60's, but can now be the reality of the '80's and '90's. There have already been some packages developed for computer aided learning of specific knowledge areas, for example the linked radio and software packages produced by the B.B.C. on Structures, Pneumatics, Electronic systems, Gearing and linkages and Motors and the Materials database produced by the I.T.V. linked to their GCSE series. These pioneering efforts provide the background for the development of

major packages utilising the recent cost saving and technical advances in hardware and software. Conventional video and TV programmes have, of course, been used for many years to bring the outside world of manufacturing processes or design practice in to schools and colleges and there have also been many excellent programmes made covering specific knowledge areas e.g. graphics and mechanisms. Building these up in to fully interactive teaching packages is also clearly within the capability of currently available technology.

Databases, expert systems, interactive audio and video offer fantastic opportunities which could be brought to fruition. It is vital however to recognise clearly the practical limitations imposed by the school or college context, and design systems within these constraints. Information must be locally relevant and the form of presentation and the information provided must be appropriate for the age range intended to use it. However, much is known from successful conventional school publications about language requirements and the appropriate use of graphics. Development costs might be high, but equally so is the potential for influencing the design experiences of every student in the educational system whilst allowing their teachers to update their skills simultaneously. It is however essential to note that for the foreseeable future conventional publishing and distribution routes will still have a major and dominant role to play in meeting the needs of our school and college students. Professional designers are in a rather different position and because they have easier access to computer hardware and costs can be more easily justified, computer based systems are already beginning to significantly influence their approach.