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JOURNAL TYPOGRAPHY IN TRANSITION*

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ABSTRACT

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New technical developments in journal publishing challenge traditional standards of typographic design. Basic typographic issues are identified and discussed under three headings: legibility, style and structure. Research is reviewed and future directions for journal design suggested.

INTRODUCTION

Scanning a typical periodicals section in a university library, it is easy to get the impression that typography has not been a major concern of their editors; most could be described as adequate, although few are distinguished by their functional or aesthetic quality. At the same time it is noticeable that journals from a wide range of disciplines in both sciences and arts - containing a correspondingly wide range of subject matters - look similar.

We can identify three possible reasons for the apparent uniformity of journal design.

Firstly, many journals are published by specialist journal publishers or manufactured by printers who concentrate on this particular market. It simplifies the publishing process if a standard format and house style can be adopted, since a single copy-editor or compositor may handle a number of journals.

Secondly, journal articles tend to have the same constituent parts - title, author, acknowledgements, text, references etc. - and similar conditions of use; so it is perhaps natural that they should result in the same visual configuration.

Thirdly, typographic design can be viewed socio-linguistically.

* This paper, originally heavily illustrated, was presented at the Second International Conference of Scientific Editors, Amsterdam, October 1980.

Perhaps the uniform a journal wears conditions certain expectations in its users and contributors. A cynic might even suggest that the unreadable contents lists, impenetrable authors' notes and dull colourless title pages of some journals represent a conscious avoidance of an image that might appear too popular.

On the whole, conservatism in design is probably a good thing; a system that is well understood by its producers and users results in a reliable consistency of presentation. Indeed, if journal typography was particularly noticeable there would probably be something wrong with it - good typography is often said to be 'transparent', or as one writer put it, like a 'crystal goblet' whose quality lies in the perfection with which it displays its contents.

However, the continuing success of traditional typography depends on the stability of the technology and the industry on which it is based. And in recent years printing has undergone a technical revolution that poses a considerable threat to traditional standards.

A problem facing all academic publishers, whether of journals or of books, is that continually increasing specialisation of scholarship creates the demand for more and more titles with ever smaller audiences. In these circumstances traditional printing methods are prohibitively expensive and many journal publishers now use low-cost reprographic techniques that require less-skilled labour and which consequently place more of the responsibility for design quality on the editor or author. The use of the IBM composer (or electric typewriter) and small offset litho equipment is now common, and computerised word-processing equipment will grow more popular, offering on-demand printing of off-prints or even whole issues. Such systems are a challenge to graphic quality, firstly, because they bypass the skills and standards of traditional printers, and secondly because they introduce their own systematic graphic inadequacies - poor letter spacing and alignment, poor character design and justification programs with poor or no word-break provision, for example.

On-demand printing, of course, challenges the very concept of 'journal'. Databanks like the ERIC system are, in effect, journals too, but they have no regular 'issues' and only a broadly defined subject matter. A computerised 'journal' can be said to contain as many journals as it has users, each specifying the content of his or her own edition by the use of key-words. Such new information-access systems render the make-up of a writer's audience particularly difficult to predict; he or she will have to consciously cater for a greater number of less committed readers. This part of a journal's audience, more than any other, needs the ease of scanning provided by a clear typographically-signalled structure.

A third challenge to traditional standards is posed by the new electronic text media. Information accessed on a computer visual display or via a videotex system such as the British Post Office's Prestel must be organised exceptionally well to compensate for the handicaps such systems place on the selective reader. Scanning well-designed 'ink-and-paper' journals on a library shelf can be an extremely fast operation. Experienced users can flick through pages, spot headings at a glance, and note or discard an argument with relatively little effort. At their present state of development electronic systems offer less effective visual cues, present information in comparatively small chunks, and can be uncomfortable to use at length. Apart from obvious technical improvements, it may be that such systems will result in the development of a special writing style - perhaps a more economical one, or one with a more heavily emphasised internal cohesion than is traditional, making a more effective use of graphic and spatial cues.

What exactly is typography and how are its traditional standards challenged by such developments? It is, like most concepts, defined in different ways by different commentators, but most of them could be encapsulated in a three-way description. Typography is the study and practice of the visual display of written language, and contributes to (1) its legibility, (2) its style, and (3) its visible structure. We will take each in turn, defining it further and summarising relevant research issues.

LEGIBILITY

The legibility of print has been studied extensively for many years. Legibility factors relate to the visual perception of text or graphic symbols, and should not be confused with readability which refers to the comprehensibility of text (vocabulary, syntax, cohesiveness etc.). How long should lines be? How large the type? How wide the margins? How white the paper? Whether to justify columns? - these are the sort of questions posed by psychologists. Good reviews are those by Tinker(1963), mainly of his own considerable output; Spencer (1969), a sound and well-illustrated popular account; Reynolds (1979a), an excellent up-to-date review aimed particularly at information scientists; and Katzen (1977) reviewed current research and practice with particular reference to journal design.

A number of legibility studies have been published that relate specifically to journals. Poulton, Warren and Bond (1970) described how Applied Ergonomics, appropriately, had been designed with the research evidence in mind. However, their analysis revealed a large number of design decisions for which no references could be cited, and no evidence was cited that was actually counter-intuitive; it is quite probable, then, that their design philosophy alone - that is, their concern for usability rather than aesthetics - would have been enough to ensure an effective layout had there been no data at all available to them. Indeed, Reynolds (1979a) points out that research has almost always confirmed the traditional practices of printers and the intuitive judgment of typographic authorities (Dowding, 1966, and Williamson, 1955, are examples). Accordingly, the work of her own institution, the Royal College of Art Graphic Information Research Unit has concentrated on issues for which no traditional guidelines exist - background 'noise' on photocopies, Computer Output Microfilm, and so on.

A further problem with legibility research is that results are often contradictory. For example Foster (1970) reported that a two-column layout was preferred (for publications of the British Psychological Society), while Poulton (1959) found a single-column journal layout to be superior, and Hartley, Burnhill and Fraser (1974) found no significant difference. However, Hartley et al pointed out that "It is important to note... that other variables apart from line length were also changed. The conclusions reached here, therefore, are specific only to those particular layouts of Programmed Learning and Educational Technology."

The earlier generation of typographic researchers (reviewed by Tinker, 1963) underestimated the complexity of typographical variables, and consequently much of their data is now considered by many researchers to be unusable. But the major difficulty in interpreting legibility research is that within a typical area each researcher uses a different methodology and different subjects, measures different criteria and addresses a different hypothesis. Indeed in many cases the hypothesis deals with rather trivial issues specific to a particular situation, and there has been little attempt to produce a 'theory of legibility'. Consequently it can be argued that the relative failure of the scientific method to improve the reader's lot stems from the fact that it has not been applied to the problem in a properly coordinated or truly scientific way. Alternatively it has been argued (Macdonald-Ross and Waller, 1975) that the traditional experimental method is just not suited to this practical area of human interaction where knowledge exists rather less in the form of quantitative data than in the tacit domain of expert judgment and skill. Considerable experience of trouble-shooting problems of typographic design convinces me that an illegible text usually results from a poor design strategy - a failure to identify with the readers, an insensitive use of a standard rule of procedure, or simple technical incompetence - rather than ignorance of the research data.

Whether we trust expert judgment or the research literature, we would conclude that the text typography of traditional journals is generally to a reasonably high standard of legibility. Standards often break down, however, in more complex components such as the contents list. Here it is common to find typographic practices which have been condemned by both legibility research and traditional standards. Long lines of italic or capital letters slow down reading significantly, yet they frequently appear on the pages that need to be scanned the fastest. The perceptual behaviour of skilled readers can be described as ideographic rather than phonetic. That is, they do not build up meanings by letter but recognise whole word-shapes. These are less graphically distinct in capitals (no ascenders or descenders) and in italics (letters more similarly shaped). In the same way, dot-matrix computer-printout alphabets that tuck the descender into the line have been shown to be significantly less legible than ordinary print (Whalley and Waller 1981).

This last factor has serious implications for journals that employ word-processor printing technology. Many examples of such equipment break a number of established typographic rules, and as yet we have no research evidence to validate their letter-spacing, line-spacing and justification practice, which intuitively seems frequently inadequate. We do have some evidence, however, relevant to the legibility of videotex systems (reviewed by Reynolds, 1979b). In these systems colour-coding replaces the typographic coding offered by conventional print and a typical page of, say, the BBC's Ceefax may well use the full repertoire of seven bright colours, even within a single table or diagram. However, research has shown that the perception of different self-luminous colours by the human-visual system is uneven. For example, red has only 30% of the perceived luminance of white, and blue only 11%. Findings like this suggest that screen-based text systems represent a medium where traditions have had no time to develop, and, it seems, where intuitions cannot necessarily be trusted. They suggest that journals using new technologies should therefore take evaluation seriously.

STYLE

It is curious that researchers have most thoroughly investigated a problem that most readers seem to take for granted - legibility - but virtually ignored the criterion so often used by consumers to judge graphic design - its style. There are only one or two studies reported, but these use dubious methodologies. Perhaps from a strictly ergonomic viewpoint the psychologists are right - but it can be argued that reading a text is rather more than just a man-machine interface. Stylistic or aesthetic factors may not be easily quantified, but most designers would argue that they can significantly affect our response to written messages (see Doblin 1980). A well-known demonstration from the world of advertising asks you to consider two signs - one a scruffy hand-written blackboard nailed to a tree saying 'FRESH EGGS FOR SALE', and the other a well-finished stainless steel plaque inscribed in an up-to-date plain typeface 'FLYING SCHOOL'. Each sign is appropriate for its purpose. But if you imagine them reversed, would you now buy the eggs, or take the flying lessons. To translate the analogy into scientific editing terms, journals frequently announce their status or their personality by their cover design and their text typography: few editors could claim that these decisions were made on purely ergonomic grounds. In the social sciences, where interdisciplinary work is perhaps more common, a new project may require a researcher to scan a large number of journals he or she has never previously encountered - it is a strong-willed and diligent reader who takes no account of surface-level signs of validity in assessing an article.

Many journals, mainly in the humanities and social sciences, but also in the natural sciences, are more concerned with argument and analysis than the reporting of empirical data. Writing about philosophy journals, Quinton (1979) pointed out that "Scientists as readers use periodicals to find out what is going on in or near their own particular areas of research...The situation is quite different in philosophy. Communication or the exchange of ideas is not secondary to the original work of discovery. It is the typical form in which that original work takes place." Philosophy may be a different activity from science but wherever data is interpreted and explained, rhetoric must play some part - interpreting writers' persuasive strategies is certainly an essential task for social science journal readers; their job is not to simply absorb or ignore information according to its relevance but, 'suspending disbelief', to sift, analyse, and finally discard or accept an argument. Anderson (1981), discussing the presentation of research in education, includes graphic factors in his analysis of rhetorical tricks; his argument is further discussed and developed by Blake (1981). Waller and Anderson (1981) also explore the use of diagrams (graphic devices which also have a significant stylistic dimension) in argument.

The visual appearance of a journal, then, like the voice of a speaker, seems to give it personality - and according to Sandell (1977) the perceived personality of a speaker affects our readiness to attend or be persuaded. On television, historians are interviewed in book-lined studies, and scientists in white coats stand amidst expensive apparatus. Out of uniform they may have to employ other devices to assure us of their authority or scholarship. Evolutionary theory is an example of a journal with aspirations to academic quality that uses extremely low budget stencil-duplicated reproduction. Thus 'out of uniform', it reassures us with the cover statement "Dedicated to the primacy of content over display". But, of course, not every frog is an enchanted prince, and most of us will continue to find it hard to avoid judging by appearances. I also suspect that electronic journals, on-demand publications and other graphically uniform media (uniform because they display text on screens or printout systems which offer a standard range of letterforms) will not be long in discovering compensatory techniques for projecting their personality and status.

STRUCTURE

We have reviewed some ergonomic and some stylistic aspects of typography; a third, and in my view more significant, set of functions can be termed 'structural' - significant because it can affect not just the more mechanical and aesthetic aspects of the writer-reader transaction but also the argument or 'content' itself.

A number of studies of the structuring role of typography have been reported. Hartley and Burnhill (1976) criticised the use of space in British Psychological Society publications and have subsequently published the results of research into various components of journal articles: indexes (Burnhill, Hartley and Davies, 1977), references (Hartley, Trueman and Burnhill, 1979), and contents pages (Hartley 1979). In the latter two studies, it was concluded that the use of space to differentiate items was a stronger signal than the use of typographic variation (bold, italic); this was consistent with the findings of Spencer, Reynolds and Coe (1974) who compared alternative formats for bibliographic lists. The study of indexes showed no significant differences between the variants tested, but economic arguments were presented in favour of one of them. Indeed, this reflects the way decisions are taken in the world of publishing - practical constraints and functional considerations have to be balanced by the editor or designer. Such constraints and purposes will, of course, differ according to the subject matter and audience of the publication. This diversity of factors led Kinross (1977) to see little prospect of empirical research supplying useful advice on making indexes.

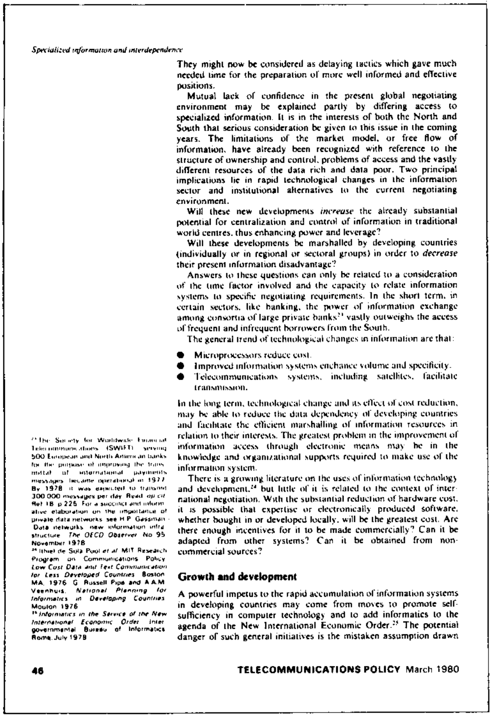
Research on typographic structure has looked mainly at text components for which visual structure is obviously a syntactic necessity - the constituent parts of contents lists, indexes and tables are related by their configuration in space. It may be, though, that the layout and typography of other more central aspects of discourse can have a similar function. For many years the study of grammar and syntax has been restricted by linguists to the level of the sentence; only comparatively recently have they begun to extend their scope to the paragraph and the text levels - (e.g., Dressler, 1978) and even this move is somewhat controversial. At the same time the study of language has been largely confined to spoken language - or at least a formalised version of it. The blame for both restrictions is generally placed on Bloomfield (1933), who considered writing as a secondary recording medium that was of no linguistic interest in itself (Mountford, 1980). It is interesting to note, though, that text-level grammarians are finding it hard to ignore typographic and spatial factors in their analysis of extended written discourse. (c.f., Werlich, 1976, van Dijk, 1979). For example, a box grouping two or more paragraphs is as much a cohesive device as purely lexical items such as 'firstly, secondly,' 'therefore' or 'in conclusion'.

I have suggested elsewhere (Waller, 1980) that this development parallels the foundational years of English linguistics in the seventeenth, eighteenth and nineteenth centuries. At that time, when basic (sentence-level) grammar was being developed, many linguists included punctuation in their analyses of written language just as they considered non-lexical aspects of phonology (Cohen, 1977). Punctuation was primarily seen as an elocutionary or stylistic device that enabled a reader to imitate in his head the sounds made by an imaginary speaker; silent reading - where meaning is derived directly from the printed characters without a sub-vocalised phonetic stage - was either not known or not considered. By the early nineteenth century the elocutionary view was largely rejected and a purely syntactic role was proposed. That is, punctuation was said to be a means by which words, clauses and sentences could be separated and their relations made clear (Honan, 1960).

Now that grammarians are turning their attention to whole texts, the analysis of macro-level typographic structures may follow the same path. That is, in addition to its obvious stylistic or aesthetic role, typography may be considered as 'macro-punctuation'; for demonstration purposes it is possible to identify a number of directly parallel roles for micro and macro punctuation (Waller 1980) but in the long term we may develop macro-syntactic concepts that have a direct equivalent at the sentence-level.

One interesting example is interpolation - the temporary interruption of a flow of discourse - which at the sentence level is effected by such means as parentheses, dashes or commas. At the macro-level, footnotes are often used for longer interpolated passages. Footnotes, though, like illustrations and tables (which according to Biderman, 1980, are the victims of segregation and discrimination comparable to that of women and ethnic minorities!) are typically regarded as rather a nuisance by editors; writers are encouraged to incorporate them into the main text 'if they are really essential to the argument'. But if we recognise that writers usually have to cater for a wide range of readers, each of whom uses the text in different ways on different occasions, then the functional argument for such graphically structured items as footnotes grows stronger. There are other common components of a journal article which are often embedded in continuous prose but for which a more graphic display might be usefully considered - experimental designs (as tabular or diagrammatic displays), main recommendations or findings (lists), summaries and abstracts (as marginal notes).

Although it is true that footnotes are a problem when traditional printing practices are used, more contemporary layouts such as the one illustrated in Figure 1 can incorporate the same length of footnote without rendering the division and make-up of pages more difficult. This idea can be extended and quite radical formats produced: Figure 2 shows an educational text where the 'footnotes' are almost as long as the 'main' discourse. It is intended that readers who



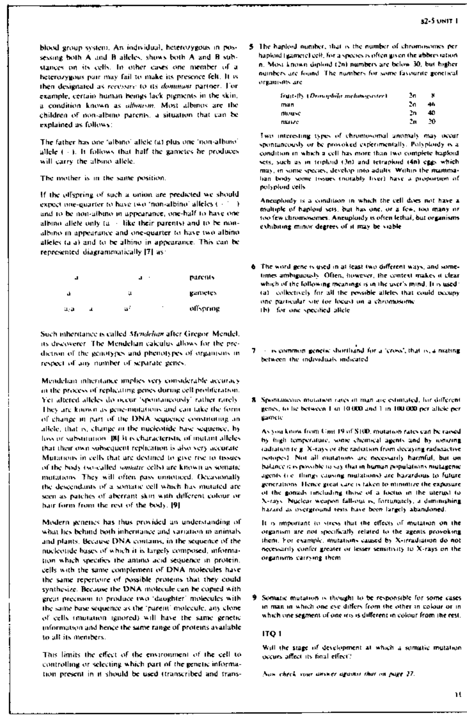


Fig. 1. (left) The use of the margin for footnotes solves the problems for most purposes and texts.
Fig. 2. (right) In this Open University text, the marginal notes form a separate level of discourse(right-hand column).

have not the prerequisite background knowledge to understand some of the concepts in the main discourse can move to the right-hand margin at appropriate points, signalled by bold numerals. Figure 3 shows the same idea extended even further; in an experimental layout for a popular science periodical, different versions of the content (diagrams, prose explanation, theory and examples) aimed at different readers are printed in four parallel columns on a double-page spread.

It is true, of course, that formats such as the one illustrated in Figure 3 would make the journal editor's job more complicated and add to the pre-production element of printing costs. However, computer-assisted editing, typesetting and page make-up will undoubtedly reduce these problems considerably in future years. And against such difficulties must be set the potential advantages of what we may call 'structured writing-systems' - a term which can be used to describe traditional graphically structure text-types such as newspapers and technical manuals as well as more radical 'patent' systems such as Information Mapping (Figure 4, Horn, in press),

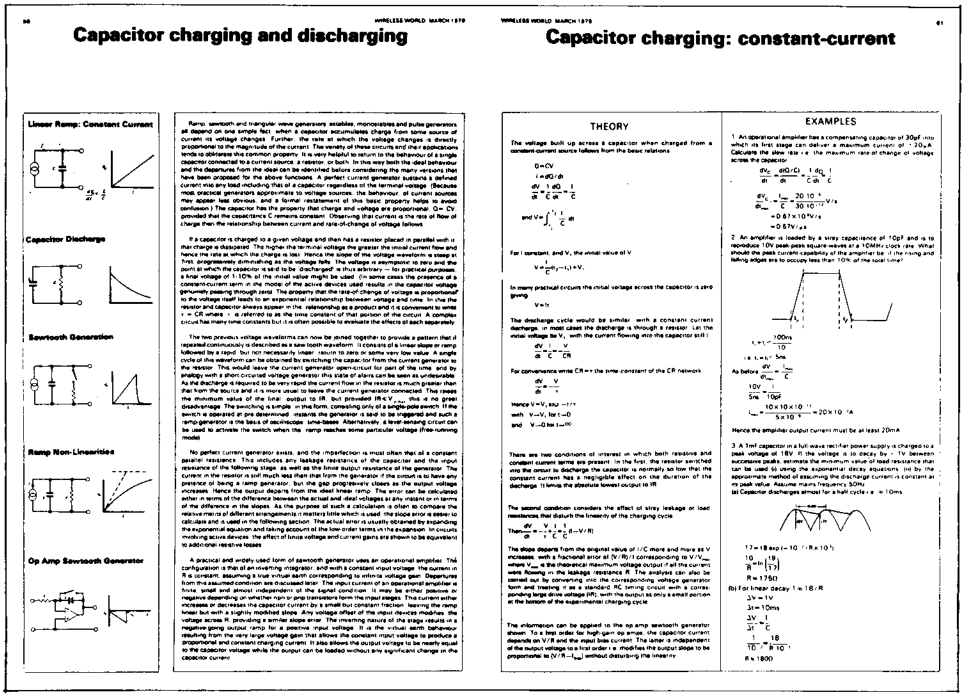
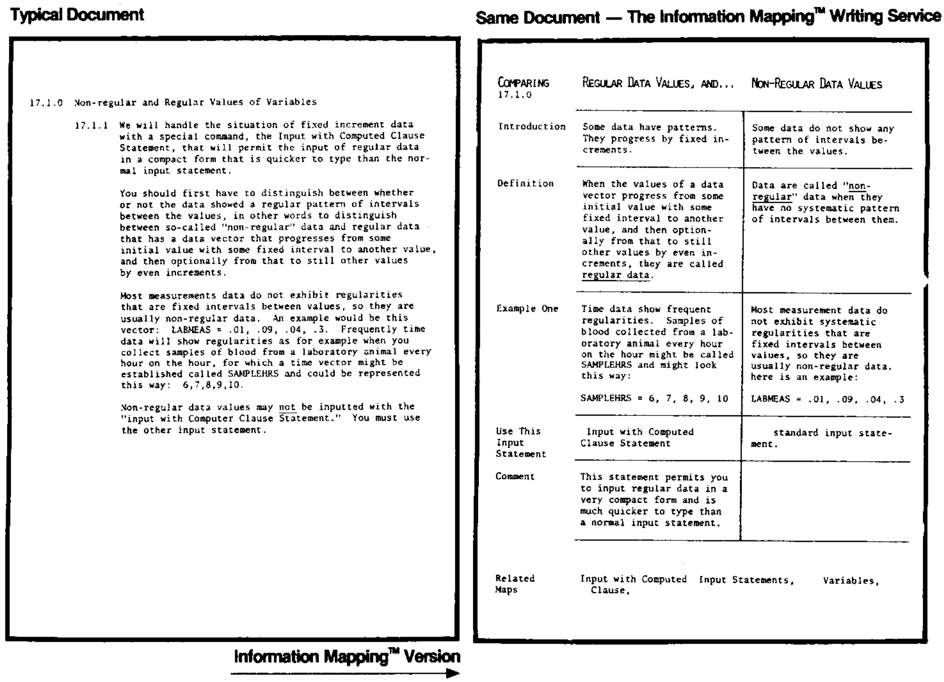


Fig. 3. This experimental layout presents four kinds of information for different readers or purposes.

Ordinary-Language Algorithms (Lewis, Horabin and Gane 1967) or Novatexts (Figure 3, Williams, 1979).

Structured writing-systems, although admittedly at a relatively primitive stage of development, represent richer hypotheses about the nature of the writing and reading processes than does traditional continuous prose. Writing is remarkably problematic for many people. Even those who do it well often admit to finding it difficult, even traumatic. Many scientists find diagrams and hierarchical list structures, such as those used in planning writing tasks or taking notes, rather easier to construct than linear prose. In diagrams, complex links between several concepts can be drawn almost instantly by spatial or graphic means while in prose the construction of such links can take a long time and calls for artistry not everyone possesses. Structured writing-systems are a compromise between the two - text as diagram (Waller, in press). They are potentially more subtle and precise than diagrams, but easier to construct than conventional prose.


Typical Document

17.1.0 Non-regular and Regular Values of Variables

17.1.1 We will handle the situation of fixed increment data with a special command, the Input with Computed Clause Statement, that will permit the input of regular data in a compact form that is quicker to type than the normal input statement.

You should first have to distinguish between whether or not the data showed a regular pattern of intervals between the values, in other words to distinguish between so-called "non-regular" data and regular data that has a data vector that progresses from some initial value with some fixed interval to another value, and then optionally from that to still other values by even increments.

Most measurements data do not exhibit regularities that are fixed intervals between values, so they are usually non-regular data. An example would be this vector: LABMEAS = .01, .09, .04, .3. Frequently time data will show regularities as for example when you collect samples of blood from a laboratory animal every hour on the hour, for which a time vector might be established called SAMPLEHRS and could be represented this way: 6,7,8,9,10.

Non-regular data values may not be inputted with the "input with Computer Clause Statement." You must use the other input statement.

Same Document — The Information Mapping™ Writing Service

COMPARING 17.1.0	REGULAR DATA VALUES, AND...	NON-REGULAR DATA VALUES
Introduction	Some data have patterns. They progress by fixed increments.	Some data do not show any pattern of intervals between the values.
Definition	When the values of a data vector progress from some initial value with some fixed interval to another value, and then optionally from that to still other values by even increments, they are called regular data.	Data are called "non-regular" data when they have no systematic pattern of intervals between them.
Example One	Time data show frequent regularities. Samples of blood collected from a laboratory animal every hour on the hour might be called SAMPLEHRS and might look this way: SAMPLEHRS = 6, 7, 8, 9, 10	Most measurement data do not exhibit systematic regularities that are fixed intervals between values, so they are usually non-regular data. here is an example: LABMEAS = .01, .09, .04, .3
Use This Input Statement	Input with Computed Clause Statement	standard input statement.
Comment	This statement permits you to input regular data in a very compact form and is much quicker to type than a normal input statement.	

Related Maps: Input with Computed Clause, Input Statements, Variables,

Information Mapping™ Version

Fig. 4. Information Mapping (a trademark of Information Resources Inc.) suggests new possibilities for scientific journals. The emphasis is on the usability of information. Reproduced with permission.

Reading, too, may be assisted by such systems. Observations of readers show that a number of distinct reading strategies can be distinguished. Three of the five listed by Pugh (1979) are selective or scanning strategies of the sort we can expect busy readers to use frequently. To such readers, typographic signalling and the sensible use of spatial layout can provide 'access structures' (Waller, 1979) that enable them to use selective reading strategies on a reliable (provided by the author) rather than an arbitrary (where the eye happens to fall) basis.

Developments such as these are of particular interest to publishers considering the replacement of paper journals or books with visual display units (which currently only allow the display of about 30 lines of text at a time). Structured writing-systems (in particular, Information Mapping; see Figure 4) tend to result in well-defined small chunks of information with well-signalled cross-referencing - potentially useful as a basis for organising electronic text systems that will in future have split screens, scrolling facilities and other cross-referencing devices requiring a high degree of explicit organisation of text material.

CONCLUSION

More than any specific guidelines or rules, good journal typography will result from a concern for good communication. Editors dealing with well-defined and homogeneous audiences may find structural factors of less interest than those dealing with multi-disciplinary and multi-level audiences; editors using traditional printing may find legibility less of a worry than those exploring new technologies. But all journal editors are professional communicators as well as professional scientists and scholars, and can learn from other (perhaps less prestigious) professionals such as those involved in education, technical writing, journalism, and popular science publishing. These more reader-centred areas are noticeably more willing to explore new communications techniques than are science publishers - even if it may cost more money to prepare material for printing. A good maxim for all publishers has been provided by Spencer (1969): "...unread print is merely a lot of paper and a little ink. The true economics of printing must be measured by how much is read and understood and not by how much is produced."

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DISCUSSION

Trigg, USA

Do I understand you correctly that there are essentially no reliable data on effects of such things as the choice of typeface, line length and so forth on legibility?

Waller

It's fair to say that there is reliable data, but that in practice it has little effect on these decisions. On the whole the research has confirmed the normal practice of printers. My job involves using the results of research as the basis of advice to designers, editors and authors about typography, but unless I can demonstrate a difference that is detectable to the naked eye - not just statistically different - the research has no effect on the decisions they make. In our own work we are trying to calibrate results in this subjectively acceptable manner. For instance we recently compared the legibility of Diablo daisyweel printer output (used by many word-processors) to ordinary print (represented by an IBM Composer in our experiment) by comparing both to what most observers would consider the worst possible print system that is still readable - a computer matrix printer that compresses the descenders of the letter up into the x-height. The fact that the result of this last comparison was intuitively 'correct' (it was about 40% slower to read) made the ~~first~~ comparison easier to believe (there was no difference), although it went against the subjective opinion of some of our editors - who understood traditional print to be better.

Eastwood, USA

There is a fashion for the ragged right. Could you state an opinion on the ragged right versus the justified right?

Waller

There has been some research on this, but there is very little difference, although it seems that ragged right is superior for a short column length. For instance that short column I showed you which was justified with no hyphenation is more problematic than the equivalent unjustified simply because justification is achieved by distributing the space not wanted at the end of the line among all the word spaces of the line. With a short column width you have fewer word spaces to distribute the same amount of space and so get more uneven spacing.

The effect on the reader has been likened to trying to run down stairs which are of different lengths and heights.

Cohen, UK

If there are no other comments it just remains for me to thank the speakers. We have covered a wide variety of topics within this field and all have been stimulating, I thank the contributors from the floor for the remarks they have made.