

Waller RHW and Whalley PC, 'Graphically organised prose', in E De Corte, H Lodewijks, R Parmentier and P Span (eds), *Learning and instruction*, 1987, Oxford: Pergamon Press, 369-381

GRAPHICALLY ORGANISED PROSE

Robert WALLER and Peter WHALLEY

The Open University, Milton Keynes, United Kingdom

A number of studies of typographic cuing have appeared in the educational research literature. They have recently been summarised by Glynn, Britton and Tillman (1985). The term "typographic cuing" refers to the use of typography (bold or italic type, or underlining) to signal the important ideas in a text. Hartley, Bartlett and Branthwaite (1980) were critical of the methodology of much of this work, but the consensus is that people are more likely to remember cued ideas, sometimes at the expense of uncued ideas.

This finding fails to astound. It is not really surprising that people are more likely to remember what they have been told to remember. Even better results could be expected if they were given the recall questions beforehand, or if less important ideas were simply left out altogether. A view of text as simply containing "gist" and some unimportant stuff between, is surely an impoverished one; as is a view of reading in which the task of the reader is just to remember and repeat certain instructor-designated "ideas". Although most reviewers admit a wide range of functions for typography and the text components it structures or signals, an unfortunate consequence of simple experimental methodologies is to limit greatly the devices that are tested.

A major problem with research on typographic structuring is that it has often taken place within a theoretical vacuum: researchers rarely have a meta-level theory with which to generate hypotheses or interpret results. Such a theory might be cognitive or linguistic. A cognitive theory

would have to incorporate the role of non-segmental (i.e., spatial or graphic) features into models of reading that typically regard it as a linear sequential processing of strictly segmented language. A linguistic theory would have to place graphic factors in the context of other linguistic cues: How can typography be used as a cohesive device? Is it paralinguistic, like gesture or tone of voice? Is it metalinguistic, assigning a particular status to a textual unit such as a paragraph or section? Is it rhetorical?

A further problem is that the research is simply unimaginative in its view of the expressive potential of written language, which is seen as a simple sequence of words to be comprehended. In contrast to this, other researchers have proposed and tested innovative and unusual typographic formats. A number of these were published in a special issue of *Visible Language* by Hartley and Burnhill (1981). Examples of innovative formats include the use of different levels of indentation to indicate hierarchical levels of argument (Jewett, 1981), and the combined use of bold type and parentheses to distinguish between "important" sentences and "gist" sentences (Shebilske & Rotondo, 1981). "Structured writing" (Horn, 1985) involves the use of tabular layout and frequent headings to present technical information in an organised and accessible way.

While it uses the empirical method well, to refine and test intuitive notions and insights, this research on innovative formats is somewhat premature. Again, unless we have a theoretical understanding of the role of conventional graphic design, we lack an adequate framework in which to fit the result of innovative research: can these new formats be used for all purposes, in all content areas, by all readers?

THE PRACTICAL CONTEXT

Although most research on instructional text concentrates on verbal language, for many centuries the verbal and the visual have co-existed. Twyman (1979, 1983) has demonstrated how most actual texts combine the organizational and representational methods of prose, diagrams and pictures. Only recently, however, have scholars begun to account for the linguistic and functional relationship between verbal language and its graphic display. Hartley (1982), for example, has published many experiments on the structural use of typography, and Waller (1982, 1985)

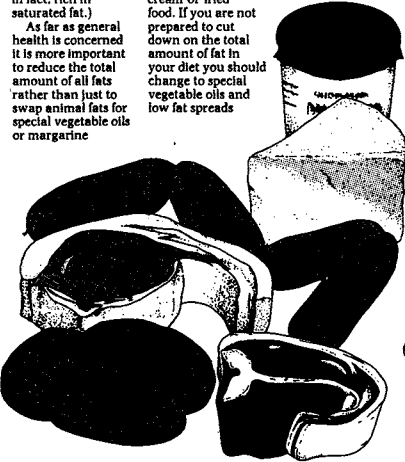

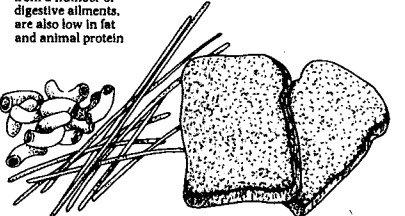
Target – eat less fats			Target – eat less sugar		
Why? Cholesterol is the main constituent of fatty deposits in arteries and of gallstones. Excess amounts are made in the body when high fat foods are eaten. Particularly food rich in 'saturated' fat mainly found in animal foods. Other fats in the diet – called 'poly-unsaturated' fats – tend to reduce cholesterol in the body. This type of fat is found in many foods, particularly in corn oil, sunflower seed oil and soya oil. (NB some vegetable oils and margarines are, in fact, rich in saturated fat.) As far as general health is concerned it is more important to reduce the total amount of all fats rather than just to swap animal fats for special vegetable oils or margarine	By how much? We get more than 40% of the calories we need from fats. It would be better to reduce fats to 30–35%. This is difficult to calculate. You almost certainly need to cut down if you often do one or more of these things. Eat fatter food. Put butter or margarine on cooked vegetables. Spread butter thickly on your bread. Eat a lot of the foods listed in the next column. Provided you keep the total amount low you do not need to cut out completely your favourite butter, cream or fried food. If you are not prepared to cut down on the total amount of fat in your diet you should change to special vegetable oils and low fat spreads	Watch these foods Fat is a major part of: cakes, pastries, biscuits and chocolates, sausages, salami, pork, lamb, cheese, cream, butter and margarine, cooking oils and fat. If you love the taste of butter, really savour it on a plain slice of bread and butter. Change your cooking habits by ○ Grilling instead of frying ○ Using non-stick pans ○ Using recipes which use less fat ○ Using skimmed (low fat) milk instead of ordinary milk in recipes	Why? A high sugar diet encourages dental decay. Sweet foods can spoil the appetite for more nourishing foods. Sugar only provides energy which is also provided by, for example, potatoes and wholemeal bread. Because we become addicted to sweet things we are tempted to overeat and so may put on weight	By how much? Most people get one fifth of their energy needs (calories) from sugar. About half of this is from the use of packet sugar and jams. The other half might be thought of as 'hidden sugar' which is added to many manufactured foods. <i>We do not need any sugar at all</i>	Watch these foods Sugar is the major part of sweets, soft drinks, cakes, biscuits, puddings and jams. It is also added to many manufactured foods like tomato ketchup, tinned fruit, ice cream and frozen foods. Reading the label will tell you which have sugar added to them. If you have a sweet tooth you could have an occasional treat, eg. Jam on your bread or a piece of chocolate
					
			Target – eat more fibre		
Why? There are probably a dozen different kinds of fibres, all with different roles to play. Therefore cereal foods and fruit and vegetables are equally important. Extra bran is not the same as 'high fibre diet' and is only good for helping constipation. 'High fibre diets', which may offer protection from a number of digestive ailments, are also low in fat and animal protein			By how much? You can't really eat too much when it is a natural part of food. You could eat too much bran – but you would be hard put to swallow it. You are probably eating enough if you have regular bulky, but not hard, bowel movements		
Watch these foods Eat more of the bulky foods listed in 'fillers' and a variety of fruit and vegetables ○ Eat breakfast cereals made from the whole grain ○ Try brown rice or wholemeal pasta ○ Eat wholemeal or brown bread ○ Eat the skins of old potatoes as well as new ones					

Figure 1: A page from the Open University text *The Good Health Guide*, Harper & Row, London, 1980

has analysed the use of format to signal argument structures in popular non-fiction texts and manuals.

Figure 1 shows an example from a textbook which uses format to structure its argument. The rhythm of the argument is displayed through the headings ("Target . . .", "Why?", "By how much?", "Watch these foods") and by the graphic arrangement of the three sets of information. Even when this page is read in a normal sequential manner, the graphic shape of the text affects its interpretation. To achieve the same effect

using only linear prose, additional introductory, connecting and concluding sentences would be necessary.

This is typical of a style of text which has become increasingly popular in recent years. In order to attract the uncommitted and casual reader, publishers of popular manuals and handbooks (on such topics as health, home-maintenance, hobbies etc.) have developed a highly graphic style of text in which layout and typography is heavily used to structure the argument. Each topic is displayed within separate pages or double page spreads using multi-column layouts and bold headings.

The components of such pages often fit together so perfectly that it is obviously not accidental. Whereas in the normal publishing model books are laid out on the page after they have been handed over by the author, it is clear that in these graphic texts both processes—writing and design—have been done simultaneously. The design of the page can thus be integrated with other structuring techniques available to the writer.

It is worth noting that most of these new “graphic texts” have been developed without the direct influence of instructional psychologists: their testing ground has been that of the marketplace.

Access structures

This modern style of instructional text has developed in recognition of the fact that it is only in a very few cases that authors can make completely accurate predictions about the needs and abilities of their readership. Most textbooks are used within a variety of instructional settings by students with different cultures, educational backgrounds and purposes. Rather than locking all readers into a single linear sequence, these texts are accessible for a range of different purposes.

The term “access structures” (Waller, 1979) has been used to describe textual features such as the contents list, the index, the glossary, headings of various types, summaries, and diagrams of its structure. These are well known devices which have been developed over several centuries in response to the needs of writers and readers. They reflect the essential power of the print medium: that it can contain arguments which are longer than a reader’s attention span, which contain depths of significance revealed only by careful study over a long period of time, and which can be used in different ways by readers with different purposes.

All language is linear in its most basic form, but text is less restricted by this fact than speech. De Beaugrande’s theory of linear action (de Beaugrande, 1984) lists seven principles of linearity—strategies used by writers to manage the transition between complex multi-dimensional “cognitive space” and linear linguistic sequences. For example, writers have various strategies for looking ahead or looking back at other parts of the linear text. These include such things as parallelism, alliteration, rhyme, and endophoric reference. But while these cohesive strategies are essential for both readers and listeners, readers have the advantage of being able to check for themselves. They can literally look back to the preceding text, not just to their memory of it. They can do so not only when the writer alludes to it, but when some cognitive or logical problem, unpredicted by the writer, presents itself. This *accessibility* of text liberates the reader from the linearity of language.

Access structures as relevance cues

Grice (1975) has provided an influential account of the cooperative nature of communication, observing that we are able to understand apparently illogical or unconnected statements by constructing a scenario within which they make sense. We do this because we assume that all contributions to a discourse are made with an effort to cooperate and communicate. Grice identifies four “conversational maxims” which govern our cooperative assumptions: quantity (that the information is adequate); quality (that it is true); relation (that it is relevant); and manner (that it is unambiguous).

So long as we read in a linear manner, the techniques listed by de Beaugrande (1984) enable skilled writers to adhere to Grice’s maxims. For example, writers of fiction create expectations and scenarios to which subsequent text is relevant. Writers of functional texts (textbooks, technical manuals, and so on), though, have less control. In particular they cannot be responsible for the relevance of information for every reader or for the quantity of information needed. Instead, they typically provide a high level of signalling—an access structure—which enables readers to assess the relevance of text in relation to their own purposes rather than simply the internal expectancies created within the text. Indeed, Van Dijk’s (1979) list of “relevance signals” brings together surface level cues, such as typography, and deeper semantic ones implicit in the language or rhetoric of the text.

It was in the context of this conceptual framework—graphic formats as relevance cues or access structures—that we undertook the study reported here. Instructional research on conventional prose tends to present publishers with a dilemma when it suggests how authors can best present arguments to readers with particular levels of prior knowledge or particular learning objectives (i.e., those used in the experiment). One such study was reported by Schnotz (1982). In the study reported below we sought to test our concept of access structures by extending his study to include graphic formats used for more than one purpose.

THE SCHNOTZ STUDY

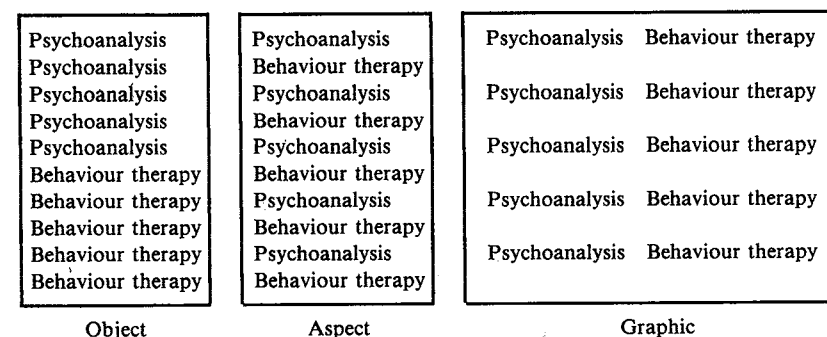
Schnotz investigated the effect of alternative ways of presenting comparative/contrastive arguments to readers with different levels of prior knowledge. He found that the comparative processing of the two sets of ideas was encouraged by one text arrangement but discouraged by another.

Schnotz's text contains descriptions of two kinds of psychotherapy, psychoanalysis and behaviour therapy. Each description contains five paragraphs describing an aspect of each therapy (for example, its theoretical principles or its definition of neurotic disorder). One version (which Schnotz called "organization by object") presents a description of one therapy followed by a separate description of the other. The second version (organization by aspect) interweaves the two descriptions. We used the same texts for our study, translated into English with a few minor alterations in style.

Schnotz found that readers did more comparative processing with the aspect- than with the object-organized text. The arrangement of the text clearly encourages that strategy. However, he also reported that readers with lower prior knowledge took longer to read the aspect-organized text. In assessing the practical implications of his results he therefore presents us with a dilemma: the first arrangement is best if comparative processing is required, but worse if students have low prior knowledge.

This study introduces a third, graphic, arrangement which, it was proposed, combines the merits of Schnotz's alternatives and so resolves the dilemma. It was thought that if the graphic layout of the argument allowed a range of reading strategies (in contrast to the linear strategy imposed by conventional prose), then the style of processing achieved

Figure 2: The structure of the three text versions. There were two sets of five paragraphs on various aspects of the two kinds of therapy



would be a deliberate choice of the reader rather than a side-effect of the text arrangement. The third version (graphic-organization) presents the two descriptions side by side in a tabular arrangement, with row and column headings. Figure 2 illustrates the difference between the aspect-, object- and graphic-organized texts.

It was hypothesized that graphic groups, reading the "multi-purpose" texts, would perform equally well as the best of the aspect or object groups on appropriate measures: that is, that both aspect and graphic groups would score better on comparative measures than object groups; and that both object and graphic groups would produce better general recall scores than aspect groups, reflecting the fact that both groups were able to read a single uninterrupted account of each kind of therapy.

EXPERIMENTAL DESIGN

Instructions were written on a whiteboard at the front of the room. Subjects were asked to read the text in such a way as to be able to summarize the content on behalf of another student later on, so that the notional "other student" would be able to write an essay about it. The instructions were similar to those reported by Schnotz, for the same reason: to induce task-oriented learning.

In order that this task perception should focus on both comparative and general recall, we divided our subjects into two groups. In the Integrated Essay condition, the "other student" had the task of writing a

single essay comparing psychoanalysis to behaviour therapy. In the Separate Essays condition, the "other student" had the task of writing two separate essays, one on psychoanalysis and the other on behaviour therapy. The purpose of this distinction was to enable us to observe the interaction of reading goals and text organization.

Materials

The text contained about 1100 words. While the graphic-organized version was printed on one sheet of paper (220 x 340mm), the object- and aspect-organized versions each took exactly two pages of A4 paper (210 x 296mm). They were typeset, photocopied on one side of the paper only and stapled at the top left corner.

To avoid a possible order effect, two variants of each version were used: one started with psychoanalysis and the other started with behaviour therapy. The data for the two order-variants was combined for analysis.

Subjects

Thirty-six polytechnic students were randomly assigned to the six conditions. They were studying a range of subjects for a modular degree programme.

Procedure

Students were given twenty-five minutes in which to read the text. Average reading times reported by Schnotz indicated that this would be adequate, although we did not measure differences in reading time. To ensure naturalistic conditions, the time allowed was greater than that needed for a single read-through. Students could thus reread the text several times, and they were permitted to take notes (about half of them did so). However, their notes were taken away before they did the recall task. After the reading task, subjects were distracted for ten minutes by an unrelated symbol-identification task which required them to concentrate hard and work quickly. Finally, subjects were given fifteen minutes to write a summary of the text as described in the instruction.

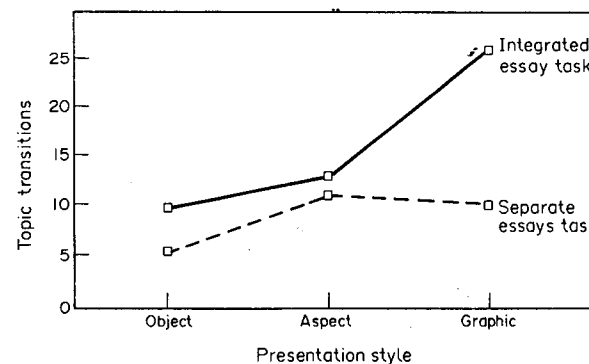


Figure 3: The results for the comparative measure. The y-axis shows the percentage of transition opportunities (sentences + sentence boundaries) at which topic transitions were made

Scoring

The essays were marked in two ways. General recall was marked using a simple scoring scheme: subjects were given marks for each of a-list of main points which they reproduced correctly in their essays.

The degree to which students had integrated the two descriptions (the comparative measure) was measured by the number of transitions between them in the essays. For example, if students produced a completely object-organized essay, there would only be one transition between their description of psychotherapy and their description of behaviour therapy. If they produced an aspect-organized essay, there would be many more transitions as they compared the two therapies along a range of attributes. A transition might be made within a sentence or between sentences. Our measure was therefore the proportion of transitions to transition opportunities (sentences and sentence boundaries).

RESULTS

On general recall, no significant differences were found. The results for the comparative measure are shown in Figure 3. Table 1 presents an ANOVA analysis.

The main results shown here are as follows :

Table 1: Anova summary table of the comparative measure (the percentage of "transition opportunities" used for topic transitions)

Source of variation	DF	Sum of squares	Mean square	F-ratio
Task	1	484.66	484.66	6.234
Text version	2	672.877	336.438	4.238
Task/Text version	2	354.382	177.191	2.279
Residual	30	2332.192	77.74	
Grand total	35	3844.11		
Text: linear trend	1	667.921	667.921	8.592
Text: quadratic trend	1	4.956	4.956	.064

- The Integrated Essay groups produced significantly more integrated summaries than the Separate Essays groups ($p < 0.05$).
- The combined results show that the graphic groups did better than the aspect groups which in turn did better than the object groups on the comparative measure ($p < 0.05$).
- Even with the Separate Essays instructions, the format of the graphic and aspect-organized texts biased subjects towards a more integrated summary than the object-organized text. Graphic and object are not significant; aspect and object are ($p < 0.02$).
- The Integrated instructions seem to have compensated for the object-organized format. The object group's summaries were nearly as integrated as the aspect group's; the difference is not statistically significant.
- The graphic group's performance on the Integrated instructions task was outstanding. The combination of an integrative reading purpose and an accessible text produced a score on the comparative measure very much greater than the other two groups ($p < 0.025$).

Discussion

These results confirm those of Schnotz. He also found no significant difference in general recall but found that the aspect group exhibited better comparative learning than the object group. Our results, which use different measures, showed a similar effect but it was only statistically significant with the Separate Essays instructions.

The most striking result was the superiority of the graphic group over both of the others on the comparative measure for the Integrated Essay condition. The graphic layout of the graphic-organized text makes the comparative/contrastive structure of the argument much more obvious than either of the continuous prose versions. It was among subjects reading the graphic-organized text that reading purpose had the most marked effect. Because the argument structure was made accessible, they would have been able to alter their reading strategy more effectively to match their purpose.

The results can be interpreted as indicative of either an "input" or an "output" effect. The input effect implies that the graphic layout influenced the way the argument was memorized. The output effect suggests that a "separate" memory of the structure of the text influenced the way that it was recalled in the essay task. That is, the tabular structure provides a mnemonic in a way that the two conventional prose versions do not. Jonassen (1984) demonstrated that graphic organizers (diagrammatic and pictorial overviews of the argument) can provide an effective "ideational scaffold" on to which students can build as they read the detailed argument contained in instructional text. In our case it could be argued that the overall design of the page provided such a graphic organizer. Further studies would be necessary to determine which explanation is correct, and whether the effect is maintained over a long delay between study and recall. To test whether the format has actually changed cognitive structures, rather than just the way they are expressed, we plan to run a similar study using the multidimensional scaling procedures described by Whalley (1982).

CONCLUSIONS

The main hypothesis was confirmed. The graphic organized text was found to reduce Schnotz's trade-off between text organization and type of learning. The graphic version performed as well as the best of the others on both general recall and comparative structure.

The graphic format significantly affected subjects' perception of the contrastive nature of the argument they were reading. Since this intelligent integration of conflicting arguments is a major goal of many educators, this result has interesting implications for textbook designers. It reinforces other research on graphic access structures—for example,

headings (cf. Hartley, 1982) and structured writing (Horn, 1985)—and suggests that typography could become a highly significant part of the writer's toolkit.

REFERENCES

- de Beaugrande, R. (1984). *Text production: Towards a science of composition*. Norwood, NJ: Ablex Publishing Corporation.
- Glynn, S., Britton, B., & Tillman, M.H. (1985). Typographic cues in text—Management of the reader's attention. In D. Jonassen (Ed.), *The Technology of Text* (Vol. 2, pp. 192–209). Englewood Cliffs, NJ: Educational Technology Publications.
- Grice, P. (1975). Logic and conversation. In P. Cole & J. Sadock (Eds.), *Syntax and semantics III: Speech acts* (pp. 41–58). New York: Academic Press.
- Hartley, J. (1982). Designing instructional text. In D. Jonassen (Ed.), *The Technology of Text* (Vol. 1, pp. 193–213). Englewood Cliffs, NJ: Educational Technology Publications.
- Hartley, J., Bartlett, S., & Branthwaite, A. (1980). Underlining can make a difference sometimes. *Journal of Educational Research*, 73, 218–222.
- Hartley, J., & Burnhill, P. (Eds.). (1981). The spatial arrangements of text. Special issue of *Visible Language*, 15, 4–120.
- Horn, R.E. (1985). Results with structured writing using the Information Mapping (IM) writing service standards. In T. Duffy & R. Waller (Eds.), *Designing usable texts*. Orlando, FL: Academic Press.
- Jewett, D.L. (1981). Multi-level writing in theory and practice. *Visible Language*, 15, 32–40.
- Schnotz, W. (1982). How do different readers learn with different text organisations? In A. Flammer & W. Kintsch (Eds.), *Discourse Processing* (pp. 81–98). Amsterdam: North Holland Publishing Company.
- Shebilske, W., & Rotondo, J.A. (1981). Typographic and spatial cues that facilitate learning from textbooks. *Visible Language*, 15, 41–54.
- Twyman, M. (1979). A schema for the study of graphic language. In P. Kolars, M. Wrolstad, & H. Bouma (Eds.), *Processing of Visible Language* (Vol. 1, pp. 117–150). New York: Plenum Press.
- Twyman, M. (1983). The graphic presentation of language. *Information Design Journal*, 3, 2–22.
- Van Dijk, T.A. (1979). Relevance in discourse comprehension. *Discourse Processes*, 2, 113–126.
- Waller, R.H.W. (1979). Typographic access structures for educational texts. In P. Kolars, M. Wrolstad, & H. Bouma (Eds.), *Processing of visible language* (Vol. 1, pp. 175–181). New York: Plenum Press.
- Waller, R.H.W. (1982). Text as diagram: Using typography to improve access and understanding. In D. Jonassen (Ed.), *The technology of text* (Vol. 2, pp. 137–166). Englewood Cliffs, NJ: Educational Technology Publications.

- Waller, R.H.W. (1985). Using typography to structure arguments. In D. Jonassen (Ed.), *The technology of text*, 2, 105–125. Englewood Cliffs, NJ: Educational Technology Publications.
- Whalley, P.C. (1982). Argument in text and the reading process. In A. Flammer & W. Kintsch (Eds.), *Discourse processing*, 495–508. Amsterdam: North Holland Publishing Company.