

Typographic Access Structures for Educational Texts

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The term "access structure" refers to the co-ordinated use of typographically signalled structural cues that help students to read texts using selective sampling strategies. In spite of their prevalence, however, the research literature contains very few references to access devices which include contents lists, headings, glossaries, and so on. This paper suggests some reasons for this and proposes that for research to be truly actionable it must be more firmly rooted in real-world problems. Evidence for the significance of selective reading is presented and some implications for research strategies are discussed.

If you were to compare an educational textbook and a novel, both in a language you do not know, you would very probably be able to tell them apart just by appearance. The novel will almost certainly consist solely of continuous prose. The text of the educational book, though, may be surrounded by additional pedagogical components, such as contents, index, glossary, summaries and so on. Why is the difference visible? It is not because the textbook has a structure and the novel has none. It is because the structure of the textbook has been typographically signalled, while the structure of the novel is signalled by linguistic means alone. So, whereas the typography of plain text can be evaluated by criteria of congeniality and legibility, the typography of textbooks clearly involves additional factors.

Consider the readers' problem if the contents list or index of this publication were to be laid out as continuous prose. If we accept at face value the conclusions of many studies in the field of reading, there would be few problems. The words would be legible, recognisable, comprehensible (by themselves), and memorisable. Although the page might look attractive, it would never-

theless be completely unusable for its intended purpose. The problem would not be legibility so much as accessibility.

A contents list of index uses typographic layout and signalling to display structural (typically hierarchical) relations in its content. The structure of a complete book can be made accessible in a similar way. That is, typographically signalled devices can be used to help readers overview the text and locate relevant parts efficiently. To the list of such devices in the first paragraph might be added headings, concept maps, questions, study notes, and learning objectives. Used together in a co-ordinated way they comprise the access structure of a text.

Typographic signalling is not, of course, an inherent characteristic of all these devices. Much of the information they convey might well be communicated in the main explanatory discourse. That they often are signalled represents a prediction that publishers make about the purposes and strategies of readers. Whereas a continuous discourse assumes and perhaps enforces a relatively passive sequential reading strategy, a typographically structured text allows for more selective sampling. For example, when summarising paragraphs are embedded in the middle of a continuous text, they are useful only to the reader who is reading the book through in a sequential way. If the paragraphs are typographically signalled, they can be easily accessed and used for text selection, previewing the argument, reference, and revision.

It might be thought that the various components of an access structure, being so prevalent in modern textbooks, would have been the focus of reasonably thorough experimentation. Instead, it is extraordinary that whereas innovative devices, such as the advance organiser or behavioural objectives, have been the subject of dozens of studies, there are only two or three papers that even mention headings as an aid to learners; and to my knowledge, no-one has yet looked at contents lists.

If it is accepted that there are circumstances in which readers may need to read selectively, then the models, theories, or methodologies used as the basis for empirical research should take this into account. This paper was prepared for a conference one of whose aims was to promote dialogue between psychologists and graphic designers interested in implementing research findings. It is therefore appropriate to examine why access devices have so rarely been featured in the research literature. Until they are, communications-media professionals will continue to complain with some justification that empirical research is not relevant to their needs.

What Practical Research has been done?

It would be a difficult task to classify all the research that has been published on texts. We are here primarily interested in studies that specifically aim to inform and evaluate the work of professional communicators. However, not only has a wide range of topics been identified for investigation but the purposes of researchers have differed greatly. Studies range from the highly theoretical to the pragmatic, from molecular issues to whole textbooks. Much of the research has investigated theories of memory, learning, or language processing and only incidentally the use of texts. Even research that is specifically concerned with text does not always aim at the same outcome. Frase (1973) has distinguished between three kinds of problem -- theoretical,

methodological, and practical. He points out the danger of interpreting research which is primarily intended to solve theoretical or methodological problems as the source of advice about practical instructional situations.

Prescriptive research on text presentation ranges from studies of legibility, dominated by the work of Tinker (1963), to work on content sequence and structure (Posner & Strike, 1976). Readability research investigates language variables such as vocabulary, syntax, and abstractness. The main body of work was summarised by Klare (1963). "Adjunct learning aids" describe devices that researchers have examined for their effectiveness in encouraging the recall of prose. These include "pre-instructional strategies" such as advance-organisers and objectives (Hartley & Davies, 1976) and in-text aids, usually questions (Anderson & Biddle, 1975). Much, but not all, of this research has been done in the context of Rothkopf's theory of mathemagenics (1970). The word is coined from the Greek and means "giving birth to learning." Studies of adjunct aids attempt to manipulate the readers' learning set in order to improve recall. A recent overview of the area is by Faw and Waller (1976).

Why is the Research not Successful?

It would seem at first sight that text researchers are covering a wide range of factors. Most of these areas, though, are currently receiving substantial criticism not only from potential users but from within. Contradictory or inconclusive results have been reported in a number of recent reviews -- for example, Duchastel and Merrill (1973) on objectives, Barnes and Clawson (1975) on advance organisers, Rickards (1977) on questions -- and a number of criticisms have been made of research, particularly that which aims to be prescriptive rather than descriptive.

First, research has been criticised for its lack of a sound theoretical base (Hartley & Burnhill, 1977 on typography; Rickards, 1977 on questions). Even the most widely used frameworks fail to convince everybody (Carver, 1972 on mathemagenics; and reply by Rothkopf, 1974) or are misunderstood by those who use them -- Ausubel's "advance organiser" theory is particularly abused (Ausubel, 1963).

Second, methodology has been the focus of a great deal of criticism. The interpretation of results is made impossible by the wide variation among researchers in the variables they control and the experimental conditions that they report. In addition, a paper by Ladas (1973) demonstrates that different statistical techniques can be used to produce different results, using basically inconclusive data. Stokes (1978) presents evidence that questions the reliability of readability research.

Linked to problems of theory and methodology is the issue of representativeness. Since many real-world factors are missing in laboratory experiments, research results are often unreliable as a basis for instructional practice. Molecular issues may be convenient to study in a controlled context, but in real life they will often be swamped by other, more dominant, aspects of the learning environment. For example, Faw and Waller (1976) remark that the effect of the continued use of the innovative mathemagenic aids used for experiments has never been studied; yet it would seem that experience of using these devices would be an important determinant of their effectiveness. Thorndyke (1975) makes a similar point in relation to psycholinguistic

research. He suggests that where experimental situations are too far removed from normal experience, subjects may resort to special processing strategies. Snow (1974) demonstrated that the enormous range of variables present in a real-life instructional situation can never be completely replicated in a laboratory. Macdonald-Ross and Waller (1975), in addition, point out that the stimulus material used in many studies of typographic design fails to meet basic standards of clarity achieved by most professional graphic designers.

As far as practical communicators are concerned, these sorts of criticism imply that the outcomes of research are unactionable. Researchers have too rarely addressed questions that those who write, edit, and design textbooks actually need answers to.

Research and the Real World

The problems of theory and methodology are linked to the question of how representative the research on real world processes and events is. The relationship between research and the real world is discussed by Ravetz (1971), who offers an analysis of what he terms "ineffective and immature disciplines." His detailed comments echo the self-criticism heard in our own field of study. Rothkopf (1973) has written, for example, "We, the practitioners of an infant science, live in an age in which the elegant theoretical accomplishments of the advanced physical sciences are taken as the model for all scientific activity." He appeals for a return to the practical origins of science, saying that "Highly abstract conceptions of learning and teaching have not served the researcher's intuition well. They have distorted the sense of what questions are important and what results promise practicable contributions to schooling. As a consequence many research endeavours appear sterile and trivial."

As a solution, Rothkopf suggests that researchers need "cultural reconnaissance" into the real world. Ravetz cites the historical development of the now mature, positive sciences. He takes the view that immature disciplines could benefit from the former distinction between "history," "philosophy," and "arts." "Philosophy" meant reflection and explanation of the real world as described and classified by "history," while "arts" represented "the set of principles defining the methods of any class of tasks."

Such a reorientation would result not in any major change in experimental or statistical techniques, but in new research goals. Unlike the physical scientist's goal -- the definition of universal general laws -- the concept of "arts" would concentrate our efforts on identifying, refining, and testing techniques and methods. The quality control of applied research would involve the applicability of an idea to real-world situations in addition to laboratory experiments. This view does not deny the validity of all experimentation. The observation and classification that Ravetz calls "history" still needs experimental investigation into the basis of, for example, perception and cognition, but it does discourage what Anderson and Biddle (1976) call "mindless empiricism."

In Ravetz's view, knowledge in the immature disciplines is more realistically embodied in the form of aphorisms than universal general laws. Aphorisms are "where a craft knowledge finds verbal expression." They are not the perfectly validated, scientific knowledge that researchers in our field have failed to achieve. Where scientific knowledge claims to be generalisable

and value-free, aphorisms are unashamedly situation-specific and their values are openly admitted. Thus, according to the context of our problem, we are free to accept or reject them. They provide a framework in which to externalise and examine ideas and attitudes that would otherwise remain in the tacit domain.

In the field of typography the literature has always been aphoristic in nature --and the most interesting aspect of scientific research has often been its subjective element. The choice of issues is frequently more interesting than the actual results obtained. A compilation of typographic "common-sense" may be found in Zapf (1970) or Gerstner (1974). One may not agree with everything there, but will come away knowing a great deal more about typographic design. The role of empirical research is to monitor the effectiveness of the methods and techniques that aphoristic knowledge embodies, and provide an objective basis for observation of the real world of writers, books, and readers.

The Real World of Writers and Readers

What, then, are the characteristics of the real world on which research should be based? At present we are working with models that deal with only a fraction of its complexity, but which are relatively easy to investigate. For example, if we want to test the effectiveness of a particular text variable in improving learning, the criteria for successful learning (perhaps a high score in a comprehension test) will be determined by the experimenter. We could only extrapolate from such studies to situations where the achievement of predictable institutional goals was more important than the achievement of the students' personal goals. This, however, seems to deny the essence of the text medium: printed books are transportable and can be stored. That is, they can be used by people the author is not aware of and whose needs he cannot predict with any precision, and the reader is ultimately in control of the presentation sequence.

Studies of this sort seem to have a restricted view of the problems of textbook production and use. We may regain our perspective by looking at some of the other factors that in the real world of textbook publishing influence those whose job it is to oversee the production and evaluation process -- the editor, typographer, or educational adviser. The matrix in Figure 1 shows one way of representing their objectives. It is based on the assumption that all texts have a sponsor (author, publisher, etc.) and users. The ways in which these two groups influence the communicator's objectives are polarised in this diagram into positive purposes and negative constraints. The contents of the cells may, of course, vary. Although theorists and practitioners alike should ideally take account of factors appearing in all four cells, it is too often possible to identify a sort of professional tunnel-vision, that is not confined to applied psychologists. An example from the research literature is of the investigators who, often using incorrect terminology, have reported on the legibility of type without reference to particular typesetting systems. As Hartley and Burnhill (1977) point out, they have not addressed the questions typographers actually ask. They are thus quite firmly rooted in the user-constraints cell of the matrix. An example from the practitioners' side is of the many editorial house-styles that attempt to impose standard formats, presentation styles, and printing methods on publications without regard for

	PURPOSES	CONSTRAINTS
USER	Decide to/not to use Search for particular item Study in depth Browse Recap/review Entertainment etc.	Physiological (legibility, weight of book) Psychological (reading skills, aptitude, previous knowledge) Availability (delivery, storage etc.) etc.
SPONSOR	Teach particular curriculum Persuade Enrich readers' outlook Personal fulfilment Sell books etc.	Production costs Legal factors (libel, copyright etc.) Technology Standard procedures (house-style, standard forms, etc.) etc.

Figure 1. The sources of textbook designers' objectives.

the nature of particular target readerships. The application of standards and rules that cannot be justified by reasons other than tradition alone places such house-styles in the sponsor-constraint cell.

This matrix demonstrates a significant omission in the advice that is available to producers of texts, either through research literature or the traditional practices of publishing. The issues raised by the user-purposes cell have not been dealt with. Information is available about most items in the constraints cells, while the sponsor-purposes cell has dominated instructional research with its stress on the achievement of institutional goals. However, the notion that users may approach texts for many different purposes has usually been overlooked in the reduction of the real world to theoretical models for controlled experiment. There is evidence, though, that although text is on the whole a linear sequential medium, it is likely to be read in a far from linear fashion.

Evidence of Selective Reading Strategies

The authors of some kinds of texts can make strong predictions about their readers. Novelists, for example, have a self-selecting readership who appreciate and understand their style. The authors of programmed-learning texts can, by entry tests, predict their readers' prior knowledge and ability. However, conventional textbooks are open to anyone, and authors know comparatively little about the abilities, purposes, opinions, prior knowledge, and circumstances of their readers. In fact, the only reading behaviour that they

can confidently predict is that their readers must read selectively. We can cite a number of factors as evidence for this assertion.

First, observation of reading styles and strategies by Pugh (1975) and Thomas (1976) shows that a straight-through linear strategy is not typical of efficient readers. Pugh links selectivity with reading efficiency. He lists five strategies of efficient readers (defined as those whose purpose is known and who achieve that purpose). Three of them are selective activities concerned with locating and making decisions about the content of a text. Indeed, writers on reading and study skills commonly recommend that students read in a selective fashion, previewing texts by scanning ahead and selecting particular areas for special attention.

Second, research on learning styles may be cited (Cronbach & Snow, 1976). If material is presented to suit a particular kind of learner, it may be unnecessarily difficult for those who adopt a different style. Mager (1961) found that instructional sequences planned by instructors were usually quite different from those elicited from learners. Indeed, the prevailing philosophy among educational theorists appears to have shifted from the highly directed, manipulative style of education exemplified by programmed learning, towards a more open facilitative approach. Increasingly, the emphasis is on enabling students to formulate and achieve their own objectives rather than those prescribed by institutionalised education. In addition to preferred learning styles, individuals study at different rates and, in courses overloaded with impossibly long reading lists, must adopt highly selective reading strategies.

Further evidence that readership is unpredictable is indicated in the way that textbooks are marketed. At the tertiary, and to some extent the secondary, level they are sold internationally. They are therefore likely to be read by people whose cultural background, even whose mother-tongue, is different from that of the author and his immediately perceived readership. Linked to this is the important growth of interdisciplinary studies which brings readers from widely differing educational backgrounds to the same texts.

Both the Pugh and the Thomas studies mentioned above arose from courses designed to help students read more efficiently. In both studies it was found that otherwise fluent readers often found difficulty in using books effectively as resources. It is interesting, though, to compare approaches to the teaching of reading skills at the middle and secondary school levels and at the tertiary level. At the lower levels, efforts at improving the text-reader interaction are often made on both sides; that is, texts are carefully selected, often with the aid of readability formulae, and students are given instruction in spelling, vocabulary, grammar, and so forth. At the higher level, students are assumed to be fluent readers and instruction centres around study skills. However, a corresponding selection of textbooks is rarely made at that level. While readability research deals with the same text-difficulty variables found among children in schools, there is a noticeable mismatch at the tertiary level between research on reading problems and research on text presentation.

Why has Selective Reading been Ignored?

There are probably several reasons for this apparent mismatch. Hartley and Davies (1976) suggest that the comparative absence of research on overviews in texts (which could aid selective readers) may be because their worth is

so obvious "that few people have felt any real need to subject the concept to empirical investigation." However, that has not deterred researchers from investigating other "obvious" ideas. Instead we may recall Frase (1973) who was quoted earlier as saying that practical research on text has often arisen out of theories on learning, or out of the development of existing methodologies and has been concerned with books and readers only incidentally.

Many examples of theory-driven research are found in the field of reading. The size of the research effort on reading is out of proportion to the difficulty in either teaching or practising it, but it is full of issues that are intriguing to the psychologist — issues of perception, language, learning and so on.

In the same review of learning from prose, Frase gives an example of methodology-driven research. He notes that many of the research designs prevented readers from reviewing the text they had read before answering the test questions. Although this unnatural reading strategy allowed the experimenter to attribute differences in performance to, say, question position, it would be difficult to extrapolate their findings for normal instructional purposes. In addition, experimenters make a tacit value-judgement when they use retention as the sole criterion of success in the study of text, whether the form is multi-choice questions or experimenter-marked free-recall scripts. It is methodologically convenient to ignore other kinds of reading outcome.

Appropriate Research Methods for Access Structures

What would truly practical "arts"-driven research, that access-structures require, involve? It would probably be methodologically less neat; it would also be based on theories that are imprecise about cognitive processes, but which look at broader aspects of reading than has been customary.

Hatt (1976) reviewed some of the existing models of the reading process and commented how many of them take the coming together of the reader and the text as "given"; theorists have been almost solely concerned with letter and word recognition issues. With the level of fluency expected from textbook readers though, there are likely to be few such problems. Instead it would be interesting to have a more comprehensive framework for discussing the reading process so that the effect of broader aspects of text, such as the access structure, on reading behaviour might be predicted.

Hatt attempts such a framework, and it is deceptively simple. It is based on three stages: a reader finds a text; he reads the text; he uses the message (or not, as the case may be). As we have argued, many theorists confine themselves to the cognitive processes that occur within the second stage, though most now reject the early information-processing model (transmitter-message-receiver) as casting the reader in an unduly passive role. Instead we now see readers as not simply receiving information but as seeking and finding it. Kintsch (1977) summarises the theory of selective attention. Hatt extends these ideas by studying patterns of entry and patterns of exit from the reading act.

For our purposes Hatt's framework appears unduly sequential. It may be that aspects of all three of his behaviours can occur cyclically or simultaneously. So Hatt's stages may be termed "motivation," "strategy," and "outcome." All three parts are "ongoing" rather than sequential. Thus reading

cannot continue satisfactorily if there is no motivation, no effective strategy, or no outcome perceived by the reader. Some factors that such a model would have to consider are listed in Figure 2.

Consider a reader-text mismatch in the readability level of the text. The syntax and vocabulary may be too difficult for a particular student who has done no full-time study previously, or for whom English is a second language. We can anticipate that this will demotivate him (he will not enjoy reading or feel he is achieving enough), it will slow him down (prevent him from skimming, perhaps), and may result in a less satisfactory learning outcome (he may miss subtleties, or not perceive the overall structure of the argument).

A mismatch in the access structure of the text would also affect all three aspects of reading behaviour. Since he cannot overview the content, it might be difficult for the student to see the relevance of the text to his needs. It will restrict his reading style because it assumes a passive linear strategy that he may not have enough time for. It will restrict learning since the text, having no surface structure, offers him no aids to memory.

Successful research on access devices would have to report on many of these factors. Only then could practical communicators determine the applicability of research observations to their own situations. There are indications that research strategies, broader in scope than those we have reviewed, are emerging.

MOTIVATION	STRATEGY	OUTCOME
Attention recommendation obligation attraction	Reading style browse skim/preview search/scan intense study review	Goal achievement personal objectives course assessment
Selection relevance to: course objectives personal objectives flavour context register	Purpose criticise memorise revise understand assignment make notes	Knowledge memory insights skills Pleasure amusement excitement fascination
Perseverance enjoyment achievement	Environment home, library, etc. distractions lighting, health comfort, etc.	

Figure 2. Three aspects of the reading process.

Research, using appropriate measurements, should seek ways of observing reading behaviour, rather than simply measuring specific outcomes such as retention. A past problem has been that traditional eye-movement recording techniques, in addition to being expensive, elaborate to set up, and obtrusive to the reader, have been biased towards micro-level reading. Recently, though, Whalley and Fleming (1975) and Pugh (this volume) have reported simple macro-level reading recorders which allow a relatively natural reading situation.

Behavioural records, of course, need sensitive interpretation. Whalley (1977) has proposed a research paradigm that calls for: the linking of reading records to formal structural analysis of text; subjective evaluation of text structure elicited from readers; and normal performance measures such as multi-choice texts, essays, and verbal protocols. Shebilske and Reid (this volume) have also reported studies of macro-level reading strategies related to structural analysis of text.

What Structure is to be Accessed?

The link between behavioural records of the reading process and the formal analysis of text structure makes this work of great practical interest. If the reader is, in fact, an active participant in the communication process, we are challenged to investigate ways of presenting texts that give readers a reliable basis for sensible sampling. If access is to be provided with headings, contents lists, and so on, they need to be related logically and consistently to the structure of the text and to each other.

This relationship is hard to define for some presentation devices that have been explored. Those based on research that obliges readers to adopt a linear sequential strategy -- adjunct questions or advance organisers, for example -- are essentially rhetorical devices; they are designed to influence the reader's concepts and facts as they are presented. In this sense they are conceptually indistinct from other aspects of argumentation that texts contain.

It is hoped that the rationale of access structures is more sound -- they are typographically signalled in order to be spotted by the skimming, searching, or browsing reader. Even so, how do these various graphic techniques relate to the transitional, organising, or signposting cues that are among the conventions of prose? While the mathemagenics-type research needs to know because in some ways it proposes a rival system, the designer of access devices needs to know what he is structuring. Linguistic cues are important because they may provide the key to such an analysis. In the field of cognitive psychology, a number of recent studies that employ story grammars to describe the structure of prose may be cited. There is no comprehensive review yet, but the studies by Thorndyke (1975) and Meyer (1975) are examples. This work is linked to the studies of linguists working at the inter-sentence level of text (Grimes, 1974). It is to be hoped that this effort will eventually lead to a workable system of text analysis for practical purposes. At present it is probably still too detailed to be used conveniently with large amounts of text.

When a usable macro-level system of text analysis is formulated, there will still be unanswered questions. What structures are appropriate for particular subject-areas, the teaching of particular skills, or for different

educational levels? Indeed, is it even possible to arrive at such generalisations? A further question might be: how can the clarification, through headings, of a single overall structure help students with many different needs? An access structure cannot make a poor text good, nor can it ensure that an author perceives the various needs of his readership correctly. It does, though, help the reader make informed decisions about strategies for coping with texts that may not be directly aimed at him or her.

Each device in the access structure fills a need that cannot be met in another way: the contents page and headings give an overview of the text; glossaries provide definitions of terms; the index is the means of direct access to concepts appearing in the text; a list of objectives displays the anticipated purposes of the text; opening summaries give more detailed overviews of the arguments than simple headings; and final summaries present the conclusions. A less traditional device, the concept map, shows the structure of a subject area (not the same as the text-structure which is constrained by the linearity of the medium).

In conclusion it may be said that research on access structures is proposed in reaction to some of the problems encountered by other kinds of research on text. Methodological problems will not disappear but research on access for selective reading, by having different and in some ways less ambitious goals, may avoid some of the pitfalls. Instead of investigating the effect of particular aspects of texts on memory or the learning process, it may be more appropriate to ask conceptually less rigorous but practically based questions. What sort of presentation is found most acceptable by particular groups of readers, and in what circumstances? How are reading strategies influenced by particular text arrangements?

Our criterion of actionability calls for research on the writer as much as research on the reader. In other words, research on presentation should aim to offer usable methods of text construction as well as describe the effect on learners. That these devices, used correctly, are helpful to readers is hard to dispute -- empirical research on the issue would be self-fulfilling. But although the products of authors are being investigated, little is known about the writing process. How can authors be helped to produce coherent access structures? It is hoped that the effort to answer such questions will lead to useful research in the real world of writers, editors, designers, and readers of textbooks.

REFERENCES

- Anderson, R.C., & Biddle, W.B. On asking people questions about what they are reading. In G. Bower (Ed.), *Psychology of learning and motivation* (Vol. 9). New York: Academic Press, 1975.
- Ausubel, D.P. *The psychology of meaningful verbal learning*. New York: Grune and Stratton, 1963.
- Barnes, B.R., & Clawson, E.U. Do advance organisers facilitate learning? *Review of Educational Research*, 1975, 45, 637-660.
- Carver, R.P. A critical review of mathemagenic behaviours and the effect of questions upon the retention of prose materials. *Journal of Reading Behavior*, 1972, 4, 95-119.

- Cronbach, L.J., & Snow, R.W. *Aptitudes and instructional methods*. New York: Irvington, 1976.
- Duchastel, P.C., & Merrill, P.F. The effects of behavioural objectives on learning: A review of empirical studies. *Review of Educational Research*, 1973, 43, 53-70.
- Faw, H.W., & Waller, T.G. Mathemagenic behaviours and efficiency in learning from prose. *Review of Educational Research*, 1976, 46, 691-720.
- Frase, B.T. On learning from prose. *Educational Psychologist* (Vol. 10, No. 1), 1973.
- Gerstner, K. *Compendium for literates*. Cambridge, MA: MIT Press, 1974.
- Grimes, J.E. *The thread of discourse*. The Hague: Mouton, 1974.
- Hartley, J., & Burnhill, P. Understanding instructional text: Typography, layout and design. In M.J.A. Howe (Ed.), *Adult learning*. London: John Wiley and Son, 1977.
- Hartley, J., & Davies, I.K. Preinstructional strategies: The role of pretests, behavioural objectives, overviews, and advance organisers. *Review of Educational Research*, 1976, 46, 239-265.
- Hatt, F. *The reading process: A framework for analysis and description*. London: Bingley, 1976.
- Kintsch, W. *Memory and cognition*. New York: John Wiley and Sons, 1977.
- Klare, G. *The measurement of readability*. Iowa State University Press, 1963.
- Ladas, H. The mathemagenic effects of factual review questions on the learning of incidental information: A critical review. *Review of Educational Research*, 1973, 43, 71-82.
- Macdonald-Ross, M., & Waller, R.H.W. Criticisms, alternatives and tests: A framework for improving typography. *Programmed Learning and Educational Technology*, 1975, 12, 75-83.
- Mager, R.F. On the sequencing of instructional content. *Psychological Reports*, 1961, 9, 405-413.
- Meyer, B.J.F. Identification of the structure of prose and its implications for the study of reading and memory. *Journal of Reading Behavior*, 1975, 7, 7-47.
- Posner, G.J., & Strike, K.A. A categorization scheme for principles of sequencing content. *Review of Educational Research*, 1976, 46, 665-690.
- Pugh, A.K. The development of silent reading. In W. Latham (Ed.), *The road to effective reading*. London: Ward Lock, 1975.
- Pugh, A.K. *Styles and strategies in adult silent reading*. (This volume.)
- Ravetz, J.R. *Scientific knowledge and its social problems*. Oxford University Press, 1971.
- Rickards, J.P. On inserting questions before or after segments of text. *Contemporary Educational Psychology*, 1977, 2, 200-206.
- Rothkopf, E.Z. The concept of mathemagenic activities. *Review of Educational Research*, 1970, 40, 325-336.
- Rothkopf, E.Z. What are we trying to understand and improve? Educational research as *Leerlaufreaktion*. *Educational Psychologist*, 1973, 10, 58-66.
- Rothkopf, E.Z. Barbarism and mathemagenic activities: Comments on criticism by Carver. *Journal of Reading Behavior*, 1974, 6, 3-8.
- Shebilske, W., & Reid, L.S. Reading eye movements, macro-structure and goal-processing. (This volume.)

- Snow, R.E. Representative and quasi-representative designs for research on teaching. *Review of Educational Research*, 1974, 44, 265-292.
- Stokes, A.F. The reliability of readability formulae. *Journal of Research in Reading*, 1978, 1, 21-34.
- Thomas, L. The self-organised learner and the printed word. Centre for the Study of Human Learning, Brunel University, 1976.
- Thorndyke, P. Cognitive structure in human story comprehension and memory. Ph.D. Thesis, Stanford University, 1975.
- Tinker, M.A. The legibility of type. Iowa State University Press, 1963.
- Whalley, P.C. Aspects of purposive reading: The analysis of reading records. Paper presented at the British Psychological Society conference, Exeter, 1977.
- Whalley, P.C., & Fleming, R.W. An experiment with a simple recorder of reading behaviour. *Programmed Learning and Educational Technology*, 1975, 12, 120-124.
- Zapf, H. *Manuale typographica*. Cambridge, MA: MIT Press, 1970.