COMPREHENSION-PROMOTING STRATEGIES: THE SUM OF THE PARTS AND THE WHOLE

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Abstract

Previous research on reading for academic purposes has concentrated on strategies characterizing "the good" and "the poor" reader. Using various methods, researchers have tried to identify sets of strategies, which lead readers to success or failure in academic reading. This approach seems to assume that a given set of strategies may account for success or failure in reading, and that "poor" readers may be trained to adopt "good" reading behavior once they adopt the recommended set of strategies. Contrary to this approach, an in-depth mentalistic study of ten university candidates (Sarig, in press) showed that readers differ in the sets of strategies which allow them to either succeed or fail in high-level reading tasks. Moreover, other findings from this study show that damage resulting from comprehension-deterring strategies may cancel out the benefit resulting from comprehension-promoting strategies, and vice versa. Thus, it seems that no particular strategy, or set of strategies, used by the reader can in fact enable us to predict success or failure in the reading task. Several questions arise from these findings; how can we account for the fact that readers may use a series of comprehension-promoting strategies and still not achieve the reading goal? How can readers ensure the gain expected from the comprehension promoting strategies they employ? These questions are addressed and discussed within the framework of the interactive multi-leveled view of the reading process, and in light of the data on the major role corrective, monitoring reading moves play in it. Based on findings arising from the mentalistic study, conditions for optimizing the use of

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comprehension-promoting strategies and a corrective-interactive view of text processing will be presented.

Introduction

Ericsson and Simon's valuable methodological work on ways to produce valid and reliable verbal data has recently revolutionalized research on the studying from texts (Cohen 1983, 1984a, 1984b, 1987, Cohen and Hosenfeld 1983, Grotjahn, 1987, Sarig, 1985, 1987a). Their model, predicting the reliability and validity of mentalistic data, has enabled a growing number of researchers to look closely into what they coined **"terra incognita"**.

Several insights into the nature of the reading process have been gained as a result of data yielded from mentalistic research on text processing (for an update on these please see Cohen 1987). These insights, in turn, bring up crucial questions regarding the process of learning from texts in general, and what makes learning successful, in particular. How do various strategies, both comprehension promoting and comprehension-deterring, interact? How can a series of "micro" gains, obtained as a result of sporadic comprehension-promoting reading activity, become one, integrated, overall, "macro" gain, leading to a "sum total" success? Can learners be trained to make local gains into an overall success? To discuss these questions I will first briefly review the findings which give rise to these questions. Next, I will present conditions for optimizing the use of strategies. Finally I will present a tentative corrective-interactive model of learning from texts, which may provide a possible way of dealing with these questions. I will also comment on some possible implications for teaching, and then suggest directions for future research.

High-Level Reading Strategies: Some Process Data

Background to the study

An in-depth mentalistic study done into the nature of text processing for academic purposes (Sarig 1985, 1987a)[1] will be reviewed in this section of the paper. This was the qualitative part of a comparative research into the reading processes of university candidates in their first and foreign languages. The research tasks in both studies were (a) analysis of the main propositions in the text and (b) synthesis of overall text message. The texts were two equally challenging, 500 word, authentic argumentative texts. One text was in Hebrew (the first language) and the other in English (the foreign language). The products were scored against a meaning consensus criterion answer (Sarig, 1987b).

In preparation for the mentalistic study, ten subjects were trained to produce valid and reliable mentalistic data, following production principles based on Ericsson and Simon's (1984) model (Sarig in press). The training yielded one to three hour talk-aloud protocols (totalling twenty three hours), produced in the process of performing the two research tasks.

The analysis of the data resulted in a number of findings. Two of these findings stimulated the questions to be discussed in this paper. Those concerned (a) the individual nature of the reading process and (b) the lack of a necessary one-to-one relationship between the employment of comprehension promoting, or deterring strategies and overall success or failure in the reading task. These, along with the questions they entail, will be briefly reviewed, and then discussed in the next two sections of the paper.

The Personal Reading Profile: Findings and Implications

Whether using the cloze, miscue analysis or mentalistic measures as research tools, research in reading, both in the first and a second/foreign language, has concentrated on the modeling of a "good" reading behavior (See, for example, Olshavsky 1976, Clarke 1979, Cziko 1980, Hosenfeld 1977, 1984).

The theoretical assumption underlying this approach to text processing remediation is that a certain prototypical combination of reading strategies is related to reading success. The direct implication of this assumption seems to be that once the "good" reading behaviour is identified and described, the basis for remedial teaching has been lain; that lists of comprehension-promoting strategies identified as characterizing "the good reader" can serve as a basis for both curriculum planning and material development.

Mentalistic measures, used both as a research and a treatment tool, proved to be an ideally suited tool for the actual implementation of this assumption. In one of the pioneering studies to be reported in the EFL literature, Hosenfeld (1977) described the possibilities that mentalistic research would have opened to the remedial EFL reading teacher. She foresaw that the state-of-the-art would have made it possible for the teacher to do remedial work with the student using a checklist, much like the computer diagnostic checklist used in a modern garage today, to fix a car. The teacher would use this checklist first to diagnose, and then to correct problematic aspects in the student's reading behavior. Hosenfeld's own studies (1977, 1979, 1984) contributed to the development of such a list. Naturally, this approach yielded well-known practical recommendations, shared by researchers and practitioners, such as "use knowledge of the world", "skim", "scan", "guess", and the like.

The findings of this study seem to take issue with this approach. The analysis of the data show that there is no one single way to succeed or fail in performing a high-level reading task. Rather, each reader is characterized by her or his own, individual combination of reading strategies, which leads her or him to succeed or fail. In all, around 126 (both promoting and deterring comprehension) strategies were identified. Out of around 125 strategies, 114 were "individual" strategies,either in terms of the number of other subjects using them, or in terms of frequency of use by other subjects,or both. From this potential, inter-subject repertoire,each subject used her or his own combination of strategies, consisting from as low as 56 to as high as 74 strategies, often showing a highly individual frequency of use as well. This personal combination of strategies was shown to be stable across languages: seven out of ten Pearson Product Moment correlations between the reading profiles in Hebrew and English were significant at least at the. 01 level.

The seven significant correlations range from as low as =.54 to high as = .97, showing the cross linguistic transfer itself to be an important dimension of the personal reading profile.

The conclusion arising from these findings is that both good and poor reading behaviours are highly individual. Different mental activities, or, no less importantly, the absence thereof, make different readers succeed or fail in performing the reading task. What "works" for one reader does not necessarily "work" for another;what makes one reader trip does not necessarily make every reader, or even most readers, trip.

Following these conclusions, it could be justified to suggest that remedial teaching based on prototypical good reading behavior may not ensure reading improvement for all, or even most readers. The findings surveyed above indeed seem to justify a recommendation that more respect be paid to the "cognitive privacy" of the learner (Sarig 1985), thus responding to Rivers and Melvin's (1981) call for more real focus on individual learners. Focusing on the individual learner can be implemented by way of making an individually-tailored remedial plan, comprising a list of comprehension deterring strategies (to be avoided) on the one hand, and a list of comprehension promoting strategies (to be encouraged) on the other.

Common-sensical as this approach may seem, other data from the study show that unfortunately, it may not provide all the answers to various reading failures. One more aspect of the reading process need to be considered: the corrective-interactive aspect of text processing.

Strategies and Other Strategies - The Parts and the Whole

A comparison of the individual combination of strategies (both comprehension promoting and deterring) with overall task performance leads to a rather surprising conclusion. Successful readers use a variety of comprehension-deterring strategies, just as unsuccessful readers use a variety of comprehension-promoting strategies. This comparison shows that somehow, benefit from comprehension-promoting strategies and damage from comprehension-deterring ones may cancel each other out. It seems that some interaction is taking place among the numerous success-generating and impeding strategies. Thus, it is the whole, not even the sum of the parts, that brings about success in the reading endeavor.

To make this point, let us consider two sets of comprehension promoting and comprehension deterring reading behavior of two readers, Hadas and Adi, and try to predict which of the two readers performed the research tasks successfully. The data are presented in table 1, and are taken from the mentalistic data describing the performance of the research tasks in both Hebrew and English.

Determining on the basis of the two sets of personal strategy combination who is the successful reader of the two, Hadas or Adi, seems to be a rather difficult task. Though their personal strategy combinations do show individuality in how they went about the reading tasks, they share 6 out of approximately 20 important comprehension-promoting strategies, as well as 4 out of approximately 21 serious comprehension deterring strategies. Though naturally the profiles indicate different reading behaviors, they do not seem to easily predict the fact that Hadas is a successful reader (87% success in Hebrew, 72% success in English), whereas Adi is the unsucessful reader (34% success in Hebrew, 18% in English). When data related to other dimensions of the reading profile (see Sarig, 1987a) are studied, the picture does not become clearer. It may be concluded, then, that while Adi achieved micro-successes, she failed to achieve overall, macro-success. Similarly, it may be concluded that although Hadas had micro failures, she achieved macro success.

TABLE 1 - Adi and Hadas' Personal Strategy Combination.

Comprehension Promoting Strategies In Adi's Data

TECHNICAL-AID:	CLARIFICATION AND SIMPLIFICATION:
1. use of glossary 2. overall skimming 3. review skimming	1. rhetorical function paraphrase 2. implication paraphrase

COHERENCE DETECTION:	MONITORING:
1. use of macrostructure 2. use of key textual information 3. use of textual summarizing material 4. use of explicit meta-discourse	1. correct self-assessment 2. detection of incompatibility with text produced so far 3. metacognitive planning 4. ongoing self-assessment 5. flexing the analysis unit 6. flexing rate of reading

(ADI'S OVERALL SCORES: 32% SUCCESS IN HEBREW, 18% IN ENGLISH)

Comprehension-Deterring Strategies In Hadas' Data

TECHNICAL-AID:	CLARIFICATION AND SIMPLIFICATION:
1. heavy highlighting 2. heavy note-taking 3. over-local skimming 4. skimming when needing to scan	1. over-decoding of local material

COHERENCE DETECTION:	MONITORING:
1. ignoring explicit key information in the text 2. ignoring text macrostructure 3. avoiding reduction of redundant material 4. using low-quality prior knowledge 5. misrelating claims to claimers	1. misallocating resources 2. ignoring relevant prior work 3. inconsistent self-assessment 4. inconsistent use of technical facilitador (scanning, summary-writing) 5. ink-ing (illusion of not knowing)

(HADAS' OVERALL SCORES: 87% SUCCESS IN HEBREW, 72% IN ENGLISH)

Rules for Optimizing the Use of Comprehension-Promoting Strategies.

The findings presented above indicate that success in reading may not be a function of the use of a particular set of strategies. Successful readers use "bad" strategies and yet overcome the damage brought about by them. At the same time, unsuccessful readers use "good" strategies, but do not benefit from them. It seems that being "a good reader" is not just a simple matter of using specific strategies. How, then, can overall success in reading be accounted for? In this section of the paper I will present the conditions for obtaining"macro" success from "micro" successes, resulting from the utilization of comprehension-promoting strategies. These rules were generalized from the analysis of reading failure, as it reflected itself in the protocols. They will be presented after a brief explanation of the nature of each strategy type to which they relate.

Technical-Aid Strategies: Technical-aid strategies are those the reader uses to facilitate higher-order moves in a complex reading task. For example, highlighting key terms, expressions, or whole segments for later use as a basis for gist constructing, or scanning for a text unit,the processing of which was earlier put on hold for later processing by skipping[2].

Clarification and Simplification strategies: In implementing strategies of this type, the readers utilize their linguistic competence to raise the level of linguistic and textual redundancy of the text. This is achieved by various types of paraphrase,the function of which is to clarify and simplify complex lexical, syntactical and textual segments of the text. These substitutes range from using synonyms ("**SPECULATING**? THIS HAS NOTHING TO DO WITH THE STOCK EXCHANGE MARKET. HE MUST MEAN SOMETHING LIKE **WILD IDEAS**"), or simplifying heavy syntactic structures, to propositional analysis or paraphrase of implication ("HERE HE ACTUALLY ENCOURAGES WILD SPECULATION AND WARNS US ABOUT THE DANGERS OF IDEOLOGICAL STAGNATION"), concretization ("IT'S JUST LIKE...") and reasoning.

Coherence-Detection strategies: This group of strategies involves the implementation of macro-textual and pragmatic, extra-textual knowledge intended to construct a coherent meaning for the text. These moves are actually the core of the reading process. They involve strategies like the identification of the macro-structure of the text ("SO IT'S ACTUALLY ABOUT THE DANGER OF IDEAS, NOT ABOUT THE NATURE OF WARS"), use of prior knowledge schemata, relating claims to claimers ("IT'S MARX WHO SAYS THIS, NOT MARCUSE"), cumulative reproduction of the logical thread in the text, and the like.

Monitoring Strategies: Monitoring moves have two main functions. First, the reader uses them to plan task performance, and then — to monitor the processing so as to detect errors. Thus, they involve planning and the changing of plans ("I'LL STOP WITH THIS HIGHLIGHTING. THE WHOLE PAGE IS YELLOW"), adjusting reading rate and unit of processing when incompatibilities or difficulties arise, self-assessment ("DID I REALLY GET THIS RIGHT? YES, SEEMS SO"), etc. Two of the most typical manifestations of the monitoring system are re-readings of the text and self-questioning and answering.

As shown above, earlier micro-successes, gained from the operation of these comprehension-promoting strategies, do not necessarily lead the reader to overall, macro-success. It is the interaction among the four groups that seems to be the key to macro-success in task performance. The nature of this interaction, in light of other aspects of interaction in text processing, will be discussed in the next section of the paper.

The Interactive Approach to Reading: What Does it Mean?

There seems to be a consensus among reading theorists as to the interactive nature of the reading process. Approaches to reading differ in the various aspects they focus on, depending on what the theorists define as interaction. To give a few examples, in Rumelhart's (1977) now classical model of reading, interaction is conceived of as the process of hypothesis-making and rejecting, taking place in the "message center". This dynamic interaction takes place as a result of the convergence of information streaming from othographic, lexical, syntactic and semantic knowledge on the pattern synthesizer. In the Stanovich (1980) model of reading, interaction is of a compensatory nature: readers are more/less active on the lower/higher levels as a function of the nature and quality of their data-base. Interaction in this model, then, means the interplay among the relative weights of each of the components in operation - "local" as well as "global" ones.

Both Rumelhart and Stanovich use their models mainly to explain and predict the processing of words. In the Kintsch and Van Dijk's (1977, 1983) model, however, the focus is on comprehension. Interaction in this model therefore means the often simultaneous operation of three levels of processing: the multiple process of integrating micro-meaning units into one coherent whole, the reduction of the text to its gist and the possible generation of the reader's text as his mental representation of the writer's text.

Different as the emphases on different aspects of the concept of interaction may be (Rumelhart 1977, 1980, Stanovitch 1980, Just and Carpenter 1980, Kintsch and Van Dijk 1978, 1983, Baten and Cornu 1984, De Beaugrande 1984, Frederiksen 1984, Hari-Augstein and Thomas 1984), they all reflect a view of reading as a complex, multi-leveled process, fed from both lower-level and higher-level input sources.

Knowledge about the crucial role metacognitive skills play in learning from texts has considerably expanded recently (see Brown 1982, Brown, Campione and Day 1982, Baker and Brown 1984, Sarig and Folman 1987). However, this kind of knowledge has not yet been represented as an integral part of the text processor. In their survey of current models of the reading process, Samuels and Kamil (1984) comment on the neglect of the metacognitive aspects in current models of reading:

> .... we should recognize that our models have gaping holes in them. As we have developed some sophisticated ideas about how comprehension takes place and how metacognitive strategies are used to facilitate reading, the models have been slow to incorporate this information. (p.220)

It would seem that the findings presented above support this comment. Interactive conditions which may take us a step ahead in this direction are presented below.

Corrective-Interactive Conditions for Optimizing the Use of Strategies.

An examination of the interaction between strategies within strategy type and strategies across types enables us to state conditions for ensuring overall success in task performance. First, the overall interactive nature of the conditions will be discussed. Next, the conditions for each strategy type will be presented. Finally, tentative principles of a monitoring-interactive model of reading will be presented.

To understand how to benefit from strategy implementation,a close examination of the use of all types of strategies against overall success in task performance is needed. This examination reveals the interactive nature of success in reading. Readers may use a host of comprehension promoting strategies. However, benefit from them depends on two principal, inter-related conditions: (1) each move of the first three groups (Technical-aid moves, Clarification and Simplification moves and Coherence detection moves) must first be regulated by the fourth type — monitoring moves; (2) each move, operated on any processing level, must be in accordance with (a) all moves already completed prior to a given move and with (b) all potential moves to come. Unless that two conditions are met, the readers' efforts are wasted. The instances of corrective moves presented in table 2 below exemplify how these conditions work to ensure overall success. The verbalizations presented in the table are based on authentic data, but the corrective moves are hypothetical.

The two conditions discussed so far are general enough to apply to all moves. Following are move-type-specific conditions, which are specific instances of the two principal conditions. These will be presented within each group separately.

Conditions for Optimizing the Use of Technical - Aid Moves

Readers retrieve Technical-aid moves from their strategic data base. To benefit from these acquired technical-aid

TABLE 2 - Examples for Interaction among Reading Moves Across Strategy Type.

1. The reader **highlights** names, dates, etc.(a **technical-aid** move), but a consideration of the task overall goal (assessing) make her decide to put this activity on-hold:

   ... "Why should I actually bother with this? I don't really need these details. Let me highlight key concepts and ideas."

2. The reader copies segments from the text (a **technical-aid move**). A **process evaluation** move makes her decide to better benefit from another, already completed technical-aid move:

   ... "No need to do all this tedious copying I seem to do so obssessively. I'm already half way through with highlighting key concepts and ideas; let me finish and then start organizing the main ideas from there."

3. The reader implements prior knowledge of the world (a **coherence-detection** move). The **product assessor** alerts her of the incompatibility of the product (reader's processing discourse) with other material in the text, and she corrects the miscue:

   (... "Sure, we all know that in the course of **time** women will be liberated. But what does this have to do with "TIME survey? Could he be using the word TIME in another sense? Oh, sure, it's the magazine he's referring to.")

4. The reader implements prior knowledge of the world (a **coherence-detection** move). The **product assessor** brings the **resource assessor** into action, and the reader becomes aware of a possibility of flaw in content-schemata used:

   (... "I know from history classes that Marx was an important figure in the history of the Jewish people. But this does not seem to help me. The text doesn't even mention the Jewish problem. Could I be mistaken about Marx? Let me check this.")

5. The reader implements prior knowledge of the world (a **coherence-detection** move). The **product assessor** alerts her to a miscue in a former move. Thus the processing discourse is rejected, and a series of more errors to come is avoided.

   (... "He claims only institutes will serve as a basis for the revolution he's suggesting. Very logical. They have all the resources. But wait a minute, the word here is **instinctual**, not institutional.")

6. The reader implements prior knowledge of the world (a **coherence-detection** move). The **product assessor** alerts the reader an incompatibility of given discourse with text. The **operator** goes into action, putting the clarifier into use, and a new piece of discourse is produced:

   ("... We've already seen how speculations caused the collapse of the stock exchange market. So I expect he's against this. No... he's criticizing them for not speculating. How come? Could this word have a positive meaning here?")

strategies readers must meet the following conditions:

1. Correct conception of task, and the appropriate construction of an equivalent inner goal: readers must conceive of the task as derivative of the learning situation constraints. Unless they do so, the strategies they select and implement will be of no avail to them. To do so, the monitoring system must give them the right commands. These will tell them which strategy available to them will help them achieve their macro goal. Examples nº 1 and 2 in table 2 are instances of the implementation of this condition.

2. A systematic execution of task, once the appropriate plan of action has been selected: monitoring the systematic execution of the task is the second essential condition to ensure optimizing the use of technical-aid strategies. Once strategies have been selected in accordance with the first condition, the readers must stick to the appropriate plan of action selected until the task is completed. For example, the reader will not abort a scanning plan before the necessary details are found. Likewise, the reader will not start circling and underlining key words, if he already underscored important information by highlighting it (see example nº 2).

An important aspect of the systematic execution of strategies selected is to actually optimize their use, once the technical work is done. A few of the subjects in the study invested much effort to finish using an appropriate technical aid, but never actually realized the benefit it held in store for them. When it came to actually writing out what the overall message of the text was, as the task demanded, the subject hypothetically cited in example nº 2 never used the key words and concepts she took the trouble to highlight. Instead, she started almost copying whole segments of the text verbatim. She knew how to efficiently utilize the strategy, but her monitoring system was not strong enough to help her benefit from her efforts.

Systematically sticking to a selected strategy does not mean that the reader cannot be flexible in strategy use. The reader does have recourse to another plan, on condition that a monitored decision took place so as to justify it. This change must always be for the better. For it is the very strength of a well-developed monitoring system to constantly correct and improve itself.

3. Efficient execution of appropriate technical-aid moves: Conditions 1 and 2 met - both will not be sufficient to ensure optimizing strategy use unless the operation is efficient. Note-taking and marking can really facilitate a complex reading task, but over-note-taking and over-marking, or skimming too quickly, or scanning too laboriously, or jumping around the text erratically — will naturally be counter-productive.

In sum, optimizing the use of technical facilitators depend on:

1. Understanding the reading macro goal and knowing which strategies are appropriate for achieving it;

2. Sticking to an execution plan until it is completed, unless some monitored justification for changing it enters mid way;

3. Executing the plan efficiently.

The three conditions presented above may seem to be obvious. However, it seems that doing things right is not as simple as just doing them. These principles are in line with Hari-Augstein and Thomas' (1984) concept of "the self-organized reader". They would also fit well with Brown's (1982) characterization of the expert learner.

Conditions for Optimizing the use of Clarification and Simplification Moves

The essence of clarifying and simplifying is the linguistic substitution. Simplifications can be conceived of in two ways: as the generator of comprehension and as its product. Corder (1981), Davies (1984) claim that the learner can simplify only that linguistic material he controls, i.e., understands. If we apply this claim from the context of SL/FL acquisition to the context of text processing, it may appear that simplifications are comprehension products, not generators.

Within the framework of this approach to simplification, good simplifications testify to comprehension, just as poor simplifications testify to lack thereof. However, the demarcation line between product and process here is not at all clear cut. The data show that readers stop to simplify and clarify only when comprehension breaks down. Good simplifications indeed promote comprehension. It would seem then, that simplifications both generate comprehension and are produced by it.

The first principle of success is related to this interaction between product and process. Since "error breeds error", the essence of the first principle is:

1. Avoidance of initial errors, which will necessarily lead to false, distorting simplifications and generate more false products. What this principle comes down to is that prior to simplifying and clarifying, the reader must succcessfully ensure the initial identification of lexical, morphological, syntactic and rhetorical functions of the utterances he is about to simplify — in their text-specific context. This can be done only if the monitoring system checks out with the coherence-detection system for the correct decoding of the utterance to be substituted. For example, decoding RESOURCES as RESEARCH and substituting "SCIENTIFIC STUDY OF REALITY" for it, may be a good substitution in its own right, but one which will only lead to more errors to come. Likewise, substituting "THE ENVIRONMENT DICTATES TO US WHAT TO THINK. IT SHOWS US HOW FAR WE CAN GO WITH OUR IDEAS" (reader's simplified version) for "OUR ENVIRONMENT IS CHIEFLY CONDITIONED BY WHAT WE BELIEVE" (Hoyle, 1976) is an error which may impede overall comprehension of the text, and might bring about yet other errors. This would not have occurred had the monitoring system been on the alert, checking for compatibility of this simplification with prior and later reader's text.

The second principle of ensuring optimizing the use of simplifications and clarifications has to do with the efficiency of adjusting the analysis unit, and with its effect on the overall comprehension of discourse;

2. Efficient pausing: Two frequent breaches of this principle

involve either breaking the utterance down too early or too late. This happens mostly when the readers cannot rely on punctuation, (when the utterance is long) or when they ignore it. Since pausing is done to avoid overloading the channel of capacity, it is important for the reader to know when it would be most efficient to pause. Consider, for instance, the following example (Slashes reflect the reader pauses, the lower case print represents the reader's text, i.e, the simplified product, and the upper case print is the text itself):

> IT IS WELL KNOWN THAT WHERE A WHITE MAN HAS INVADED/ everyone knows that in any culture the whites were involved/THE MOST DESTRUCTIVE EFFECTS HAVE COME NOT FROM PHYSICAL WEAPONS/ destruction was not the result of weapons/BUT FROM IDEAS/except ideas: they never caused destruction.

In this hypothetical example, inefficient pausing toward the end of the reader's text has led her to a false, illogical coherence-detection move, which in turn led her to a totally wrong reading of the text. Had she paused correctly, she would stand more chances of relating the utterance BUT MAN as the complementary correction of the claim, rather than as she did. This coherence-detection error (caused by inefficient pausing resulting in a false simplification) will impede overall understanding: the overall message of this text (Hoyle 1967) is that ideas are more dangerous than physical weapons.

In sum, optimizing the use of simplifications and clarifications depends on:

1. Checking for initial local decoding errors, so as to avoid initial errors, which will generate additional errors;

2. Pausing efficiently, so as to ensure the necessary coherence detection necessary for efficient simplification.

These two conditions show how three sub-systems must interact to ensure overall comprehension: (a) the clarification and simplification system (b) the discourse detecting system and (c) the monitoring system.

Conditions for Optimizing the Use of Coherence Detection Moves

To detect coherence in discourse the reader must be equipped with two types of knowledge: (a) text domain-specific knowledge of the world (content schemata) (b) knowledge about what makes words, sentences and paragraphs a connected discourse (linguistic, textual and rhetorical schemata). However, even when the reader is equipped with these types of schemata, and when they are actually used to process the text, satisfactory discourse-detection is still not ensured. Another major component of the discourse detection process is, just like in all other types of reading activity, the monitoring system. Regarding the first type of knowledge, the monitoring system must ensure that the following conditions are met:

1. Awareness of the dangers inherent in the use of low and/ or partial domain-specific schemata: readers must accurately assess the quality of domain-specific schemata they retrieve and implement in detecting coherence. Hypothetical correction (based on authentic error) no. 4 in table 2 is a case in point. An alert monitoring system may bring about the correction described in this example.

2. Awareness of the dangers inherent in the retrieval and implementation of accurate and full, but irrelevant, domain-specific schemata: readers must check for relevancy of the schema they use in processing the text. For example, while processing the Marcuse text, one subject elaborated on social oppression in the Middle Ages. Her knowledge seemed to be full and accurate. However, it was irrelevant to the text. Active monitoring eventually alerted this knowledgeable and intelligent reader to the text imposition she had made.

3. Ensuring that implementation of content schemata will take place only after accurate local processing has taken place: examples no. 3, 5 and 6 show how, respectively, (1) incorrect assignment of meaning to an ambiguous word, (2) error in word decoding and (3) incorrect assignment of contextualized word connotation — all took place as a result of faulty monitoring, thus preventing the optimizing of content schemata implementation. An alert monitoring system would have enabled the hypothetical

correction of authentic errors described in these examples.

The conditions for optimizing the use of discourse-detecting moves discussed so far involve, then, the constant interaction between (1) the monitoring system (2) the coherence detecting system and (3) the clarification and simplification system. This interaction focuses on the crucial ensuring of **accuracy, completeness** and **relevancy** of schemata used. It involves the constant juxtaposition of the decoding measures on the one hand, and the decoding unit, to which the measures are applied, on the other. It is both a local and a global process, much like the one predicted by the Rumelhart (1977) model, performed by means of the monitoring system. It is the monitoring system, then, which determines whether the knowledge the reader "brings to the text" will be to his or her benefit.

This interactive endeavor is rather difficult to perform. Even if the reader constantly monitors the implementation of prior knowledge, he or she might still refrain from rejecting a faulty schema: implementing the schema may have its own inherent logic, anchored in her or his outlook on the world, or even in some irrelevant (but still logical) material in the text. In this case the implementation of the schema will deter comprehension even though the monitoring system was constantly alert and active.

Here, too, the problematicity of the interaction between the process of comprehension and its product becomes evident. Text impositions may result from the paradoxical, two-directional relationship between content schemata in the text and those in the reader's data base. At times the reader will not be able to take in a domain-specific schema from the text unless he uses his own relevant prior schema. In this case his monitoring system cannot be blamed for the breakdown of comprehension.[3]

The last condition for optimizing the operation of coherence detecting moves relates to the second type of knowledge involved in detecting coherence: textual and rhetorical structures. Following are the conditions for optimizing the use of moves that relate to this type of knowledge:

4. Awareness of the unpredictable nature of textual structures:

Readers are trained to predict textual sequence on the basis of familiar rhetorical structures. However, not all texts follow the conventional, predicted sequence. First, the text itself may simply not obey the dictates of the convention. Secondly, there may be culturally-biased interference involved. It is the responsibility of the monitoring system to alert the reader to the possibility that his or her expectations may not be fulfilled. To give a hypothetical example, a reader may predict an example after a claim. If this prediction is overpowering, and the monitoring system does not interfere, the next segment in the text, which is actually an implicit result of an implicit condition, may be understood to be an example. This error may be corrected if the monitoring system intervenes:

> THE STATE MUST SEE TO THE PHYSICAL NEEDS OF THE CITIZENS/now he will surely give an example, so that I'll be able to understand his claim/ THE CITIZENS WILL INVEST THEIR ENERGY IN SERVING THE STATE / I don't get this: is this an example of what the state will do for them, or they for the state? Oh, yeah. This is not an example, it's a result. If the state... etc.

The intervention of the monitoring system is specially crucial when textual relations are implicit. In such cases it will help the readers detect an argument, identify a rhetorical function, identify claimers and connect them to the claims they make — even though the author has failed to give explicit clues for the easy detection of such information.

In sum, optimizing the use of coherence-detection moves depends on:

1. The accuracy, relevancy and completeness of the content-domain-specific schemata implemented in processing the text;
2. The accuracy of the locally-decoded material the schemata is to be implemented on;
3. The compatibility of the textual schemata (macrostructures) in the text, and the one the reader processes the text with.

Conditions for Optimizing the Use of Monitoring Moves

The complex and varied workings of the monitoring system are revealed in the conditions discussed so far. Is overall success ensured once the reader has developed a strong monitoring system, one which (a) ensures constant awareness of the macro and micro-goals (b) enables appropriate strategic planning and execution of a plan (c) detects incompatibilities in comprehension products and (d) mobilizes the appropriate corrective moves? No doubt, an expert-standard monitoring system would be an ideal start for the performance of new learning tasks, with new content domains, possibly in a new language. But, of course, it would not be sufficient. For an expertly developed monitoring system to bring about learning one needs all the ingredients involved in operating the other systems. These range from a rich variety of strategic knowledge, an expert linguistic competence (on the basis of which to clarify and simplify)and the two types of knowledge involved in coherence detecting.

Finally, the monitoring system should be able to alternate between automatic operations and metacognitive ones, as the learning challenge requires. An expert reader with this sort of "learning equipment" will stop at nothing.

In sum, the conditions for optimizing the use of monitoring moves depend on:

1. The existence of strategic, linguistic, textual and extra-textual types of knowledge.

2. The ability of the sub-system to work both automatically and metacognitively.

All the conditions for optimizing strategy implementation across strategy-type share one element: the active regulation and control carried out by the monitoring sub-system. Figure 1 presents a schematic representation of this interactive-corrective process.

The schematic representation in figure 1 gives a static picture of the components of the corrective-interactive text-processing system. Its main elements — the ASSESSOR, the PLANNER and the OPERATOR — all perform controlling and

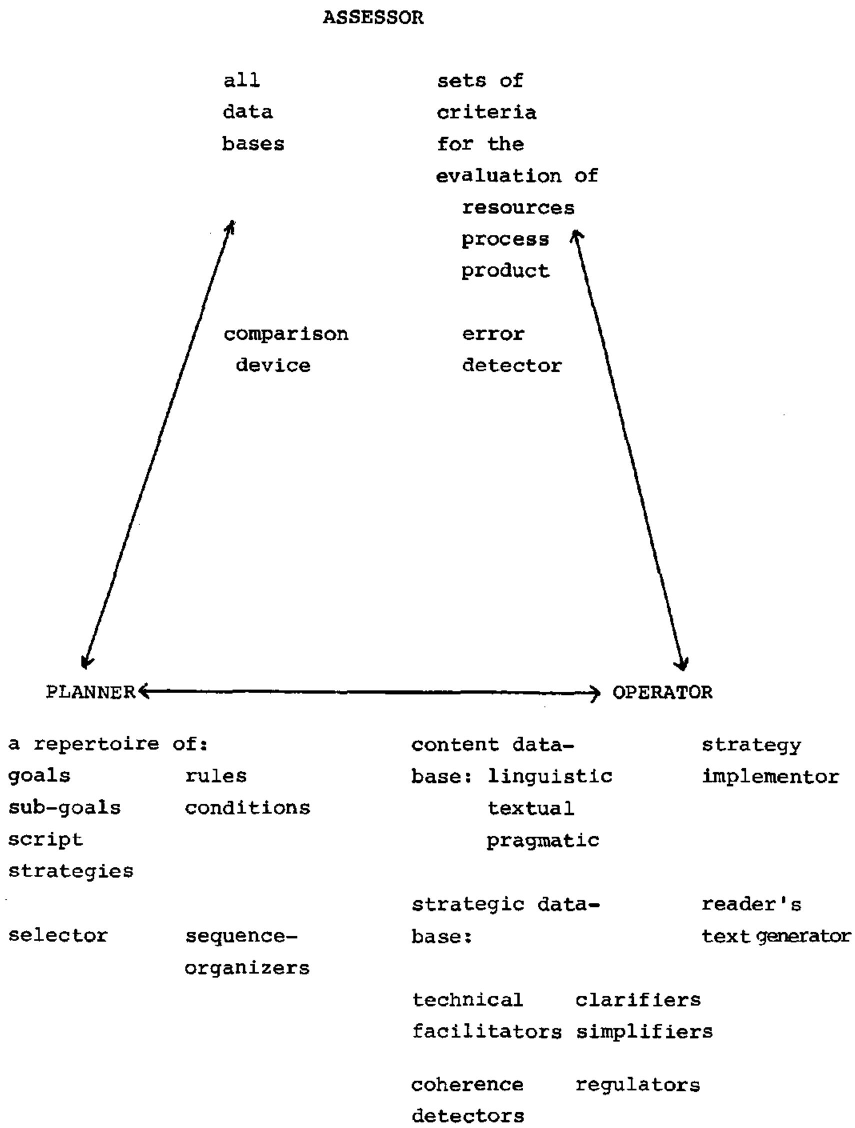

FIGURE 1 - A Static View Of An Expert Corrective-Interactive Text Processing System

monitoring activities. Each has its own authority over other aspects of the meaning construction process. Thus, the ASSESSOR controls the quality of the **resources**, the **process** and the **product**, the PLANNER selects appropriate goals, subgoals, scripts and strategies, and the OPERATOR follows the PLANNER's commands as to which of the strategies in the learner's repertoire should be implemented. Ideally, both products of the PLANNER and the OPERATOR are under the constant evaluation of the ASSESSOR. Thus, once an error is detected in the products of the PLANNER or the OPERATOR, either or both will have to enter a corrective cycle, until their respective product is given the "go ahead" signal.

To better understand the way this complex corrective-interactive system works, the PLANNER, OPERATOR and ASSESSOR need to be discussed in terms of the following dimensions: the **functions** each perform, their respective **products**, the **resources** each draws from, their **sources of input** and their respective **target outputs**. These dimensions of the PLANNER, OPERATOR and ASSESSOR are presented in figure 2.

The data presented in figure 2 highlight a few principles underlying the corrective-interactive view of text processing. First, each component of the system has its own functions. Second, while the three components share at least parts of the same resources, each component implements the required information for different purposes. Finally, the interactive nature of the system is reflected in the constant flow of information from one component to the other (see sources of input and targets of output). This interactive aspect of the system is figuratively portrayed in figure 1 above.

Clearly, not all the components within the sub-systems comprising the corrective-interactive text processor co-act simultaneously at all times. Presenting them all together therefore gives a static picture of the system at rest, showing all the sub-components which may potentially become activated

	PLANNER	OPERATOR	ASSESSOR
FUNCTIONS	. SELECTOR . SEQUENCE ORGANIZER OF: . goals . subgoals . script . strategies	. STRATEGY IMPLEMENTOR . READER'S TEXT GENERATOR	. EVALUATION . ERROR DETECTION IN/OF: . resources . process . product
PRODUCT	. RATIONALLY SELECTED: . goal . subgoal . script . strategies	. READER'S TEXT	. EVALUATION RESULT: . go ahead . error detected; go back
RESOURCES IMPLEMENTED	A REPERTOIRE OF: . goals . subgoals . scripts . strategies . rules . conditions	. CONTENT DATA-BASES . linguistic . textual . pragmatic . STRATEGIC DATA-BASE: . technical-facilitators . clarifiers & simplifiers . coherence-detectors . regulators	. ALL DATA-BASES IN PLANNER AND OPERATOR . SETS OF CRITERIA FOR THE EVALUATION OF: . the resources . the process . the product . A COMPARING DEVICE
TEXT INPUT FROM	. TEXT . OPERATOR . ASSESSOR	. TEXT . PLANNER . ASSESSOR	. PLANNER . OPERATOR
OUTPUT TO	. ASSESSOR . OPERATOR	. PLANNER . ASSESSOR	. PLANNER . OPERATOR

FIGURE 2 - Functions, Resources, Input And Output Of The Corrective-Interactive Text Processing System.

at different stages of the process, given the right occasion.

To hypothetically exemplify the workings of the interactive-corrective system, figure 3 presents a hypothetical instance of a successful corrective reading behavior. It includes the reader's discourse, accompanied by operations and outputs of the systems. This example shows a well-developed corrective-interactive system at work. All the corrective operations are obviously optional (information in lower case is the reader's text; information in brackets is the product of the PLANNER or the ASSESSOR).

It is beyond the scope of this paper to describe or exemplify the numerous intricacies of the potential, dynamic interactions among the sub-components of the system. It would suffice to say that the processing of one text should be viewed as a series of **reading cycle rounds**: the mental activity going on between two monitoring pauses (in the example above there are seven such cycles). The cycle of an expert reader will always include the operation of at least one of the monitoring components: the planner or the assessor, as the situation requires. Non-expert failures can be explained in terms of underdevelopment of one or more of the sub-components. The less than expert reader will draw more on the operating component and less on the monitoring ones; or, he or she may draw on all, but the resources implemented may be lacking, and thus no efficient correction can be generated. A novice learner may even not resort to the monitoring components at all, thus producing various illusions of knowing and not knowing (see Rahman and Bisanz 1986, Sarig and Folman, 1987).

Thus, the conditions for optimizing strategy implementation are actually descriptions of the interactions going on between each of the sub-components of the operating system on the one hand, and the sub-components of the planner and the assessor on the other.

The conditions presented above were developed on the basis of the data collected in the mentalistic study described above.

PLANNER/select goals----(goals)----PLANNER/select subgoals, script.

... I need to learn about his victories as well as failures...

---ASSESSOR/process-goal---(go ahead)---PLANNER/select subgoals, scrpit,strategies---script, strategies)---

I'll find out causes for both his victories and losses...
...first I'll scan for dates and details about each campaign... then I'll look for causes of failure and victory... I'll make up a list of events, then of dates.

ASSESSOR/process evaluation----(error detected in script - go back)--- PLANNER/reselect script and strategies--- (new script and strategies)...

...no... I'll worry about the details later... first I'll locate info about all campaigns and will classify them into failures and victories...

ASSESSOR/process evaluation--- (go ahead)--- OPERATOR/implementor --- (reader's text)---

... so we have two magnificent victories in 1977 and in 1979 attributed to clever use of media and one fiasco in 1980... due to economical trouble... so it all boils down to this...

(reader's text)--- ASSESSOR/product evaluation --- (error: incompatibility with text produced so far) ---

... hey, wait a minute... something's wrong here...

ASSESSOR/process evaluation--- (error: relevancy condition not met)---

... let me check about these economical troubles... yeah... he overcame those... so it's something else...

OPERATOR/data-base/implementor--- (new reader's text)---

.... maybe this union strike back in October 1979?... yeah... so you can actually never predict what trouble is in store for you...

ASSESSOR/process evaluation--- (go ahead)--- product evaluation --- (go ahead) --- yeah, that's it. --- END CYCLE.

FIGURE 3 - A Round of Successful Corrective Reading Cycles: An Example.

A reservation regarding their generalizability is therefore called for. Given the constraints of the experiment, the data result from a specific learning situation. This was created by the intersection of four groups of charcteristics (see the model of learning by Brown 1982): the ten specific learners giving the verbal data, the two specific research tasks, of the specific texts used and the given strategies the subjects actually used. Future experimental settings, varying in one or more of these variables, may yield different data. These, in turn, may enable the creation of additional conditions. The conditions may describe different aspects of success in text processing, thus enabling us to gain more specific knowledge about the corrective-interactive view of text processing. In this way we will learn more about what we already know now: expertise in learning results from the interaction between different bodies of knowledge and a well-developed metacognitive system (see Brown 1982, Brown, Campione and Day, Baker and Brown 1984).

Summary and Conclusion

The main point of this article is that success in reading for academic purposes depends on more than the mere implementation of comprehension strategies. A new, updated version of mentalistic methodology enables us to understand better what it takes to become an expert reader. The findings described in this article highlighted two main characteristics of academic learning from texts.

First, each reader has her or his own ways of going about a high-level reading task, be it in the first or in an additional language. It therefore follows, that no effective remedial work can be done unless the reader's personal reading profile is first diagnosed.

Secondly, and more importantly, the mere implementation of strategies, which in their own right have the potential of promoting or deterring comprehension, do not actually predict success or failure. It is their expertly performed, effective series of interactions with a complex, intricate monitoring system — or the lack thereof — that can lead to overall success or failure. The rules of optimizing the implementation of strategies discussed in this article give concrete instances of those comprehension-promoting monitoring interactions. These may explain and predict overall success or failure in learning from texts.

As mentioned above, we know today more about the crucial role of metacognitive skills in learning. The conditions presented and discussed above show us that developing our learners' strategy reservoire is only one aspect of the learning process we want to teach them. It is the expert, carefully and interactively monitored ways of implementing those strategies that we now know we have to show them.

Notes

1. The 1985 study was a part of a doctoral dissertation, done at te Hebrew University of Jerusalem under the supervision of Prof. Andrew D. Cohen.
2. For more examples of all moves identified in this study please see Cohen (1987) and Sarig (1987).
3. See Downing and Leong (1982) for a discussion of the paradoxical relationship between schema to be processed into the system and the schema through which it is to be processed.

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