Seminar

Functional information design: research and practice

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Although functional objectives have concerned designers for many years, and psychologists have published research on issues related to graphic design, fruitful cooperation between the two specialisms has only rarely been achieved. In this paper it is suggested that the traditional objectives and methods of neither group are sufficiently oriented towards the communication of information in a complex society, and that it would be unrealistic to expect the design and evaluation of information to lead to opportunities for either personal expression or the discovery of permanent truths. A user-centred approach is urged, drawing from both the intuitive problem-solving skills of designers and the methodologies of psychologists.

Each issue of IDJ will contain a contribution to a multidisciplinary *Seminar* series. This will build up a valuable collection of basic overviews of information design, and introductions to some of the specialist areas that are not always easily accessible to the practising designer or to students. Future papers planned for this series include introductions to the measurement of readability, educational technology, the ergonomics of symbol design and semiology.

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Many of those involved in research in information design are aware that the field is potentially at a turning point. A survey of papers submitted to this journal, for instance, would show a high proportion of authors concerned with the classification of the subject, with research methodologies, with teaching methods and curricula, and with the conceptual organisation of the field. They differ widely in approach and although this may be rather confusing for newcomers, or to those interested in quick answers to immediate problems, it is nevertheless entirely healthy. These are the sort of fundamental issues that must be debated in the early days of any newly recognised specialism. Although research in information design has a long history, only recently have those who do it, psychologists mostly, and those who use it, designers, begun to talk seriously about their mutual interest in communication.

It seems that the movement is towards more objectivity among designers and a greater respect for subjectivity among scientists. That is not to suggest that the two are merging, but that a new dialogue and respect has arisen between two groups with quite different traditions. On one hand, designers are coming to recognise that although the concept of 'functionalism' no longer commands the respect it once had as an aesthetic movement, nevertheless an accountable and informed approach to communication is essential if they are to have a significant rather than cosmetic role in the publication of information. On the other hand, those psychologists who are involved in visual communication recognise that designers can bring essential intuitive skills to the problem-solving process that science cannot prescribe. It's a movement that perhaps reflects the changing mood of the times. People are demanding more accountability in all areas of life from the 'high priesthoods' of professionals in whose hands they were once happy to leave specialist affairs.

Firstly, we shall look at the state of the functionalist ideal among graphic designers. Then we shall discuss the problems of interpreting psychological research as a source of theory and data to guide the designer's perception of the function of his work.

How functional was Functionalism?

The expression 'functional design' is confusing. It must be significant that, although it has been used as a catchphrase for at least fifty years, recent conferences entitled *Design for need* (at the Royal College of Art in 1977) and *Design that works* (the Icograda Chicago Congress, 1978) have been presented

as new, exciting departures from the traditional view of the designer's role. But what other functions can graphic design have other than to meet needs and to work? Although generalisations about such an amorphous area as graphic design are unwise, it seems true to say that with certain notable exceptions we are not widely perceived as a profession of concerned communicators; instead, the public image of graphic design appears to be one of a primarily decorative craft, a branch of the advertising and public relations industry rather than an essential component of education, industry or public administration.

This is, of course, perfectly reasonable where visual effect is an agreed objective of a particular design brief or where it is a function of the product itself or where the practice of typography is an artistic rather than an industrial endeavour; and it is not my intention to argue against the importance of the visual quality of all aspects of the environment, and of all manifestations of the printed word, however mundane. But serious problems can be caused when aesthetic considerations are seen to actually take precedence over communication effectiveness and usability.

During the 1920s and 30s the Modern Movement, or International Style, that altered our architectural landscape so much began to revolutionise typographic design also. Although at first slow to take root here, during the 50s and 60s it became the dominant designer's style. The age-old traditions of seriffed type and the formal symmetrical page gave way to the 'functional' typography of sans-serif type, standard page sizes, and the asymmetric layout. Historical generalisations of this kind are perhaps unwise and never completely accurate, but it is nevertheless reasonable to suggest that these trends, although revolutionary in visual terms, did not significantly affect the balance of the objectives of most graphic designers. Comparing the writings of traditionalist and modernist advocates, one finds roughly the same blend of aesthetic, communication and technical objectives in both camps; where they disagree is over the means of achieving those objectives.

After the rise of the Nazis in Germany, Jan Tschichold, perhaps the best-known advocate of the new style of typography, suffered a crisis of conscience and became as ardent an exponent of the historical tradition as he had been of asymmetric typography. The visual style of his work changed radically, but this did not reflect a major shift of his design philosophy so much as a rejection of the undesirable political connotations of his former style; he in no sense rejected his concern for precision, clarity and functional integrity. His early, Functionalist, writings reflect the same aesthetic standards as his later work: in 1935, his views already in transition, he wrote 'We must ask ourselves. . . whether the result is *pleasing*, whether we have achieved a balance. Provided the work is all right technically, there is no other criterion for typographical design.' (quoted in Maclean 1975).

This is an explicit statement of a view of graphic design that, although not often articulated, is widely reflected in the organisation of our profession. Educational qualifications, jobs and prizes are awarded largely on the basis of visual impact, and only rarely for evidence of communication effectiveness. The best book covers, record sleeves, illustrations, retail packs and posters are recorded in glossy annuals for the admiration of colleagues and students. The assessment of educational courses is heavily weighted towards the quality of visual design displayed in the final year exhibition. But design for real information-needs attracts none of this kudos.

Stanley Morison (who dominated the largely traditionalist British typography of the middle years of this century) once remarked that the history of printing is to a large extent the history of the title page. Again, this is a rarely explicit statement of a view reflected in the scope and illustration of historical studies of typography and printing. The illustrations in his *Four Centuries of Fine Printing*, for example, are almost all of title pages; yet, at the risk of an over-literal interpretation, we may reflect that we are thereby required to judge the quality of a book design from the only page in the book that, in its modern form at least, tells the

reader little he does not know already.

If most value-judgements, whether historical or contemporary, are made on the basis of a two-dimensional representation of a design-product (in a book or an exhibition) then it is easy to understand why only Tschichold's two criteria of 1935 are applied – the compatability of the design with the printing process, and whether the result is pleasing. But what other criteria are there, and how do we define and evaluate them?

In a sense Tschichold was right when he said that 'there are no other criteria for typographical design', because he was at the time, writing about book design. Continuous prose is probably the least problematic material to lay out and print. Its typographic form has scarcely changed in five hundred years. What has changed enormously is the scope and the complexity of new demands that society makes from the print medium. It is from an analysis of this that we may derive our additional criteria for evaluating visual communication. This is the rationale of 'information design'; for where graphic design is at present evaluated as an independent image, the criteria for evaluating the communication of information are external to the design-product itself.

Functionalism seems to have derived its name from at least two senses of the word. Firstly, it was art that had a function besides that of simply being art; that is, it was for advertisements or packages rather than the collector's wall or showcase. Secondly, its advocates saw technical excellence and appropriateness as a source of aesthetic quality (form follows function). Many artists in the twenties were attracted to the notion of an art that had a practical use, and thus wide distribution, as their contribution to the Machine Age, although the demands they made on printing processes were often rather inappropriate, and technically ahead of their time. At the same time there was a certain appeal in the concept that the personality of the artist be subordinated to the demands of the machine. Both kinds of Functionalism represent a search for a moral basis for an artistic activity. Typography, no less than other visual arts, has often manifested a moral or political standpoint. For example, the humanist script of the Renaissance, which established the model for almost all subsequent type design, was a conscious attempt to revive the 'true' letterforms of the classical age, and much effort was made to establish the rational and geometric principles that scholars supposed must underlie its visual form.

Writing about architectural design, David Watkin (1977) has exposed the tendency of theorists to attribute to the style of their day a historical inevitability or a moral basis. In particular he compares Pugin's 'Christian' gothic architecture and Pevsner's 'Machine Age' Modern Movement; both defended their chosen styles as rational and inevitable, true to the spirit of the age, and attacked or simply ignored other styles as if they were not only stylistically but socially deviant. The seventies have seen the beginning of the decline of the Modern Movement in Britain. Along with tall buildings and aggressive town planning, we also seem to be rejecting the 'Swiss-style' functionalist typography that became so normal during the sixties. But we should beware of the danger of assigning similarly moral values, perhaps conservationist, human-scale and vernacular, to whatever visual style emerges. Paradoxically perhaps, the next revolution in graphic design need not have a special visual manifestation at all. Rather than view technical excellence as a means to an aesthetically pleasing and correct product, we can see it as just one element of a craftsmanlike approach to communication – an approach in which the purposes and limitations of communicators and their readers direct the designer's objectives. A really functional (as distinct from Functionalist) typography is thus invisible. That is, it can be judged not by its visual appearance or its adherence to a stylistic norm, but only in relation to an analysis of its objectives.

This is not to suggest, of course, that visual style should not change with the times or that the wit and colour of stylish graphics do not contribute considerably to the quality of life; this is not an argument for austerity. But it is suggested that we should maintain a clear distinction between fine

art and information design, which although demanding some of the same visual skills is rarely an appropriate platform for self-expression.

It is perhaps unfortunate that the word 'design' has two meanings. It can mean, firstly, decorative or applied art, and secondly it can mean planning. Our problem is that for graphic design both definitions are to some degree appropriate. The concept of information design, though, challenges us to concentrate on the development of planning procedures and to relegate visual expression to a subsidiary role. Traditionally, typographic planning has been confined largely to the planning of a printing operation – in effect, as a means to an aesthetically evaluated end. But design as planning requires the designer to plan not just a well-printed product, but an effective information display and a rewarding reading activity.

To extend the designer's responsibility in this way has obvious implications for training and consequently for research. Planning for communication in this extended sense is no less creative in nature than graphic art; the process of planning still relies on intuitive problem-solving skills. But the most skilled problem-solver is limited by his knowledge-base. He may be good at balancing, optimising and compromising between conflicting objectives, but his perception of the problem and his repertoire of potential solutions will be limited by the breadth of his experience and by the reliability of his interpretation of that experience. It is because of this reliance on personal experience as a source of tacit problem-solving knowledge that craft training has traditionally taken the form of long apprenticeships. In the same way, most design education relies on teaching by projects; ideas and skills are transferred by experience, criticism and discussion rather than through the presentation of an explicit, organised knowledge-base embodied in books and lectures. This system works well where the design-product is intended solely for peer-group approval, but where aspects of the problem lie outside the experience of the designer, the absence of a well-organised public system of knowledge can have serious consequences.

Paul Rand (1951) wrote that 'the absence in art of a well-formulated and systematised body of literature makes the problem of teaching a perplexing one'. Besides education, we need a more objective and comprehensive knowledge-base for at least two reasons. The first lies in the nature of the print medium itself. When we talk face-to-face we can adapt the form or content of our message according to the feedback we get from our listener – through puzzled looks or questions. But most printed information is available to readers who span a wide range of abilities and who come to the book or document with a wide range of purposes. We need information about these things in order to augment our own limited experience and to help evaluate our design solutions.

Secondly, we need a better knowledge-base so that we can formulate effective systematic procedures to organise the large proportion of information publishing that, being routine and perhaps mundane, cannot receive the attention of a designer or editor; this includes the vast quantities of documents on which we rely to further science and technology, display regulations and instructions, and communicate information for the administration of government, industry and our personal lives. Further, as computer text-processing systems grow in numbers and in capability, they will bring the option of automating many design and editing tasks, and the opportunity to improve the standard quality of documents that at present receive little in the way of quality-control.

Psychological research and the practice of design

It is not surprising that psychology is the discipline that has predominated among attempts to establish a scientific or theoretical basis for information design. But although the two areas share a common concern with human communication it has not been easy to realise hopes for a more direct connection. It appears that such inter-disciplinary co-operation has never been much of a priority for either psychology or design – only a small proportion of psychologists have been specifically inter-

ested in applying their work to problems of practical communication, and only a few designers have been interested in learning from and cooperating with the researchers. So in one sense the problem has been simply a logistic one – until recently there have been few opportunities to exchange views and experience between the two specialisms and the same issues have been pursued by each in ignorance of the other. But it can be argued that the real problem is deeper than this – that the lack of cooperation is due to the insularity of two systems of thought, empirical science and intuitive common sense, and that a sound basis for both the theory and practice of information design will depend on whether each group is prepared to accord more respect to the other.

The organisation of psychology is complex, reflecting the history of the discipline as much as any coherent plan. The different areas reflect the subjects they investigate, the methodologies they use, and their theoretical orientation. In terms of the practical applicability of their research, psychologists often talk in terms of a spectrum from pure to applied research. Pure research is concerned with the investigation of fundamental and relatively abstract aspects of human perception and cognition, often isolated from a practical context and often speculative and exploratory in nature. Applied research uses the same scientific methods to tackle real-world problems more or less directly.

This kind of summary is necessarily a gross oversimplification of the real relationship between the two. Theories and models generated by researchers at the pure end of the spectrum are often used as a basis for applied experiments, and the results of observation of practical situations often suggest a deeper theoretical significance.

In addition, our pure/applied distinction is blurred by the degree to which theories of cognition account for pragmatic considerations of the perceiver's world-view and experience, as well as 'content-free' mechanisms of the mind; that is, theories that consider *what* people think about (which must necessarily relate to the real world) can seem more 'applied' than theories that consider *how* people think (which often use nonsense material to prevent the interference of real-world contextual knowledge in experimental situations). The trend seems to be in this direction; cognitive psychology, with its stress on 'ecological' factors, is rapidly replacing behaviourism as the 'leading-edge' theoretical orientation. We shall return to this.

This variety of research styles and theoretical orientations can make the interpretation of this research a perplexing problem for the designer. In addition he must pick his way through quite a mine-field of experiments and data which can unintentionally mislead.

Firstly, there is a great deal of research published which appears at first sight to be directly addressing an issue of central interest to the designer, but in fact has quite a different purpose. For example, numerous studies on human memory use strings of letters or numbers as 'stimulus material' for experimental purposes; but the use of typographical material is just part of the methodology, a convenient laboratory task, and is quite incidental to the main focus of the study. Similarly, many studies use illustrations as part of investigations into the role of mental imagery in comprehension, but it is not always the researchers intention to say anything about the illustrations themselves.

Secondly, because applied psychologists often base their work on the findings of pure laboratory research, certain real-world factors can get ignored, even though in actuality they may dominate the interaction of the reader with the text. For example, because theorists have often used rather mechanistic models of learning in the laboratory, experimenters have sometimes overlooked the effect of belief systems and purposes on the process of reading and learning. Thus, a failure to learn a particular fact or prose passage may be the result not of a reading disability or a poor stimulus, but of a conscious rejection of the message, or simply the lack of an adequate incentive or purpose in the reader.

Perhaps a more serious trap for the unwary is the research that seems to have little or no theoretical basis at all. Research methodologies can sometimes divert the scientist from an analysis of his problem

area; they can be so complex in themselves that it is easy to forget that they are just one element of a wider process of enquiry and reasoning. Material can be prepared, a test devised and results obtained, but unless we know what the results mean and how they relate to other data, we have some new 'facts' but no new knowledge. This rather barren data-collection (it has been called 'dustbowl empiricism') suggests a parallel to our distinction between functional design and Functionalism – science and scientism. The purpose of experimentation is to test hypotheses which are themselves drawn from theoretical ideas or models. A hypothesis is a prediction that, if a particular theory is accurate, a particular outcome will result from an experiment. The results of experiments do not directly relate to the complex world of people, events and relationships, but only serve to add to or detract from the power of a theoretical model of some aspect of the world. If there is no genuine foundation for the process of systematic enquiry we are engaging not in science, but in what Liam Hudson (1972) has called 'the cult of the fact'.

Experiments are evaluated primarily on their reliability and their validity. Reliability refers to the accuracy and stability of measurements and results; it is established by the replication of experiments and by statistical analysis of the data. Validity is a more accessible concept for the designer – it refers to the extent to which the controlled laboratory situation adequately simulates the theoretical model being tested; for example it would be invalid to test material intended for poor readers using skilled readers as subjects. Various kinds of validity are identified by methodologists but for the practical designer the relatively new concept of *ecological validity* is of special interest. This refers to the extent to which the methodology adequately represents not only a theory but also the real-world (ecological) system that the theory reflects, and to which the result might be applied.

The move towards ecologically-related theories of cognition is encouraging; it suggests a psychology from which information designers might draw helpful theoretical constructs to enrich their perception of the communication process. The prospect of a psychology that is both theoretically rigorous and yet fairly directly related to reality seems to challenge the basis of the pure/applied distinction which is itself somewhat confusing.

The difficulty lies in the relative generalisability and applicability of pure and applied research. Pure research is highly generalisable, but its applicability is extremely obscure; that is, it examines relatively constant and reliable factors of human thought and behaviour, but these factors are usually extremely remote from the real-world context in which they occur. Applied research closely examines a real-world problem, but its results are not on the whole generalisable to other contexts. So although we often argue that designers need more practical applied research to inform their design decisions, it may be that, paradoxically, it is more of the pure, and thus generalisable, research that is needed. This is an oversimplification – a great proportion of pure research is so specialised or remote that it is of no real practical value – but in the past it has been research into fundamental invariants of human thought, usually translated or popularised by a sympathetic science writer, that has had the most lasting and productive effect on the practice of design and on design education; for example, fairly 'pure' research on colour perception, information processing and reading have provided both an extension of the designer's experiental knowledge and richer models of communication to augment or confirm his intuition.

Although to the scientist the pure/applied or the laboratory/ecological spectrums may seem to cover the issue of applicability fairly comprehensively, to the designer that spectrum is itself at the end of another spectrum. Pure and applied are dimensions of scientific investigation which, it can be argued, contrasts with the commonsense knowledge of the craftsman. Empirical science represents a system of knowledge which is publicly demonstrable by reasoning and experiment. But although designers can draw on scientific facts and theory, the synthesis of the ingredients of a problem and the generation of alternative solutions stems from a different kind

of knowledge or skill that, although usually tacit and perhaps beyond simple analysis, is nevertheless real. This pragmatic knowledge has been contrasted with scientific knowledge by David Olson (1977), drawing on the philosophy of James and Dewey: 'Commonsense knowledge. . . involves a plan for contingent action, not a conception of universal truth. . . Its intellectual tools are illustration and example rather than definition and deduction'. Common-sense knowledge, he says, recognises that it is value-laden and context-specific, whereas scientific knowledge 'is coded for reflection, not for action. It seeks universal laws that are free from exceptions and contradictions and it cuts ties to values to become "the disinterested search for truth".'

It is possible to exaggerate the contrast, which may be as much to do with the language in which the two systems are encoded as with substantial differences in content. But nevertheless their reconciliation is problematic. Because commonsense is situation-specific and action-oriented, to codify it into systematic procedures can be dangerous, especially if we fail to recognise exceptions and contingencies. Commonsense maxims can be totally misleading when an inexpert user attributes to them the characteristics of scientific law; the results of research rarely have a problem-solving value by themselves, but only through interpretation in the light of a fuller assessment of the context of the problem.

What then is the place of experimental psychology in information design? This issue contains two contributions on psychology that illuminate this point. Linda Reynolds reviews the results of research into constant factors of human colour perception and interpreting this according to the technical characteristics of the teletext medium, extrapolates positive guidance to designers. Patricia Wright demonstrates that although different research techniques have varying strengths and weaknesses, used wisely they can provide an effective quality control of particular documents. Both represent the controlled and judicious use of scientific methodology to guide design practice. An unquestioning scientist and an uninformed designer are equally ineffective. The problems of communication in the real world of government, industry and the environment are too complex to rely blindly on the magic of either data or creativity.

A user-centred approach

A shared problem of design and psychology seems to be that peer-group approval of 'good design' or respectable science does not necessarily reflect good communication. The dominant objectives of the two specialisms will always be divergent, so information designers and evaluators cannot always rely on the methods and aims of the mainstream of their disciplines to result in effective communication. While they may not agree on everything or share precisely the same expertise, designers and evaluators do share the same task of planning and overviewing a communication process.

Planning is a process of drawing together a range of factors, some of them conflicting, and producing a balance or compromise. Design as planning is often said to be a problem-solving activity, and that is true as far as it goes; problems, though, do not always appear in single, easily defined units to be solved one at a time. Design as planning is more a matter of resolving a difficult situation – reconciling positive and negative factors. Herbert Simon (1959) has called it 'satisficing' rather than optimising.

Planning is also a mediating activity. Designers usually have to work with a sponsor (client, author, employer etc.) for the benefit of users (readers, consumers, travellers etc.). From these two groups come the positive and negative factors to be reconciled. The positive factors are the purposes of the sponsor and users – all those things that they hope the document, display or sign will help them achieve. The negative factors are constraints that limit the designer's options. We can show this four-way interaction of sponsor, user, purposes and constraints in a diagram (Figure 1). In the cells of the matrix are the kind of factors that apply in the case of textbooks.

	Purposes	Constraints
User	Learn Search/select Browse Preview Revise	Ergonomics (legibility, weight, size etc) Psychology (language level, previous knowledge etc) Availability (delivery, storage storage etc)
Sponsor	Teach Inform Persuade Motivate	Cost, legal factors Print facilities Standard procedures (house style, purchasing etc)

Figure 1: sources of planning objectives in the design and evaluation of textbooks (from Waller, 1979).

This simple diagram has a relevance to both designers and scientists investigating information design. To designers it can represent a framework for a checklist of design objectives that arise not from his or her personal aims, but from the nature of the communication task. To the researcher or evaluator it can act as a check on the real-world relevance or ecological validity of a particular investigation.

Design is a kind of argument. Its generation is a creative task, and we recognise and tolerate a degree of bias and a variety of rhetoric and style; but it is essentially the selection and ordering of evidence to reach a conclusion. The results of empirical psychology and the perceptions and theories of researchers, together with the experience of personal successes and failures in the past, form the evidence or the knowledge base from which the designer can construct solutions to complex problems; and in addition to theories and facts, he can learn from the methodologies of psychologists and other social scientists, which offer him objective techniques for evaluating his products, and thereby enriching his personal skills.

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