"The Road Less Travelled by": On Exploring Psychology of Reading[1]

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This paper explores the different avenues of reading psychology. The first question is: What is psychology of reading the psychology of? There is not one kind of psychology of reading but an integration of psycholinguistics, experimental psychology, neuropsychology, and education. The term neuro-socio-psycho-textlinguistics may be coined to express the current zeitgeist of the multi-disciplinary richness of reading. The next question is: Psychology of reading for what? The answer is probably learning and teaching reading, learning and teaching *about* reading, and learning and teaching *through* reading.

Theories and research findings in the last decade are outlined. The interdependence of rapid, automatic decoding with and comprehending is discussed; comprehension at the sentential and discourse levels is stressed. Yet, these advances in both theories and empirical studies find their way only slowly into teaching practices and teaching programs. Much less is being done on learning *about* reading and *through* reading. Reading as literacy acquisition and development is not fully realized. Note must also be taken of the role of microcomputer technology in helping readers and the reading processes.

Dans cet article on explore les différentes avenues de la psychologie de la lecture. La première question se pose ainsi: la psychologie de la lecture est la psychologie de quoi? Il n'y a pas de psychologie unique de la lecture mais plutôt un amalgame de psycholinguistique, de psychologie expérimentale, de neuropsychologie et d'éducation. On pourrait inventer le terme de neuro-socio-psycho-textolinguistique pour exprimer le courant Zeitgeist de la richesse multi-disciplinaire de la lecture. La question suivante est de savoir à quoi sert la psychologie de la lecture? La réponse est probablement l'apprentissage et l'enseignement de la lecture; l'apprentissage et l'enseignement du *pourquoi* de la lecture; l'apprentissage et l'enseignement *à travers* la lecture. On présente brièvement les théories et les résultats des recherches. On discute de l'interdépendance du décodage et de l'automation ainsi que la compréhension. On souligne la compréhension au niveau de la phrase et du discours. On remarque pourtant que ces découvertes aussi bien théoriques qu'empiriques ne s'infiltrent que très lentement dans la pratique et les programmes d'enseignement. On fait encore moins de recherches *sur* la lecture et *à travers* la lecture. On ne connaît pas encore à fond l'aspect de la lecture comme outil d'acquisition et de développement des connaissances. Et actuellement, on doit considérer comment la micro-informatique peut aider les lecteurs et les processus de lecture.

There are different routes in exploring psychology of reading. Some are well trodden; some are less travelled; some may lead to garden paths; some may be full of thickets of thorns. What appears to be a tangled jungle has turned into an eighteenth-century garden and finally a veritable Garden of Delight for me, and I would like to share some of these delights.

This paper explores first the nature of psychology of reading. It then discusses some of the significant theories and research findings during this decade and relates these theoretical and empirical findings to current practices of instruction. The role of reading in a *literate society* is examined in relation to such technological advances as the use of microcomputers in the school and at home.

NATURE OF PSYCHOLOGY OF READING

The questions that continue to confront reading researchers include: Is there a psychology of reading? What is psychology of reading the psychology of? Psychology of reading for what? These important questions have engendered self-doubts and self-criticisms, but I will attempt some kind of Procrustean answers.

The answer to the first question, is there a psychology of reading, seems to be *yes*. This is evident from the often-quoted and near-classic work of Huey, *The Psychology and Pedagogy of Reading* (1908/1968), to the volume *The Psychology of Reading* by Gibson and Levin (1975). The many anthologies on the subject do not encourage the idea that there is an all-inclusive kind of reading behaviour. There is not one kind of reading but many different, inter-related aspects of reading. By the same token, there is no one reading process, but different processes which vary according to the readers, their purposes, and the nature of the reading materials. Reading has also been defined as *a* skill (Downing & Leong, 1982). This means a highly complex pattern of behaviour with interrelated subskills. The explanation by Cronbach (1963, p. 309) is relevant: "... The expert performs more smoothly and more automatically than others. Skilled performance is a series of actions, each regulated by cues; the expert senses relevant ones quickly, interprets them promptly and correctly, and runs off the sequence without pause ...." Reading as *a* skill thus involves the smooth and automatic integration of complex, inter-related subskills with cues (external shifting to internal ones) being used in the feedback process for even more efficient performance.

Accepting that there is a psychology of reading, we will need to explore the many aspects of such a psychology. In one sense, we are dealing with the psychology of language or psycholinguistics, for reading is part of the language continuum. In another sense, we are concerned with neuropsychological substrates because it is not so much the eye that reads as the brain. Neuropsychological findings have helped to chart processing routes in reading, especially with developmental dyslexia and acquired dyslexia (deep dyslexia in particular). In yet another sense, there is the sociolinguistic aspect in that reading as literacy acquisition and develop-

ment is concerned with communication between the reader and the writer. This communicative process includes both the primary activities of speaking and listening (Mattingly, 1972; 1984) and the interpretation of meaning from text. In this way, psychology of reading combines all of the above, and more. At the risk of ponderousness, it seems the term *neuro-socio-psycho-textlinguistics* may not be inappropriate. One advantage of this unwieldy term is that it underlines the increasingly interrelated and multidisciplinary nature of reading psychology. No longer can we afford to disregard works from allied disciplines simply because they do not address "educational" issues as such.

The next question to consider is the nature of psychology of reading. Downing and Leong (1982, p. 4) define reading as "the interpretation of symbols." The term *interpretation* refers to both a product and a process. The product or the outcome of reading arises with the successful completion of the reading act when readers comprehend what they read. This is in itself a large statement, as there are different levels of comprehending: memorizing, translating, paraphrasing, abstracting ideas, drawing inferences, and making applications. Readers comprehend to the extent that they bring their previous knowledge to bear on the text which should be so organized as to facilitate understanding. The process explains how to get to the product. We emphasize the process aspect because it is flexible, adaptable to manifold resources. The term *symbols* is used in the semiotic sense to focus on the relationship between linguistic, gestural, pictorial, musical, video, and other kinds of *symbol systems*. As symbol systems, these different instances can be read, albeit in different ways. It is known, for example, that perceiving print is not the same as perceiving pictures. Further, the same symbol system (e.g., language) may occur in different modes (listening mode or print mode), just as the same modes (electronic mode on the radio, television, or the computer) may be vehicles for different symbol systems. There are at least two reasons for defining reading in terms of interpretation of symbols. One is to underscore the broader aspect of reading not only of textual materials but also other symbol systems as part of the quest towards the literate society. The other reason is to highlight the commonality of processes of reading different orthographies. The intent is to emphasize the importance of *knowing*. Just as Halliday (1973) argues for learning language (using language to serve functional ends), learning about language (reflection on language), and learning through language (acquiring world knowledge), so reading should be learning through reading. Teaching reading should be teaching how to learn through reading. Knowing is not just knowing *what*, but also knowing *how* and knowing *why* (Broudy, 1977).

STATUS OF READING RESEARCH

Interdependence of Decoding and Comprehending

Current theory and research take the view that reading is *interactive*. In general, there are *bottom-up* or *data-driven* models of reading such as presented by Gough (1972) and LaBerge and Samuels (1974). These models work their way up from subskills to the integration of skills, from sensory to the syntactic-semantic levels. In contrast, there are *top-down* or *concept-driven* models such as those of Smith (1978) and Goodman (1968). These terms bottom-up and top-down are derived from computer usage and refer to the way in which an *internal representation* of some events (e.g., a string of words) is derived. Bottom-up analyses begin by analyzing the stimulus (e.g., features and letter clusters) and work their way up to "higher levels." Top-down analyses start with hypotheses, attempt to verify them by checking the stimulus (e.g., Is there a verb phrase here? After identifying the verb what is the corresponding argument?), and work their way "down." Thus bottom-up analysis is stimulus-driven whereas top-down analysis is concept-driven. These processes are interactive and reciprocal (Rumelhart, 1977). Relationships among these processes are neither sequential nor strictly hierarchical. They are orderly, they are forward-feeding, and they follow a cascade system (McClelland, 1979). Such a system allows output from a particular level to feed into adjacent levels, lower or higher, and to more distant levels up or down, enabling every level to interact with every other level.

The current theories and empirical studies of the interactive and reciprocal nature of bottom-up and top-down processes provide a great deal of insight into reading and individual differences. Research programs by Perfetti and his associates (see Perfetti, Goldman, & Hogaboam, 1979; Perfetti and Roth, 1981, for representative findings), Stanovich (Stanovich, 1980; Stanovich & West, 1981), Carr (1981) and Haines and Leong (1983) have all shown the interdependence of decoding and comprehending. Typically, the experimental paradigm is that of pronunciation latency and lexical decision. In these experiments subjects are asked to pronounce a word or to decide if a string of letters is a word or a non-word as quickly and as accurately as possible, and their reaction times are taken as an index of their verbal efficiency. In general, the results of the various studies are that (a) less skilled readers showed longer vocalization latencies for context-free printed words and pseudowords; (b) less skilled readers showed slower lexical access, probably as a result of their difficulty with decoding letter strings and not so much their poor lexicon; and (c) less skilled readers were less efficient with the phonological coding so essential to comprehension.

To some extent, the findings of longer vocalization latency or slower lexical access in less skilled readers can be explained in terms of the *automaticity* model of LaBerge and Samuels (1974). This model implies that readers must be alert to the source of information, be selective, and allocate their attention to advantage. When readers attain automaticity in reading subskills, they can concentrate on the meaning of what is read rather than on the mechanics of reading.

It should be noted that the focus is more on verbal knowledge from print than on overcoming competing attention. Efficient phonological processing facilitates lexical access and the formation of a stable code for storing information in short-term memory. In one sense, the Great Debate between decoding and comprehending seems to return full circle. Both emphases could be right, as reading is interactive and draws information from multiple sources. The crux is how fast and how automatically children decode or comprehend. If they decode accurately but very slowly, their attention is directed away from comprehension. One possibility in teaching is practice with fast word recognition, but there is insufficient evidence to support the efficacy of this approach. What is important is a systematic strategy of teaching word recognition subskills. A balanced *code* and *meaning* emphasis is needed.

In terms of individual differences, evidence is strong that poor comprehenders tend to be verbally deficient in decoding context-free printed words. The question of whether poor readers also fail to use context to comprehend what they read is important. Here, the ongoing research of Perfetti and Stanovich is illuminating. An example of the *context-facilitation* effect of word recognition from the work of Stanovich (1980) provides some answers to the question. Subjects were asked to read aloud a sentence context with its final (target) word missing. When the subject finished reading the incomplete sentence context, the target word appeared and the subject was asked to name it as fast as possible. The kinds of sentences are as follows:

Condition	*Context*	*Target*
Congruous	The soldiers flew in the ...	*plane.*
Neutral	They said it was the ...	*plane.*
Incongruous	The cowboy fired the ...	*plane.*

The prediction was that recognition times in the congruous condition should be faster than the times in the neutral condition (the context facilitation effect) if context is used to speed up word recognition. Similarly, an incongruous context should slow down word recognition relative to the neutral condition (context inhibition effect). This general hypothesis was upheld. In particular, poor readers seem just as likely to

use context to facilitate word recognition when the context is understood, and it appears that overall context effect diminishes as developmental level increases. Word identification performance is greatly accelerated when the word is predictable from context, and it is slowed down when the word is unexpected. Thus the paradox is that context effects are much more pronounced in poor readers while the greatest facilitation of word recognition by meaningful context is also observed with poor readers.

The above reasoning is in essence Stanovich's *interactive compensatory* model of reading (Stanovich, 1980; Stanovich & West, 1981). It is based on the assumptions that difficulties in processing at one level can be compensated for by a greater use of information from other levels and that this compensation takes place regardless of the level of the deficient process. It is important that the context be appropriately understood, and the failure of poor readers is not so much with the "psycholinguistic guessing game" as with fast, accurate decoding of words to the automatic level. It is this deficiency in verbal processing that affects discourse comprehension.

Discourse Processing

What is comprehension of discourse? The definition by Kintsch (1977, p. 232) is a cogent one: "Comprehension involves integrating information from different sentences, organizing and supplementing it through inferences from what one already knows, rather than merely interpreting what is directly expressed by a sentence." The emphasis is on organizing, integrating old and new knowledge, and making inferences. In essence, coming to comprehend involves content and process. Content includes such aspects as prior knowledge, given-new contract, and linguistic devices to provide coherence to the discourse. Process refers to such aspects as motivation, attention, encoding, integrating, retrieving, and monitoring comprehension. But a discussion of these ideas is needed.

Comprehension requires using prior knowledge and linking the new and the old. Isolated sentences and sentences in sequence will be used in an attempt to show how language calls forth knowledge and, in turn, is modified by knowledge. Isolated sentences have syntactical, semantic, and pragmatic properties of their own. But processing and understanding of sentences will need to consider other sentences or sentence sequences through such devices as connectives, topics, turn-taking, point of view, and so on. In other words, an understanding of sentences depends on an understanding of surrounding, mostly previous sentences. The following panel of sentences (Trabasso, 1979) illustrates the need for prior knowledge – of nursery rhymes, food, animals as pets, sheep, vets – for comprehension:

1a. Mary had a little *lamb*. Its fleece was white as snow.
1b. Mary had a little *lamb*. She spilled gravy and mint jelly on her dress.
1c. Mary had a little *lamb*. The delivery was a difficult one, and afterwards, the vet needed a drink.

Let us examine the next panel:

2a. Jane had worked in the hospital for years.
2b. The woman was outstanding in the theatre.

In order to understand 2a and 2b readers must infer that the words "theatre" is used in the sense of operating theatre. In other words, the scenario is that of the hospital, and theatre is instantiated as a slot that fits into this frame. In isolation, 2b would likely be taken as referring to the place where plays are performed, and Jane would likely be thought an actress.

Thus, from a psychological point of view, the mental representation of text materials requires the integration of information in the text itself and also its interpretation in terms of the reader's knowledge. Another example is from the panel of sentences from 3a to 3e from Sanford and Garrod (1981):

3a. John was on his way to school last Friday.
3b. He was really worried about the maths lesson.
3c. Last week he had been unable to control the class.
3d. It was unfair of the maths teacher to leave him in charge.
3e. After all, it is not a normal part of a janitor's duties.

While there is nothing to indicate explicitly that John is a schoolboy in 3a and 3b, sentence 3c may come as a surprise. As the readers read on, sentences 3d and 3e may appear strange. Thus panel 3 illlustrates the interplay between information in the text and the knowledge that the reader already has. While discourse sets up mental representation of situations, objects, events, and actions, readers must bring to bear their previous knowledge to integrate and organize any new knowledge. One of the outcomes of comprehension is memory representation and memory representation of discourse is seldom verbatim.

In his studies of prose comprehension in adults, Bartlett (1932) suggested that recall is a *reconstructive* process rather than the mere passive reproduction of stored memories. In his informal analysis of subjects' recall of the story "The War of the Ghosts," Bartlett found that recall was susceptible to a high proportion of inaccuracies in the form of omissions of ideas, transformations, embellishment, and condensation of major themes. He found that his subjects did not appear aware of these inaccuracies and that the inaccuracies increased over time. In Bartlett's

view, remembering prose begins with the impression of the whole story, which is used to reconstruct the details and then the schemata for understanding. Meaning is thus not the same as context but is found in context and in other situational variables. Meaning results from an individual's active cognitive efforts to fit the material (prose) into the person's knowledge system so that some conscious awareness of the material is possible. We should note, however, Bartlett's choice of the rather exotic North American folktale. His concept of schemata was vague, and he did not explain the organizational structure of prose. Nevertheless, his observations show some of the complexities of recall protocols and their interpretation. His reconstructive theory shows that recall is not random but relates to the gist of the story. Thus comprehension processes are implicated in the way the story is stored in memory. With less exotic materials, recall depends upon the subject's familiarity with the materials, the story format, and other factors.

This brings us to *memory*, *gist*, and *representation*. Psychologists and educators have long sought to identify and analyze the organizational structure that facilitates prose comprehension and to provide both a theory of comprehension and a way to assess it (see Anderson, 1972; Bormuth, 1970). It is only more recently that systematic procedures have been developed to analyze the organization of information and the representation of meaning in prose. These procedures make possible the comparison of the internal structures of text materials and throw light on what it is that enables readers to recognize, reconstruct, and recall these materials.

In general, current research has sought to analyze reading as the extraction of propositions (assertions about the relation between information entities) from text and their organization into a coherent and cohesive sequence for ease of comprehension. As an example, Kintsch and van Dijk (1978) have explicated a psychological-processing model to examine the dual mental operations that underlie both the processes occurring in text comprehension and the production and recall of text summarization protocols. The model deals with semantic structures in both the *microstructure* (structure of the underlying propositions and their relations) and the *macrostructure* (structure of the discourse as a whole). Meyer (1975) proposes a conceptual framework system for analyzing the organization of information in text materials. Her aim is to determine why some prose ideas are more accessible than others (hierarchical relations between the text elements) and how prose structure predicts recall of prose materials. In his research program, Carl Frederiksen (1975; 1977; 1979) has proposed a system for analyzing data structure in terms of a labelled *network* for both memory and text processing. In analyzing children's discourse comprehension, he discusses the form of

the abstract, internal structure of representation at the different levels of processing.

At the risk of over-simplifying, the different frameworks for studying discourse may be summarized as follows: (a) something like case structure might be the basis for sentential memory; (b) text material is analyzable into propositions to generate testable hypotheses for recall and comprehension; (c) the processing of text is related to the structural relationship among the propositions in the text base (dependent propositions are less important than independent ones, and main goals are more important than subgoals); and (d) recall of text is both constructive and reconstructive.

It seems that discourse analysis of the kind outlined provides one means of systematically analyzing characteristics of text materials and estimating their effect on comprehension and memory. What is not clear at this stage in the development of discourse analysis research and methodology is how such work will serve teachers and reading specialists. We will do well to remember that text is never fully explicit nor is reading comprehension exclusively textual.

As an aside, the hierarchical order of the elements in a story suggested by some systems (e.g., Thorndyke, 1977) may be varied – for example, in poems and plays, for otherwise these works of arts will be dull. It is not unusual for flashbacks or resolutions to be presented in plays before the events leading up to them. With some works, there is not much of a plot; character study is all important. Nevertheless, some kind of structure does exist in works of literature. It must be remembered that long ago folktales were passed down by word of mouth and were not written down. To be effective, story tellers must rely on their memories, and they must have some well-organized structure within which to unfold their stories.

THEORY INTO PRACTICE

Carroll (1972) reviewed the research about learning from prose because so much teaching is through text or lecture. He found that educators tended not to pay enough attention to the nature of prose itself or to its organization. Instead, they tended to rely on aids such as adjunct questions, training programs, and other works. There are, however, some difficulties in comprehending textual materials. First, textbooks may not be redundantly coherent because the knowledge propositions needed to establish coherence are not expressed. There is a need to enhance the coherence of both reading instruction and reading curriculum (Calfee, 1983).

Second, coherence of a global kind as illustrated with the hierarchical

analysis of prose needs to be established. There is evidence in developmental psychology (Donaldson, 1978) that children are capable of reading with comprehension provided that the materials are given at their level. With proper teaching and an awareness of the structure and function of language, they can go a long way in developing discourse comprehension.

Third, the role of learning *about* language and reading, and learning *through* reading cannot be emphasized too strongly (Downing & Leong, 1982). A useful and practical approach is that of Moffett (1968) who emphasized the full symbolic system (discourse). He has been described as an author who is "agreeably diffident about his theories and wisely flexible in the advice he gives" (Moffett, 1968, p. ix), but for some reason this work does not seem to attract the attention that it deserves. The rationale behind much of Moffett's work finds a parallel in Donaldson (1978, p. 112): "Education should aim to encourage the readiness to come to grips with incongruity and even to seek it out in a positive fashion, enjoying challenge." One way is to provide a set of options and a sense of how to employ them rather than just the notion that any particular option is acceptable.

Fourth, at the instructional level, practitioners and publishers of teaching programs are slow in applying the cumulative body of theories and research findings, although this is changing. In reviewing instruction in reading comprehension Pearson and Gallagher (1983) were optimistic about bridging the gaps among basic research, applied research, and practice in reading. Still, there are problems. Venezky (1979) rightly pointed out the need to refocus attention on the school, the classroom, and the teacher and the need for a new science of experimentation in the classroom, an "experimental pedagogy." This includes examining classroom programs, monitoring instructional methods, and evaluating reading and language gain or loss. This kind of experimental pedagogy must transcend mere instruction in so-called basic skills. It must explore reading and literacy acquisition as a generative process that draws on varying social contexts (Purves & Niles, 1984). Only in this way can we really elevate reading to the high road that leads to the Garden of Delight.

SOCIAL CONSEQUENCES OF READING AND ITS BREAKDOWN

The social consequences of reading difficulties should not be overlooked. In 1981, in the U.S., the National Assessment of Educational Progress (1981a, 1981b) issued two reports on the changes in reading achievement during the preceding decade. In general, these two reports show that,

while many students can read by the minimal definition of reading, they have difficulty in reading textual materials by the broader definition of literacy.

In Canada, Graves and Kinsley (1983) used explanatory log-linear and logit statistical techniques with nationally representative data from the 1978 Canadian Readership Survey to model a range of reading activities in Canadians. These techniques enable the prediction of probability of membership in cells in a contingency table (e.g., illiterate vs. literate) as a function of membership in certain other cells (e.g., education, settlement type, language, age, and occupation) of the cross-classified table. Their data show that, by the usual criterion of functional illiteracy, most individuals with an education at less than the Grade 9 level engage in some reading activities. The authors then identify the truly functionally illiterate, estimating that some 88,000 individuals over the age of 15 fall into this category. Of this number, over 90% have less than Grade 8 education, and 20% of these functionally illiterates reside in the Atlantic region although this area contains only 9% of Canada's population.

What is more significant, and socially alarming, is the identification by Graves and Kinsley, through the powerful log-linear technique, of *elective* illiterates who could attain considerable literacy but do not choose to do so. While these results confirm the bivariate relationship between education, settlement type, language, age, occupation, and elective illiteracy, they show higher order effects which significantly alter these simple associations. Furthermore, education is found to operate differently across linguistic boundaries, with age and settlement type having different effects (e.g., the under-35 population is less likely to read, even though the individuals are more likely to have a Grade 9 or higher education). While this trend may reflect social and technological changes, educators should remember that a well-developed industrial society may not be synonymous with a literate society.

The Canadian Commission for UNESCO (1983) reports on adult illiteracy in Canada and points out that many Canadians are seriously under-educated. The Commission suggests that literacy or illiteracy should not just concentrate on reading and writing and that "the real issue is whether people possess the education and skills necessary to participate fully and productively in the life of their society" (p. 3). The report acknowledges innovative Canadian approaches to literacy, such as Frontier College's community educational programs, but it also points out that we can learn much from developing countries. One question is whether modern technologies work to the advantage or the disadvantage of the marginally literate by widening the gap in both print and technological literacy.

THE ROLE OF TECHNOLOGIES

We come then to the role of expanded technologies and reading psychology. The 1970s and 1980s have witnessed some of the effects of print and non-print media on literacy acquisition and development. An early volume, *Media and Symbols* (Olson, 1974), has critically examined the potentials of prose, pictorial, electronic, and other media in improving children's learning and in relation to different intellectual purposes. Popular television programs dealing specifically with teaching children the patterns and values of the literate society – *Sesame Street* and *The Electric Company* – exemplify the "desanctification of print" and attempt to promote literacy through the electronic medium. Nevertheless, these alternative modes of literacy acquisition generally deal with a low level of literacy. The higher integrative levels are achieved through reading print itself.

What about microcomputers? Properly used, the microcomputer can serve as a "tutor, tool, [and] tutee" (Seidel, Anderson, & Hunter, 1982). There are many and varied functions and menus. At one level, software packages help in drill and practice and simulated exercises. At another level, they enable individualization of content and pace. At yet another level, they should serve as vehicles for problem solving. As yet, much of the microcomputer usage in schools is at the "tutor-tool" stage. But there are innovative programs. Martin (1985) outlines some preliminary results in a large-scale project using the IBM PC in a writing-to-read program. There are reports of the teaching of composition through word processors and editing programs in a theoretical framework consonant with current research into the composing process (Bradley, 1982; Shostak, 1984). A highly innovative use of microcomputers in the classroom is Papert's (1980) LOGO language which enables children to learn subjects like physics and geometry in an enjoyable and informative way. We may yet see more of this approach of software programs which are open-ended and which bring students into decision-making and problem-solving processes.

Thus, on the one hand, we should accept the ubiquitous use of microcomputers and encourage it. In the United States, various states and the Congress either have initiated or are considering substantial tax write-offs for computer manufacturers who donate computers to schools to promote computer literacy. In Canada, we do not have a parallel move, although some firms are in fact donating hardware to universities for research into the educative process in schools. This is very encouraging. But underlying this euphoria in embracing microcomputers are some fundamental questions. These include: What are some of the social and

cognitive consequences of this microchip age? What is the role of microcomputers in literacy acquisition and development? What is the educational value of microcomputers? At the pragmatic level, many teachers will need to be prepared for the new technology and to accept the relationship between computer printouts (soft and hard copies), videotapes, videodiscs, and printed books as expressions of symbol systems. The state of the art of electronic print is in a continuous flux. These tools may not be superior to classroom instruction and cannot replace the teacher. They have a place in education, but ultimately we need to come back to some kind of print media.

In this regard we should note Havelock's (1971; 1976) observation that the development of the Greek alphabet not only altered significantly human culture but also human cognition. He points out that the evolution of literacy in the West is from craft literacy through recitation literacy to scriptorial or typographical literacy. The advent of the Greek alphabet writing system after 700 B.C. rendered language explicit and helped in the formulation of logical, definitional statements. From a psychological perspective, Miller (1972) commented on the importance of the script medium:

> The written proposition is a tangible representation of an act of thought. It is a physical thing, an object, and it can be reacted to as any object can. Thus writing made it possible to react to one's own thoughts as if they were objects, so the act of thought became itself a subject for further thought. Thus extended abstraction became possible, and one of the brilliant abstractions recognized by the Greeks concerned the forms of valid arguments. And so, out of writing, was logic born. (p. 374)

Only time will reveal the full impact of extended technologies on literacy.

SUMMARY

The psychology of reading must be seen as learning reading, learning *about* reading, and learning *through* reading. As educational psychologists, there is much we can do individually and collectively to promote literacy. Whatever our preparation, our experience, and our inclination, we need to ponder what we as educational psychologists really are. What is our role? To what extent should we be concerned with learning processes in the classroom, with the art and science of instruction, or with individual differences? What are we really? How can we maintain a balance between educational psychology as a science and an art? How does this interrelated view help us to understand reading psychology? These and many others are the issues with which we must grapple.

Clearly those of us engaged in research into reading psychology live at the intersection of many intellectual, multi-disciplinary routes. As a result, we can shed some light on many aspects along the way (as well as dimness and confusion). Let us hope that it is light that we give.

NOTE

[1] An earlier version of this paper was given as an invited address to the Canadian Association for Educational Psychology at the CSSE Annual Conference, June, 1984 in Guelph.

REFERENCES

Anderson, R. C. (1972). How to construct achievement tests to assess comprehension. *Review of Educational Research, 42*, 145–170.

Bartlett, F. C. (1932). *Remembering*. Cambridge: Cambridge University Press.

Bormuth, J. R. (1970). *On the theory of achievement test item*. Chicago: University of Chicago Press.

Bradley, V. (1982). Improving students' writing with microcomputers. *Language Arts, 59*, 732–743.

Broudy, H. S. (1977). Types of knowledge and purposes of education. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), *Schooling and the acquisition of knowledge* (pp. 1–17). Hillsdale, NJ: Erlbaum.

Calfee, R. (1983). The mind of the dyslexic. *Annals of Dyslexia, 33*, 9–28.

Canadian Commission for UNESCO. (1983). *Adult illiteracy in Canada: A challenge*. Ottawa: The Canadian Commission for UNESCO.

Carr, T. H. (1981). Building theories of reading disability: On the relations between individual differences in cognitive skills and reading comprehension. *Cognition, 9*, 73–114.

Carroll, J. B. (1972). Defining language comprehension: Some speculations. In R. O. Freedle & J. B. Carroll (Eds.), *Language comprehension and the acquisition of knowledge* (pp. 1–29). New York: Wiley.

Cronbach, L. J. (1963). *Educational Psychology* (2nd ed.). New York: Harcourt, Brace Jovanovich.

Donaldson, M. (1978). *Children's minds*. Glasgow: Fontana/Collins.

Downing, J., & Leong, C. K. (1982). *Psychology of reading*. New York: Macmillan.

Frederiksen, C. H. (1975). Effects of context-induced processing operations on semantic information acquired from discourse. *Cognitive Psychology, 7*, 139–166.

Frederiksen, C. H. (1977). Semantic processing units in understanding text. In R. O. Freedle (Ed.), *Discourse production and comprehension* (Vol. 1) (pp. 57–87). Norwood, NJ: Ablex.

Frederiksen, C. H. (1979). Discourse comprehension and early reading. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 1). (pp. 155–186). Hillsdale, NJ: Erlbaum.

Gibson, E. J., & Levin, H. (1975). *The psychology of reading*. Cambridge, MA: MIT Press.

Goodman, K. S. (Ed.). (1968). *The psycholinguistic nature of the reading process.* Detroit, MI: Wayne State University Press.

Gough, P. B. (1972). One second of reading. In J. F. Kavanagh & I. G. Mattingly (Eds.), *Language by ear and by eye* (pp. 331–358). Cambridge, MA: MIT Press.

Graves, F. L., & Kinsley, B. (1983). Functional and elective illiteracy in Canada. *Canadian Journal of Education, 8,* 315–331.

Haines, L. P., & Leong, C. K. (1983). Coding processes in skilled and less skilled readers. *Annals of Dyslexia, 33,* 67–89.

Halliday, M. A. K. (1973). *Explorations in the functions of language.* London: Arnold.

Havelock, E. A. (1971). *Prologue to Greek literacy.* Cincinnati, OH: University of Cincinnati Press.

Havelock, E. A. (1976). *Origin of western literacy.* Toronto: Ontario Institute for Studies in Education.

Huey, E. B. (1968). *The psychology and pedagogy of reading.* Cambridge, MA: MIT Press. (Original work published 1908)

Kintsch, W. (1977). Reading comprehension as a function of text structure. In A. S. Reber & D. L. Scarborough (Eds.), *Toward a psychology of reading* (pp. 227–256). Hillsdale, NJ: Erlbaum.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. *Cognitive Psychology, 85,* 363–394.

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology, 5,* 293–323.

Martin, J. H. (1985). The writing to read system and reading difficulties. In D. D. Duane, & C. K. Leong (Eds.), *Understanding learning disabilities: International and multidisciplinary views* (pp. 159–163). New York: Plenum.

Mattingly, I. G. (1972). Reading, the linguistic process, and linguistic awareness. In J. F. Kavanagh & I. G. Mattingly (Eds.), *Language by ear and by eye* (pp. 133–147). Cambridge, MA: MIT Press.

Mattingly, I. G. (1984). Reading, linguistic awareness, and language acquisition. In J. Downing & R. Valtin (Eds.), *Language awareness and learning to read* (pp. 9–25). New York: Springer-Verlag.

McClelland, J. L. (1979). On the time relations of mental processes: An examination of systems of processes in cascade. *Psychological Review, 86,* 287–330.

Meyer, B. J. F. (1975). *The organization of prose and its effect in memory.* Amsterdam: North-Holland.

Miller, G. A. (1972). Reflections on the conference. In J. F. Kavanagh & I. G. Mattingly (Eds.), *Language by ear and by eye* (pp. 373–381). Cambridge, MA: MIT Press.

Moffett, J. (1968). *Teaching the universe of discourse.* Boston: Houghton Mifflin.

National Assessment of Educational Progress. (1981a). *Three national assessments of reading: Changes in performance, 1970–80.* (Report No. 11-R-01). Denver, CO: Education Commission of the States.

National Assessment of Educational Progress. (1981b). *Reading, thinking, and writing: Results from the 1979–80 National Assessment of Reading and Literature* (Report No. 11-L-01). Denver, CO: Education Commission of the States.

Olson, D. R. (Ed.). (1974). *Media and symbols: The forms of expression, communication and education.* Chicago: University of Chicago Press.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology, 8*, 317–344.

Perfetti, C. A., Goldman, S. R., & Hogaboam, T. W. (1979). Reading skill and the identification of words in discourse context. *Memory and Cognition, 7*, 273–282.

Perfetti, C. A., & Roth, S. (1981). Some of the interactive processes in reading and their role in reading skill. In A. M. Lesgold & C. A. Perfetti (Eds.), *Interactive processes in reading* (pp. 269–297). Hillsdale, NJ: Erlbaum.

Purves, A. C., & Niles, O. (Eds.). (1984). *Becoming readers in a complex society*. Chicago: University of Chicago Press.

Rumelhart, D. E. (1977). Toward an interactive model of reading. In S. Dornic (Ed.), *Attention and Performance VI* (pp. 573–603). Hillsdale, NJ: Erlbaum.

Sanford, A. J., & Garrod, S. C. (1981). *Understanding written language*. New York: Wiley.

Seidel, R. J., Anderson, R. E., & Hunter, B. (Eds.). (1982). *Computer literacy: Issues and directions for 1985*. New York: Academic Press.

Shostak, R. (1984). *Computers in composition*. Eugene, OR: International Council for Computers in Education.

Smith, F. (1978). *Understanding reading: A psycholinguistic analysis of reading and learning to read* (2nd ed.). New York: Holt.

Stanovich, K. E. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16*, 32–71.

Stanovich, K. E., & West, R. F. (1981). The effect of sentence context on ongoing word recognition: Tests of a two-process theory. *Journal of Experimental Psychology: Human Perception and Performance, 7*, 658–672.

Thorndyke, P. W. (1977). Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology, 9*, 77–110.

Trabasso, T. (1979). Reflections on reading about reading. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 3) (pp. 281–293). Hillsdale, NJ: Erlbaum.

Venezky, R. L. (1979). Harmony and cacophony from a theory-practice relationship. In L. B. Resnick & P. A. Weaver (Eds.), *Theory and practice of early reading* (Vol. 2) (pp. 271–284). Hillsdale, NJ: Erlbaum.

Diese Arbeit untersucht die verschiedenen Wege der Psychologie des Lesens. Die erste Frage ist: Wovon ist die Psychologie des Lesens eine Psychologie? Es gibt nicht nur eine Art der Psychologie des Lesens sondern eine Integration der Psycholinguistik, experimentale Psychologie, Neuropsychologie und Erziehung. Der Ausdruck "Neuro-sozio-psycho-textlinguistik" kann geprägt werden, um den heutigen Zeitgeist des multidisziplinarischen Lesereichtums zu bezeichnen. Die nächste Frage ist, wozu Psychologie des Lesens? Die Antwort ist wahrscheinlich das Erlernen und Lehren vom Lesen; das Erlernen und Lehren *über* Lesen; das Erlernen und Lehren *durch* Lesen. Die bestehenden Theorien und Forschungsergebnisse des letzten Jahrzehntes werden dargestellt. Die gegenseitige Abhängigkeit des Decodierens zur Automatizität und des Verstehens werden besprochen; das Verstehen auf den sentenziellen Stufen und Redestufen wird betont. Jedoch finden diese Fortschritte in Theorien sowie empirischen Studien nur langsam ihren Weg in die Lehrmethoden und Lehrprogramme hinein. Viel weniger wird in Bezug auf das Lernen *über* Lesen sowie *durch* das Lesen gemacht. Das Lesen als Erwerbung und Entwicklung von der Fähigkeit zu lesen und zu schreiben wird nicht voll realisiert. Die Rolle der Mikrocom-

putertechnologie als Hilfe für den Lesen und bei den Leseprozessen muß heutzutage auch in Betracht gezogen werden.

Este articulo explora las diferentes avenidas de la psicología de la lectura. La primera interrogante es: ¿Cual psicología es la psicología de la lectura? No existe un tipo único de psicología de la lectura sino más bien una integración de psicolingüística, psicología experimental, neuropsicología y educación. Se podría usar una nueva definición, la de neuro-socio-psico-textolingüística, para expresar el Zeitgeist actual de la riqueza multi-disciplinaria de la lectura. La interrogante siguiente es ¿psicología de la lectura para qué? La respuesta es, probablemente, para aprender y enseñar a leer; para aprender y enseñer *acerca* de la lectura; y para aprender y enseñer *por medio* de la lectura.

Se delinean las teorías y los resultados de investigación durante la última década. Se discute la dependencia por parte de la decodificación; se pone hincapié en la comprensión a los niveles de frase y discurso. Sin embargo, estos resultados, tanto teóricos como de estudios empíricos, se hacen camino sólo lentamente en las prácticas y programas de enseñanza. Se hace aún menos en lo relativo a aprender *acerca* de la lectura y *poro medio* de la misma. No se cumple el potencial de la lectura en tanto alfabetización y desarrollo de la misma. Y ahora también debemos tomar nota del papel de la tecnología del micro-computador en la ayuda a los lectores y los procesos de lectura.

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