A comparative analysis of two models of reading: Goodman and Guthrie.

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ABSTRACT

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Two models of reading are compared: a psycho-linguistic model, presented by Goodman (1967), and a psychological model, presented by Guthrie (1973). A review of the literature provides examples of support for, and dissent from, each model. The possibility of integrating these models is discussed.

Experiment One is a partial replication of a study by Allington and McGill-Franzen (1980), in which subjects are required to read aloud lists followed by equivalent texts. The results support the findings of the original study.

Experiment Two is similar to Experiment One, but investigates the effects of incongruous homophones on the reading behaviour of good and weak readers. The results indicate that there is no significant difference in the extent to which incongruous homophones affect the oral reading of both good and weak readers. Both groups appear similar in their awareness of the internal structure of words when reading texts aloud.

It is concluded that reading is too complex a process to be explained solely by the models of either Goodman or Guthrie.

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1.0 Introduction. The reasons for this study.

1.1 The need for further investigation into the reading process.

Reading is an important component of modern life in all the advanced, technologically well-developed countries of the world. Those people who can read a wide variety of textual materials with good understanding are more likely to educate themselves in an independent way and to integrate themselves effectively with their society than those who are unable to read.

The author is a teacher at a North London boys' comprehensive school. His pupils include some of those whom teachers and parents consider to be below average at reading. He is interested in improving his understanding of how to assess pupils' reading problems and how to help them to improve their reading ability.

Some authorities have advocated teaching phonic skills in remedial reading programs, but others have provided alternative suggestions as to how best to help pupils to learn to read effectively. The author decided to undertake a small-scale investigation in order to aid his understanding with a view to changing or modifying his teaching-methods.

He studied various theories concerning the processes involved in reading, and this brought to his attention several models of reading. According to Collins Dictionary of the English Language (1979), "theory" can mean

(1) a hypothesis (ie. a suggested explanation for a group of facts or phenomena); or

(2) a set of hypotheses related by logical or mathematical argument to explain and predict a wide variety of connected phenomena in general terms.

According to Collins Dictionary, "model" can mean a simplified representation or description of a system or complex entity, especially one designed to facilitate calculations and predictions.

For the purpose of this thesis the author interpreted these definitions as implying that, whereas a theory attempts to suggest the relationships between a group of facts or phenomena, a model attempts to represent these relationships in a simplified form.

Davis (1972) stated that numerous models of reading had been published in research journals and specialist books. They included neurological, perceptual, behavioural, general-memory, verbal and psycho-linguistic models. The author chose to study two such models, which seemed particularly relevant to his work as a teacher, because they were so contrasting that he wanted evidence as to which model to follow.

Guthrie (1973) presented the view that phonic knowledge is fundamentally necessary for effective reading, whereas Goodman (1967) presented the view that the reader's reliance on linguistic knowledge is of primary importance. The author chose to study these two models, because they seemed to him to be representative of two important schools of thought as to how best to help children to learn to read.

Guthrie's (1973) research was in the tradition of behavioural-psychology, whereas Goodman's (1967) research used psycho-linguistic methods. This contrast is explained more fully in the next section.

1.2 Two models of particular importance.

Goodman (1967) produced a psycho-linguistic model of reading, which resulted from his observations and interpretations of children's reading behaviour when reading narrative texts aloud. This task involved reading passages for meaning. He analysed the children's responses to linguistic elements within the texts and his findings have helped and encouraged teachers and researchers to reconsider the nature of the reading process.

Until Goodman introduced his psycho-linguistic approach to reading, teachers had tended to stress the desirability of reading every word accurately. For example, it was the custom for infant teachers to introduce pupils to previously unseen words (eg. on cards, or as a list at the beginning of a text). It was believed that pupils would benefit if they developed a knowledge of individual words ("sight vocabulary") before they were presented with these words in a particular text. Infant teachers tended to encourage children to aim for the accurate reading of every word and to this end used phonic schemes which were designed to help pupils to become aware of the possible ways of pronouncing various combinations of letters. Teachers also tended to prompt pupils by hinting at the sound of part of a word, or even by supplying the whole word, if the pupil were slower to pronounce it than the teacher wished. Goodman (1965) suggested that these methods were questionable (see Chapter Two, Section Five).

Guthrie (1973) tested his model of reading by using traditional psychological methods of research, in which he tested and compared the reading skills of several groups of children and then subjected the results to statistical analysis. The task involved the perception of, and response to, individual words, pseudo-words and parts of words.

Although Guthrie's research did not directly involve his subjects in reading passages for meaning, the conclusions which he drew from his results implied that Goodman's model was not universally applicable to the reading process.

These models are important for two reasons. Firstly, they are representative of differences in methodology. The psycho-linguistic approach (Goodman) concentrates on examining the responses of each individual reader to a meaningful passage of text. It is a form of case-study. The psychological approach (Guthrie) compares groups of readers as they respond to tasks which involve a limited number of skills which can be measured and statistically analysed.

Secondly, the two models present alternative interpretations as to the relative importance of basic word-recognition in the reading process. For the purpose of this study the term "basic word-recognition" means that the reader is able to pronounce, and/or provide a meaning to, a word which is not part of a connected text. This refers to a process which is not the same as normal "word-recognition," which usually occurs when reading words as part of connected texts.

Goodman's (1967) view was that the use of context facilitates the process of basic word-recognition and that linguistic skills are of paramount importance. Guthrie's (1973) view was that quick and accurate basic word-recognition is an essential step which enables readers to make use of their linguistic skills.

The author decided that it would aid his understanding as a remedial specialist if he were to examine the relative merits of these contrasting models. He produced a comparative analysis of the two models of reading, Goodman and Guthrie:

(1) by reviewing the articles in which they presented their models (see Chapters Two and Three);

(2) by reviewing a variety of written sources which seemed relevant to an appreciation of these two models (see Chapters Four and Five);

(3) by mentioning some aspects of reading which appeared to be lacking in the two models (see Chapter Six);

(4) by undertaking two pieces of research (see Chapters Seven, Eight and Nine); and

(5) by producing a general conclusion (see Chapter Ten).

2.0 Goodman's model of reading.

2.1 The psycho-linguistic nature of his model.

Goodman's model was first published in his article, "Reading: A Psycho-linguistic Guessing Game." (1967). It was reprinted by Gollasch (1982), who suggested that it was perhaps Goodman's most cited work. The article reprinted a paper which Goodman had presented to the American Educational Research Association, which represented his views after the first five years of his research. For the purposes of this thesis the words "Goodman's model" refer to the model presented at the end of that paper.

The articles in Gollasch's book indicate that for over a decade Goodman's (1967) model of reading remained essentially unchanged. This model presented the view that reading does not depend primarily on the accurate perception of texts, but on the skilful use of the linguistic knowledge which a reader is able to apply to texts.

Goodman's ideas challenged what he took to be the accepted view at that time - that reading is a precise process involving the exact perception of sequences of written symbols. He did not agree with the view that the reader accurately identifies letters, words, spelling patterns and large language units. His view was that reading is a selective process, by which he meant that the efficient reader is skilful in selecting the fewest, most productive cues necessary to produce guesses which are right first time. "Skill in reading involves not greater precision, but more accurate first guesses based on better sampling techniques, greater control over language structure, broadened experiences and increased conceptual development." (Goodman (1967), quoted in Gollasch (1982), page 39). It was for this reason that Goodman labelled reading as a "guessing game," and suggested that

linguistic elements were the most important aspect of reading.

2.2 The cycle of steps in his model.

At the end of his (1967) article Goodman provided an outline of his model of reading, having first commented that the steps do not necessarily take place in the sequential or stretched-out form shown in the list. He presented it as "my model of this psycholinguistic guessing game we call reading English."

1. The reader scans along a line of print from left to right and down the page, line by line.
2. He fixes at a point to permit eye focus. Some print will be central and in focus, some will be peripheral; perhaps his perceptual field is a flattened circle.
3. Now begins the selection process. He picks up graphic cues, guided by constraints set up through prior choices, his language knowledge, his cognitive styles, and strategies he has learned.
4. He forms a perceptual image using these cues and his anticipated cues. This image then is partly what he sees and partly what he expected to see.
5. Now he searches his memory for related syntactic, semantic, and phonological cues. This may lead to selection of more graphic cues and to reforming the perceptual image.
6. At this point, he makes a guess or tentative choice consistent with graphic cues. Semantic analysis leads to partial decoding as far as possible. This meaning is stored in short-term memory as he proceeds.
7. If no guess is possible, he checks the recalled perceptual input and tries again. If a guess is still not possible, he takes another look at the text to gather more graphic cues.
8. If he can make a decodable choice, he tests it for semantic and

grammatical acceptability in the context developed by prior choices and decoding.

9. If the tentative choice is not acceptable semantically or syntactically, then he regresses, scanning from right to left along the line and up the page to locate a point of semantic or syntactic inconsistency. When such a point is found, he starts over at that point. If no inconsistency can be identified, he reads on seeking some cue which will make it possible to reconcile the anomalous situation.
10. If the choice is acceptable, decoding is extended, meaning is assimilated with prior meaning, and prior meaning is accommodated, if necessary. Expectations are formed about input and meaning that lie ahead.
11. Then the cycle continues.

Goodman concluded by commenting that throughout the process there is constant use of long- and short-term memory.

The author suggests that the ten steps of the cycle could be summarised as follows, for the sake of simplicity:

1. Scanning.
2. Focussing.
3. Selection.
4. Perception.
5. Memory-search.
6. Initial Response.
7. Further Response (if necessary).
8. Monitoring.
9. Further Monitoring (if necessary).
10. Adoption, Adaptation and Expectation = Conclusion.

2.3 Cues and miscues in reading.

Goodman's model of reading developed as a response to his research into what appears to happen when children read texts. He developed a method of analysing children's responses to texts, which he entitled "Miscue Analysis." By 'miscue' Goodman meant that a child omitted to read a word aloud, or pronounced it in a non-standard way. This was similar to the method of using IRIs (Informal Reading Inventories) whereby teachers made notes on how children read texts aloud. Goodman's method of analysis differed from that of the IRIs, however, in so far that he suggested that each miscue could not necessarily be considered equivalent to another. The previous method of listening to children read had tended to assume that all miscues were equally wrong, for they were inaccurate responses to the text. Since Goodman considered that the search for meaning was the primary purpose of reading, he believed that it was possible for a child to read a text aloud in a non-standard way and still understand it adequately. Accuracy of oral response to each individual word was less important than global, holistic understanding.

Goodman (1973, in Gollasch, 1982) described his system of miscue analysis. He explained that a miscue was an actual observed response in oral reading which did not match the expected response, and claimed that this was like a window on to the reading process, since nothing that a reader does in reading is accidental. The procedure for undertaking miscue analysis was as follows:

1. An appropriate story was selected which was somewhat difficult for the pupil.
2. The material was prepared for recording on to tape.
3. The reader was tape-recorded while reading from the book, and the

researcher marked miscues on a copy of the text.

4. The subject then retold the story without interruption.
5. The researcher replayed the tape later in order to check miscues and finish noting them on the copy, and then coded them according to the analytic procedure used.
6. Finally the patterns of miscues were studied in order to produce information that could become the basis of specific instruction.

Goodman (1976, in Gollasch, 1982, pages 104-105) stated that he and his colleagues had produced a taxonomy for the analysis of oral reading miscues. Since taxonomy can mean the science or practice of classification (Collins Dictionary, 1979) it seems that Goodman wished to indicate that his miscue analysis involved the classification of miscues into groups in a systematic way. He presumably wished to make it clear that there was a contrast between his analytical system and the previous system of IRIs, in which the use of the word "inventory" had implied a list of equivalent items.

Goodman explained that each miscue needed to be examined by asking a number of questions about the relationship of the expected response to the observed response, and claimed that what then emerged was the pattern of how the cuing systems were used in continuous reading. Here is his list of questions:

1. Is the miscue self-corrected by the reader?
2. Is the reader's dialect involved in the miscue?
3. How much graphic similarity is there between the ER (Expected Response) and the OR (Observed Response)?
4. How much phonemic similarity is there?
5. Is the OR an allolog of the ER? 'Typing' and 'typewriting' are allologs of the same word. Contractions are also allologs.

6. Does the miscue produce a syntactically acceptable text?

7. Does the miscue produce a semantically acceptable text?

8. Does a grammatical retransformation result from the miscue?

9. If the miscue is syntactically acceptable, how much is syntax changed?

10. If the miscue is semantically acceptable, how much is meaning changed?

11. Is intonation involved in the miscue? In English changed intonation may reflect change in syntax, meaning or both.

12. Does the miscue involve the submorphemic language level?

13. Does the miscue involve the bound morpheme level?

14. Does the miscue involve the word or free morpheme level?

15. Does the miscue involve the phrase level?

16. Does the miscue involve the clause level?

17. What is the grammatical category of the OR?

18. What is the grammatical category of the ER?

19. What is the relationship between function of ER and OR?

20. What influence has the surrounding text (peripheral visual field) had on miscues?

21. What is the semantic relationship between ER and OR word substitutions?

2.4 Goodman's first research report.

According to Gollasch (1982), Goodman's research report (1965) was the first public statement of miscue analysis research. In this article Goodman defined reading as the active reconstruction of a message from written language, and stated that reading MUST involve some level of comprehension. He assumed that all reading behaviour is the result of cues and miscues which appear as the child interacts with written language. These cues included:

(a) cues within words (eg. word configuration),

(b) cues in the flow of language (eg. syntactical structures),

(c) cues external to language and the reader (eg. pictures), and

(d) cues within the reader (ie. his innate ability and general experience).

His subjects were 100 children in grades 1, 2 and 3 (ie. aged 6.0 - 9.0), who attended the same school in an industrial suburb of Detroit. Goodman (1965, page 640) explained his procedure as follows. "An assistant called each subject individually out of the classroom. The subject was given a word list for a story at about his grade level. If the child missed many words, he was given a list for an earlier story. If he missed few or none he was given a more advanced story. Each child eventually had a word list of comparable difficulty. The number of words which each child missed on the lists, then, was a controlled variable."

Goodman explained that the child next read aloud, from a previously unseen book, the story on which his word list was based. The assistant merely listened and made notes of the child's oral reading behaviour on work-sheets. Finally each subject was required to retell the story as best he could without previous warning. The reading and retelling

of the story were recorded on to tape. Goodman's article gives the impression that the reading of the lists was not recorded on to tape.

Goodman found that the children were able to read many words in stories which they could not recognise in lists (see Table 1). He interpreted this as an indication that context could be an important element in word-recognition, and this supported his view that cues could be supplied by the child's knowledge and utilisation of language. His statistical results showed that as children grew older they became increasingly efficient in using cue systems that were beyond the use of print-to-sound correspondences.

Goodman also found that as children grew older they used word-attack skills with increased frequency, though not necessarily with increased efficiency. He preferred to define "word-attack skills" as "responses to cue systems within words." Younger children were inclined to omit unknown words, whereas older children tended to produce substitutions in their attempt to pronounce the word. None of the children consistently missed a word in the story which they had read correctly in a list, but they often made an incorrect substitution in the reading of the story in individual occurrences of known words. As the children grew older they made many more "one-time substitutions" per line read.

Goodman suggested that three possible causes of these one-time substitutions might be:

1. the over-use of 'cues within words' to the exclusion of other cues,
2. miscuing by book language which differs from the language as the child knows it, and
3. ineffective use of language cues.

Average Words Missed in List and in Story

	List	Also Missed in Story		
	Average	Average	Percent	Ratio
Grade 1	9.5	3.4	38%	2.8: 1
Grade 2	20.1	5.1	25%	3.9: 1
Grade 3	18.8	3.4	18%	5.5: 1

Table 1. Goodman's (1965) Table 1, showing the average number of words missed (omitted or mis-read) by subjects when reading a list and its related story.

Goodman also found that virtually every regression made by the children in his study was for the purpose of correcting previous errors in reading. He suggested that, contrary to what he believed to be the popular view at that time, regressions themselves were not errors, but were attempts to correct errors which had been made previously.

As a group his subjects made an approximately equal number of single-word regressions and phrase regressions. He considered both kinds of regression to be self-corrections which play a vital role in children's learning to read, and he suggested two reasons why errors went uncorrected:

1. The error made no difference to the meaning of the passage.
2. The reader was relying so heavily on analytical techniques, using only cues within words, that he had lost the meaning altogether.

2.5 Goodman's conclusions in his first research report.

Goodman's (1965) article was important since its results led him to conclude that some then common practices in the teaching of reading were questionable. He suggested:

1. that introducing new words out of context before new stories were introduced to children appeared neither necessary nor desirable.
2. that it seemed unnecessary and undesirable to prompt or correct children when they were reading aloud, since their knowledge of language led them to correct themselves.
3. that regressions (ie. looking back and re-reading part of a text) were the means by which a child not only corrects him-herself, but also learns, and that it was therefore unfortunate that teachers discouraged such regressions.
4. that the effectiveness of teaching phonic skills to groups of pupils was highly questionable in view of the extreme diversity of the difficulties displayed by the children in his study.
5. that since the children in his study found it more difficult to recognise isolated words than to read them in stories, it would be better to abandon the previous emphasis on individual words when teaching reading and to stress the importance of language.

His views are of direct relevance to teachers of reading, because they question the effectiveness of what appear to be traditional and popular methods of instruction. If Goodman is correct, then those who help others to learn to read need to modify their attitudes and techniques by turning their attention away from a stress on phonic skills and towards the psycholinguistic aspects of reading. Goodman's conclusions have been investigated by various researchers, and Guthrie is one of those who have provided alternative interpretations of the

reading process.

3.0 Guthrie's model of reading.

3.1 A comparison of the Assembly Model and the System Model.

Guthrie (1973) presented two models of reading which he had tested and compared. The Assembly Model portrayed reading as requiring an assembly of independent components, as opposed to the System Model which suggested that reading requires the presence of components which are not identical in function or strength, but that are inter-dependent. He considered that these two models had been implicit in much of the previous research into the nature of reading (see Fig. 1).

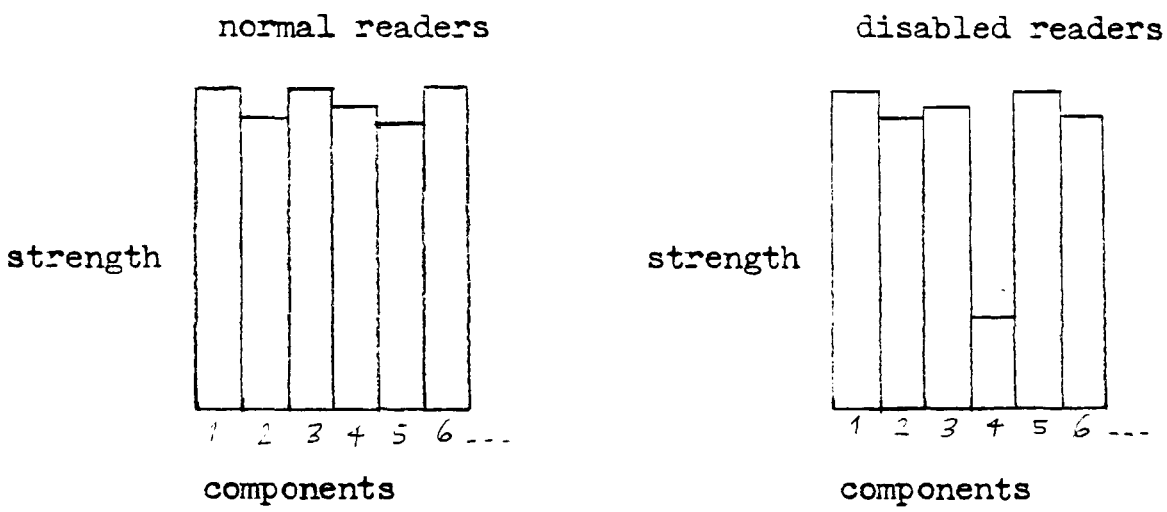
In the Assembly Model the components are independent since they may exist in high or low degrees of strength for a given individual. Guthrie considered that this model was widely used for the study of cognitive processes in "disabled readers." Such research was based on the assumption that children develop certain skills independently and that one or more of these skills may be weaker than the others. This approach assumes that such sub-skills as auditory discrimination, visual discrimination, auditory memory, visual memory, and the memory for word meaning are independent skills which can be isolated. As examples he quoted Johnson and Myklebust (1967) as making implicit use of the Assembly Model in their approach, which maintained that a defect in any one of many processes might cause dyslexia, and Katz and Deutsch (1963), who claimed that the inability to shift one's attention from auditory to visual stimuli is the perceptual process which accounts for the reduced proficiency of the poor reader.

In contrast to this the System Model supposes that such sub-skills in normal readers are inter-related and that the development of one skill depends on the development of other skills. Guthrie suggested that Goodman was a proponent of the System Model, and quoted

(A) The Assembly Model.

The components are independent.

A specific deficit in one component leads to impairment of reading.



(B) The System Model.

The components are inter-dependent.

Components do not increase in strength more rapidly than the component with the slowest growth rate.

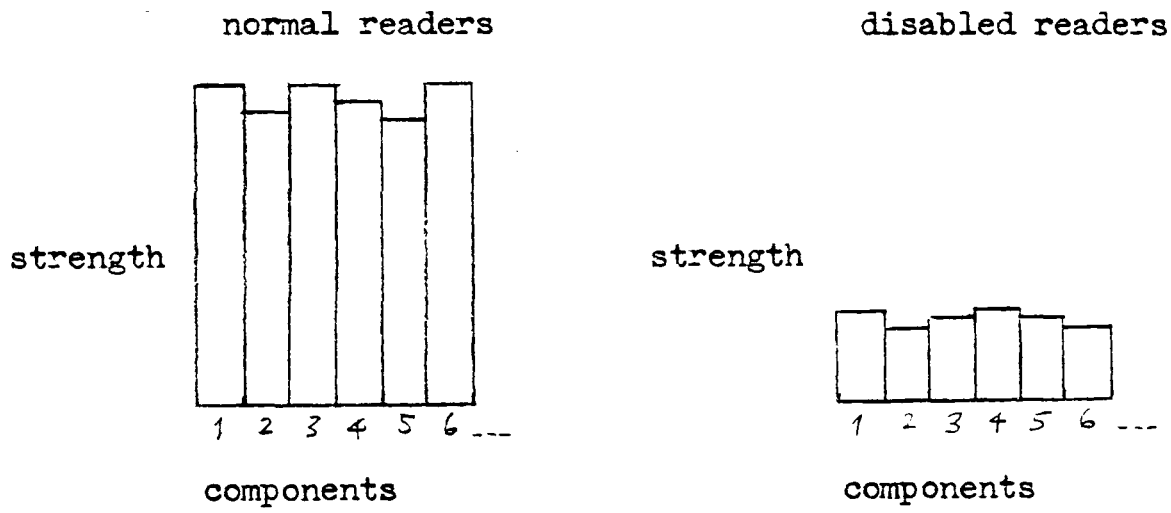


Figure 1. A representation of Guthrie's (1973) models of reading and reading disability.

Goodman's (1967) model, summarizing it in five steps in place of the original ten. According to this, reading requires the individual to:

(a) sample visual cues from the array on the printed page;

(b) form a perceptual image;

(c) search memory for psycholinguistic cues related to the perceptual image;

(d) convert the perceptual image to a unit of new meaning; and

(e) integrate the new meaning with previously established meanings.

Guthrie pointed out that since the temporal sequence during reading consists of steps (a) to (e), the occurrence of (e) depends on the occurrence of (a). The interdependencies among the processes would prevent a majority of them from developing to normal levels if one or two of the processes were severely deficient.

3.2 Guthrie's study.

Guthrie examined these two models with respect to the development of phoneme-grapheme association skills in both normal and "disabled" readers. His hypothesis was as follows:

If the sub-skills evinced by normal readers were to exhibit a low inter-correlation, it would tend to confirm the assembly model, whereas if the sub-skills in normal readers were highly inter-correlated, this would tend to confirm the system model.

His subjects were 48 readers from metropolitan Baltimore. There were 19 "disabled readers," 19 young normal readers and 10 older normal readers. The disabled readers were matched with the older normal readers for age and intelligence, and with the younger normal readers for reading level and intelligence (see Table 2).

All three groups undertook the 15 sub-tests of the Kennedy Institute Phonics Test. Guthrie (1973) described this as a criterion-referenced test that measured reading sub-skills, and explained each sub-test in some detail. The 15 sub-tests were as follows:

1. Word reading in context.
2. Word reading when flashed for 0.5 seconds.
3. Word reading when untimed.
4. Nonsense word production.
5. Long vowel production.
6. Short vowel production.
7. Consonant cluster production.
8. Letter-sounds production.
9. Letter naming.
10. Nonsense-word recognition.
11. Consonant cluster recognition.

AGE, IQ, AND READING LEVEL OF SUBJECTS

Characteristic	Disabled (boys = 17; girls = 2)	Normal young (boys = 10; girls = 9	Normal old (boys = 5; girls = 5)
Chronological age			
$\overline{X}$	9.17	7.00	8.61
SD	1.24	.48	.32
Intelligence quotient			
$\overline{X}$	104.48	105.36	106.00
SD	12.53	11.14	7.66
Reading comprehension			
$\overline{X}$	1.80[a]	1.91[a]	4.20[b]
SD	.52	.57	.77
Reading Vocabulary			
$\overline{X}$	2.07[a]	2.21[a]	
SD	.73	.83	

[a] Grade equivalent of the Gates-MacGinitie, Primary A, Form 1.

[b] Grade equivalent of the Gates-MacGinitie, Primary C, Form 1.

Table 2. Guthrie's (1973) Table 1, giving the Age, IQ and Reading Level of his subjects.

12. Initial letter-sound recognition.

13. Final letter-sound recognition.

14. Auditory blending.

15. Syllabication.

Sub-test intercorrelations were computed on the scores of the 19 young normal and 19 disabled readers. Guthrie explained that he had chosen to compare only 8 of the original 15 sub-tests, because these 8 sub-tests were highly reliable and provided a cogent basis for the evaluation of models of sub-skills. The first five sub-tests were considered to be tests of production skills; the other three sub-tests were considered to be tests of recognition skills (see Table 3).

Guthrie found that the intercorrelation among sub-tests for the young normal readers was high (see Table 3A). The table has been divided into three sections. The section on the left side of the matrix contains the intercorrelations among those sub-tests which have been defined as production tests. In 9 out of 10 cases these correlations exceed the .01 level, with the correlations ranging from .49 to .94 indicating uniformly high correlations. The lower right section of the matrix indicates the interrelations among the recognition sub-tests. These are significant beyond the .01 level in all three cases.

The disabled readers exhibited a different pattern of results from the normal readers (see Table 3B). Guthrie (1973, page 15) stated that "In the production tests there are only 4 correlations of the total group of 10 that are significant at beyond the .01 level. For this group of poor readers there was little relation among the production sub-tests, although the relation was extremely high for normal readers. The recognition sub-tests intercorrelated at beyond the .01 level for

(A) Guthrie's Table 4: CORRELATIONS AMONG EIGHT SUBTESTS OF THE KENNEDY INSTITUTE PHONICS TEST (KIPT) FOR YOUNG NORMAL READERS

Subtest	NP	LVP	SVP	CCP	SLP	NR	CCR	ILR
Nonsense-word production (NP)		.78*	.87*	.94*	.53*	.84*	.72*	.66*
Long-vowel production (LVP)			.94*	.83*	.47	.85*	.48	.45
Short-vowel production (SVP)				.90*	.56*	.91*	.57*	.44
Consonant-cluster production (CCP)					.60*	.83*	.69*	.57*
Single-letter production (SLP)						.56*	.59*	.57*
Nonsense-word recognition(NR)							.62*	.55*
Consonant-cluster recognition(CCR)								.82*
Initial-letter recognition (ILR)								

* $p < .01$

(B) Guthrie's Table 5: CORRELATIONS AMONG EIGHT SUBTESTS OF THE KENNEDY INSTITUTE PHONICS TEST (KIPT) FOR DISABLED READERS

Subtest	NP	LVP	SVP	CCP	SLP	NR	CCR	ILR
Nonsense-word production (NP)	.50	.85*	.69*	.37		.68*	.55*	.52*
Long-vowel production (LVP)		.52*	.34	.18		.24	.24	.26
Short-vowel production (SVP)			.66*	.40		.60*	.52*	.45
Consonant-cluster production (CCP)				.49		.66*	.63*	.74*
Single-letter production (SLP)						.45*	.67*	.81*
Nonsense-word recognition (NR)							.69*	.66*
Consonant-cluster recognition (CCR)								.79*
Initial-letter recognition (ILR)								

* $p < .01$

Table 3. Guthrie's (1973) Tables 4 and 5, showing correlations among eight subtests of the Kennedy Institute Phonics Test, (A) for young normal readers, and (B) for disabled readers.

disabled readers as they did for normal readers. One critical difference between normal and disabled readers is that the production skills are more highly interrelated for normal than disabled readers."

Guthrie's findings indicated that not only were the disabled readers inferior to normal readers matched with them for age, but that the disabled readers were nearly identical to normal readers matched with them for reading-level, who were about two years younger. It seemed that none of the sub-skills had developed to normal levels of strength in the group of disabled readers. There was a high correlation among the sub-skills of normal readers, which thus supported the System Model of reading (see Table 3A). The sub-skills were not highly correlated in the disabled readers, which therefore supported the Assembly Model (see Table 3B).

Guthrie concluded that the various phoneme-grapheme association skills are distinct components that are highly integrated in normal readers, but which remain independent and unique in disabled readers. His research study therefore indicated that reading appears to be a holistic process only when such sub-skills have been mastered.

3.3 The relationship of Guthrie's model to Goodman's.

It can be suggested that Guthrie's model of reading really consists of his synthesis of two contrasting theories as represented by the Assembly Model and the System Model. In so far that Guthrie's System Model reflects Goodman's views it can be suggested that Guthrie's study tested, and to some extent supported, Goodman's psycho-linguistic model. The implications of Guthrie's work are, however, that Goodman's model is not sufficiently flexible to be applied to all readers. Goodman claimed that, since all readers use their linguistic skills as the primary strategy in reading, there is little difference between the approach adopted by beginning readers and that of mature readers. Guthrie, in contrast, suggested that some disabled readers have failed to master grapheme-phoneme association skills and so cannot approach the task of reading in the same way as normal readers, who have been able to integrate such sub-skills with their language skills.

Guthrie's (1973) research indicated that the disabled readers were similar in skill to young normal readers, and so his model appears to equate disabled readers with immature readers, while his older normal readers could be considered equivalent to Goodman's mature readers. In effect Guthrie's study supported Goodman's psycho-linguistic model of reading, but only for one group of readers - those who are good at reading. It did not corroborate Goodman's theories as a universal description of the reading process.

Various authors have presented views which tend to support either Goodman or Guthrie. Their views are presented in the next two chapters.

4.0 An evaluation of Goodman's model.

4.1 Similar views to those of Goodman.

(a) Some authors have provided support for Goodman's views in so far that they indicate the important part which linguistic elements play in the comprehension of texts.

Smith (1978a) presented similar psycho-linguistic views to those of Goodman. He explained that short-term visual memory is limited and that there is a need to "trade off" visual and non-visual information when reading. The more that a reader can utilise non-visual information, such as linguistic knowledge, the less he-she will need to devote attention to analysing visual stimuli. For this reason, as much visual information as a person needs to identify a single letter in isolation will permit that person to identify an entire word in a meaningful context. Smith suggested that readers are subject to "tunnel vision" in so far that research has shown that it takes the brain one second to identify 5 random letters from a single eye-fixation. Since 60 words per minute is too slow to permit reading with comprehension, the reader needs to find a way to speed up the process. He-she can do this by scanning more quickly, looking less accurately at individual letters, and using previous knowledge of the English language to help fill in the mental gaps left by this sampling of the visual cues.

Smith claimed that the recognition of individual words is not necessary for the comprehension of text and that, on the contrary, some form of previous comprehension is often necessary if the reader wants to identify individual words. He pointed out that, like all other languages, written English involves the use of redundancy. This means that there is more than one source of information, eg.:

1. visual (ie. the printed signs of the text itself);
2. orthographic (ie. the reader's knowledge of spelling patterns);
3. syntactic (ie. the reader's knowledge of sentence structure); and
4. semantic (ie. the contextual information of the text).

Smith believed that if the brain is over-loaded with visual information by concentrating too much on recognising individual letters and words, the reader will be unable to make use of other redundancy-cues of a non-visual kind. The result will be "tunnel vision." These views support those of Goodman, for he, too, suggested that it is more important for a reader to use holistic, linguistic skills when reading than to concentrate his-her attention on recognising individual words.

Niles (1975-76) examined one aspect of Smith's (1971) description of the reading process related to the redundancy available in English orthography. Niles' study involved 45 subjects: 15 were in the 1st grade, 15 were in the 3rd grade and 15 were in the 5th grade. He examined three variables related to the printed aspects of the text:

1. sequential dependency (ie. the fact that some letters come together in English and others do not);
2. discriminability (ie. the physical characteristics provided by the featural information of the letters); and
3. word-length.

He found that the readers were flexible in their utilisation of cue sources. Whenever one cue source was at a minimum, it became evident that the reader was dependent on another cue source. His research provided support for the views of Goodman (1967) and Smith (1971): the reader predicts his-her way through written language by utilising the implicit knowledge which he-she brings to the task, and this includes

knowledge of English orthography, which provides one set of redundancy cues.

Horning (1979) also considered the concept of redundancy. She quoted Smith (1971) as suggesting that a fluent and skilful reader is one who makes maximum use of redundancy to get meaning from print. She explained that Goodman's theory of reading also rested to a large extent on the assumption that the reader makes use of redundancy and that the ability to make use of redundancy-cues was crucial to proficient reading.

Recht (1976) discussed the self-correction process in reading. She pointed out that most of the standardised Informal Reading Inventories had treated regressions as oral reading errors. She quoted from her unpublished research study of 1973, in which she used 47 subjects from grades 2, 3, 4 and 6 (ie. about 12 at each level). She found that proficient readers demonstrated well-developed correction strategies, made comparatively few miscues and successfully corrected a large percentage of miscues which they did make. Those readers who comprehended the text used the correction strategy consistently, and this suggested that they were aware of miscues which distorted structure or meaning. She suggested that self-correction is a positive indicator that the reader is comprehending what is being read, and her article therefore provided support for Goodman's view that regressions should not be treated as errors.

Kolers (1970) mentioned that one of his experiments had indicated that the more of a grammatical structure one grasps, the less one is likely to make an error when reading. He suggested that the grammatical complexity of a text is an important factor in comprehension.

Fowler (1974) suggested that a sentence is more than just the sum of the meaning of the lexical parts within the sentence. The reader needs to re-create the meaning of a sentence,

(a) by using his-her knowledge of how the words are related to all the other words in the language, and

(b) by considering their interaction within the sentence.

Many sentences imply more than they state, and even an apparently simple sentence may be ambiguous.

Clay (1968) undertook a syntactic analysis of reading errors. Her subjects were 100 children aged 5, whom she saw once per week over a period of time. She analysed the substitution errors which they made and found that self-correction occurred more frequently in some linguistic classes than others, eg. errors involving nouns were corrected less often than those which involved pronouns. She suggested that there was evidence that the error behaviour of the children was guided by the syntactic framework of the sentences being read, rather than by the phoneme-grapheme relationships in the individual words.

(b) Some authors have attempted to make Goodman's work more easily comprehensible.

Gollasch (1982) collected together fifteen of Goodman's articles, because he considered that Goodman's insights had made significant contributions to our understanding of the reading process. He suggested that a number of principles and attitudes underlying Goodman's work set it apart from most traditional research, and mentioned the following features:

1. The utilization of a broad range of scientific knowledge from various disciplines in the formulation of a theory of reading.

2. The utilization of descriptive research that observes what the reader is doing in as natural a setting as possible.
3. The insistence on integrating research and theory. According to Gollasch, Goodman sees theory NOT as being simply the end product of research, but the operational base from which research evolves. The research then in turn adds to and modifies the theory.
4. The use of whole stories, in an attempt to eliminate some of the problems of using short or fragmented text.
5. Detailed and complex data recording which allows a broad, holistic view of the on-going process in context, as well as a flexibility of focus.
6. A positive view of all children as competent language learners that focusses on their strengths and accomplishments rather than their weaknesses and failures.

Gollasch commented that these principles and attitudes were positive factors that had contributed to the relevance and accuracy of Goodman's research findings.

Cambourne (1977) provided a sympathetic consideration of Goodman's views. He concluded that Goodman's work was not suited to an evaluative strategy which seeks to validate or invalidate hypotheses produced from a theoretical position by testing them against other empirical research findings. Goodman's approach was naturalistic in so far that he claimed to study children while they read books within the school environment. His approach was not a laboratory-centred, experimental method in which the researcher engages in a manipulative study of cause and effect within a specially created situation.

Cambourne pointed out that although Goodman's model rested on the assumption that written text and oral speech are merely alternative

forms of the same language process, some researchers had disagreed with him and had asserted that written text is a secondary, more abstract representation of oral speech. According to Cambourne, Goodman's assumption led him to believe:

(a) that children should be able to learn to read quite easily because by the age of 5 or 6 they have acquired basic language skills; and

(b) that there was a direct link between the reader's perception of printed words and his-her semantic understanding. He strongly de-emphasized the role of decoding from print to sound.

Cambourne explained that this brought the Goodman model into conflict with other theories of the process of beginning reading, since it:

(a) denied the idea of distinct stages in reading development; and

(b) denied the idea of decoding to speech or speech sounds.

Cambourne pointed out that Goodman's model of reading was relevant not only to researchers but to teachers. If accepted by teachers, many of Goodman's ideas would have a profound effect on methods of teaching and therefore ultimately on children. Cambourne suggested that so far as reading-researchers and teachers were concerned the major controversial aspects of Goodman's model were as follows:

1. De-emphasis on decoding to speech or sound as a necessary intermediate step between grapheme and comprehension of meaning;
2. Denial of the notion that a hierarchy of sub-skills is a necessary aspect of beginning instruction;
3. Support for the encouragement of making the fullest use of the internalized knowledge that the speakers of a language have; and
4. De-emphasis on the teaching of phonics in any form and a denial that such analysis is either a useful or necessary method of

getting meaning.

Cambourne suggested that we can evaluate Goodman's work in two ways:

1. We can study the internal consistency and validity of the generation process which he has employed, eg. Are his categories clear? How fine are the distinctions?
2. We can consider his two critical assumptions that the written mode of language is independent of speech, and that oral reading provides a window on to the process of silent reading.

Cambourne's article may have educational implications which go beyond his immediate consideration of the controversy surrounding Goodman's model of reading. The four controversial items listed by Cambourne seem to indicate new roles for both teachers and pupils, in so far that Goodman's model implies that children can teach themselves to read and do not need the traditional system in which teachers control their pupils' rate of progress by using graded books and phonic schemes. Guthrie's model, which presents phonic sub-skills as the primary factor in becoming a skilled reader, may encourage the view that a teacher needs to take control of the learning situation. These educational implications are considered further in Chapter Ten.

4.2 Alternative views to those of Goodman.

(a) Some authors have presented views which, though similar to those of Goodman, provide alternative ideas.

Clark and Clark (1977) explained that while children are acquiring their knowledge of spoken language they use context to help them learn the meanings of previously unknown words. They use their existing knowledge together with contextual cues to form hypotheses about what new words might mean. Goodman believed that children use a similar approach when reading and it was for this reason that he suggested that even beginning readers should be able to read easily, because they can utilise their knowledge of language. Clark and Clark, however, were of the opinion that it can take years for children's understanding of spoken words to coincide with adult understanding. This implies that young readers cannot necessarily rely on their linguistic skills to the same extent as adult readers can.

Fowler (1974) pointed out that any national language includes many different styles and registers of speech within it, such as baby-talk, women's language, the language of television advertising, and pub conversation. Native speakers of a language need to be able to appreciate different styles of speaking, and the problem for the maturing child is to learn to be flexible in his-her response to switches in style. Fowler stated that linguistic capabilities differ from one individual to another. There are subtle variations which result partly from general experience and partly from such factors as intelligence, memory and educational experience. He quoted Carol Chomsky's (1969) work in which she had speculated on the possibility that some speakers never attain certain parts of linguistic structure.

Carol Chomsky's (1969) research provided some evidence for the idea that children develop their linguistic abilities at differing rates and cannot be considered equivalent to adults. She pointed out that for a word such as 'promise' a child seems to acquire semantic knowledge of its meaning first and later progresses to a knowledge of its syntactical use. She found that some children aged 5.0 to 6.0 years confused the following two constructions which appear to be similar:

(a) John promised Mary to shovel the driveway.

(b) John told Mary to shovel the driveway.

Carol Chomsky explained that a native speaker knows the types of syntactic structure that may be associated with each verb, and that the total set of constructions permitted by a verb is part of the information that a speaker needs to learn.

She studied children's acquisition of four syntactic structures by testing 40 children between the ages of 5 and 10 at elementary schools in the Boston area. She found that active acquisition of syntactic knowledge was taking place up to the age of 9.0 and perhaps even beyond. This contradicted the commonly held view that a child has mastered the structures of his native language by the time he reaches the age of six.

Although Slobin's (1966) research led him to state that the grammatical system appears to be well developed in a child by the age of six, he suggested that the more simple aspects of the grammatical and semantic systems are stabilised at an earlier age than the more complex. He thought it reasonable to conclude that linguistic learning continues throughout childhood. After the child is able to speak grammatically, its learning involves increasing skill in manipulating

the more complex and subtle aspects of the system.

Clay (1969) quoted Festinger's (1958) work, which had discussed the concepts of "cognitive dissonance" and "perceptual dissonance" in the reading process. His view had been that the reader needs to be aware of any lack of agreement (ie. dissonance) between what he expects to read and his actual response to the print before him. Clay repeated the idea that the reader must not only predict what is going to come but should check to ascertain that his responses have been correct. She suggested that in order to predict and check successfully a mature reader will use cues from dimensions such as phonology, morphology, syntax and graphic aspects of a text. The beginning reader has limited knowledge of these dimensions. Clay's view differed from that of Goodman in so far that she considered beginning readers and mature readers to be different in their ability to use a variety of cues to help them predict their way through texts.

(b) <u>The following authors have queried Goodman's views more strongly</u>.

Mosenthal (1976) attempted to validate the idea that reading competence uses the same linguistic competence that the auditory processing of language uses. His research findings suggested to him that although silent reading and auditory processing employ the same comprehension competence, reading aloud does not.

A study by Lassen, Ingvar and Skinhøj (1978) revealed that reading silently and reading aloud involved different patterns of activity in the cerebral cortex. This suggests that reading silently and reading aloud are not neurologically equivalent.

These two articles seem to indicate that it is necessary to reconsider Goodman's view that oral reading provides a window on to the reading process. There may be processes in reading which do not

become evident when readers respond to texts orally. In that case, children's oral reading may provide only partial information as to the nature of the reading process. Miscue analysis may provide only one window among several.

Blanchard (1979) made several comments concerning Goodman's (1965) research study, which had been part of the basis for his (1967) model of reading:

1. Blanchard suggested that Goodman had drawn a number of causal implications from descriptive statistics. He had provided insufficient methodological information of the study to enable a robust verification of his findings to be made.
2. Blanchard commented that the study's only measure of reading or linguistic achievement had been oral reading fluency. There had been no other measures of achievement, such as comprehension tests, which might have provided a clearer picture of the effects of introducing new words in isolation rather than in context.
3. There had been no control groups or other training groups besides those which received words-in-isolation training. No groups had received training on new words in context. Blanchard therefore concluded that Goodman had failed to support his most widely accepted implication: that subjects would "learn" better as a result of encountering new words in context. Blanchard implied that Goodman had made this assumption without sufficient research evidence.

Newman (1979) disagreed with Goodman and Smith in several particulars. He commented that they had failed to high-light the significance of:

1. Those misreadings which result in the unmeaningful distortion of

text. He asked why many children fail to correct mistakes in reading which they would almost certainly correct when in a speaking or listening situation.

2. The difficulty which readers face when attempting to determine the meanings of new words in context. Newman stated that a review of the literature indicated that good as well as poor readers have problems in identifying words from their context.
3. The idea that the inability to read accurately could result from a limited knowledge of phonics. He suggested that phonic knowledge is essential under certain conditions, because there are basic differences between the perception and comprehension of speech and reading.
4. The problem of snail-pace reading, in which the reader proceeds word by word, which results in inadequate comprehension.

Newman claimed that Goodman and Smith had not fully accounted for these four types of common reading behaviour.

Thompson (1984) provided a review of the literature concerning self-corrections. He commented on the idea that when readers correct oral miscues this reflects efficient reading. He suggested an alternative interpretation: self-corrections to some extent reflect incomplete processing that occurs with premature responding. He claimed that on the evidence available there was no adequate empirical support for the claim that high progress readers are more discerning than low progress readers in the quality of the errors that they selectively self-correct. Nor was there adequate support for recommending that teachers should try to increase the incidence of a child's self-corrections.

Wixson (1979) provided a review of miscue analysis. She stated that the information reported up until that time suggested to her that

both the assumptions underlying miscue analysis and the procedures used to analyse miscues required additional empirical explication and validation.

There was evidence that miscue patterns vary as the result of such factors as:

1. the instructional method received by the reader;
2. the reader's background;
3. the reader's skills;
4. the reader's purpose for reading; and
5. the specific nature of the reading material.

Wixson suggested that there were at least two possible implications of this observation:

1. Miscue patterns as identified by standard miscue analysis procedures did not provide an accurate reflection of the reading process.
2. Alternatively it was possible that the reading process is variable and that it therefore produces variable miscue patterns.

The articles in this section are representative of authors who have provided alternative views to those of Goodman. Their views indicate that it is desirable to reconsider:

1. Whether young readers and mature readers may be considered equivalent in their ability to use linguistic skills when reading;
2. Whether reading aloud may be considered equivalent to silent reading;
3. Whether Goodman's descriptive research methods were adequate to sustain the conclusions which he drew;
4. Whether Goodman underestimated the difficulties involved in reading new words in context;

5. Whether Goodman underestimated the value of using phonics as a strategy which aids the reader to read new words in context; and
6. Whether Goodman's model adequately helps to explain the behaviour of those readers who read at a slow, word-by-word pace.

Guthrie's (1973) model of reading is particularly concerned with item 5. He suggested that disabled readers are equivalent to young beginning readers in so far that they have similar weaknesses in their ability to utilise phonic cues (ie. grapheme-phoneme associations) when reading, and that mature readers are able to integrate their use of phonic cues effectively with their other reading strategies. Various authors have provided similar views to those of Guthrie, and a selection of their work is presented in the next section.

5.0 An evaluation of Guthrie's model.

5.1 Similar views to those of Guthrie.

(a) Some authors have presented evidence to suggest that the ability to read well is closely related to the ability to decode easily from print to sound.

Clark (1976) studied 32 young children who were already reading fluently and with understanding when they started school in Scotland at about the age of five. She found that all these children showed the necessary decoding skill to tackle, without contextual cues to help them, many words which they were unlikely to have met in print or even in their spoken language.

Golinkoff (1975-76) reviewed literature concerning comprehension processes in readers who reveal good and poor comprehension of texts. She explained that various pieces of research evidence suggested that poor decoding skills may hamper the process whereby the reader mentally organises text into units larger than the single word, and that poor comprehenders may possess inadequate decoding skills. She quoted Golinkoff and Rosinski's (1976) research which indicated that the good comprehender seems to be capable of rapid and accurate basic word-recognition.

Steinheiser and Guthrie (1977) used the experimental method which involves the analysis of response latencies. (A response latency is the period of time taken by a subject to respond to a stimulus). They obtained response latencies in word-matching and sentence completion tasks from disabled readers, normal readers matched with the disabled readers for age, and normal readers matched with the disabled readers for reading-level.

The group of disabled readers was significantly slower than the

normal group on both tasks and did not differ from the young normal group. None of the groups required more time for completing sentences than for matching words, which indicated that the semantic processing of these sentences was highly automatised. The disabled and younger groups were slower on words that looked similar than on dissimilar words, whereas the older subjects were the same on both types of word. None of the groups of children seemed to require extra time for semantic processing beyond that needed for perceptual and decoding operations. Steinheiser and Guthrie suggested that this indicated that perceptual and decoding processes are learned by normal readers but are a primary source of deficiency in disabled readers.

Shankweiler and Liberman (1972) suggested that a basic question was whether the major barrier to reading acquisition is in reading connected text or whether it may be instead in dealing with individual words and their components. Their research studies investigated this.

The subjects in their first experiment were 20 boys from grade 2, 18 pupils from grade 3, a complete class of 30 boys and girls, and 20 boys from grade 4. The subjects were given two tasks: (a) they were required to read paragraphs which were graded so as to vary in level of difficulty (the Gray Oral Reading Test), and (b) they were required to read two lists of words. Shankweiler and Liberman found that there was a moderate to high relationship between errors on the word lists and performance on the Gray paragraphs.

The correlations in their first experiment suggested to them that the child may encounter his major difficulty at the level of the word: his reading of connected text tends to be only as good or as poor as his reading of individual words.

The problems of the beginning reader appeared to have more to do

with the synthesis of syllables than with the scanning of larger units of connected text. Shankweiler and Liberman commented that their work provided results which were in agreement with Katz and Wicklund (1971): good and poor readers among young children do not differ in the rates at which they scan words but in their ability to cope with individual words and syllables.

Shankweiler and Liberman suggested that the slow rate of reading individual words might contribute, as much as inaccuracy, to poor performance when reading paragraphs. They then suggested that this could be explained by the rapid temporal decay in primary memory. If it takes too long to read a given word, the preceding words will have been forgotten before a phrase or sentence has been completed.

A further experiment by Shankweiler and Liberman (1972) compared their subjects' responses to spoken and written words. The children were required to repeat words from a word list on one occasion and read the list aloud on another day. Shankweiler and Liberman found that for the listening task their subjects made more errors involving consonants than vowels; for the reading task their subjects made more errors involving vowels than consonants. This seemed to indicate that mis-hearing differs from mis-reading in certain respects. They concluded from these two studies that the word <u>and its components</u> are of primary importance in the reading process. These components may be syllables, or smaller units such as letter combinations which represent vowel sounds (eg. ee, ea, oo, ou).

Shankweiler and Liberman therefore claimed that the perception of "speech by reading" has problems which are separate and distinct from the problems of perceiving speech by ear.

(b) Some authors have suggested that it is necessary for readers to be able to process printed material letter by letter.

Gough (1972) explained that research studies by Tinker (1958) and Sperling (1960) had shown that the recognition of individual letters can be very rapid. He presented a model of reading in which he suggested that readers need to be aware of all the letters which are scanned when reading a sentence, because of the limitations of what he called Primary Memory (ie. a small-capacity mental storage system, where 4 - 5 verbal items are maintained for a matter of seconds).

Gough (1972, page 354) stated that, "If it takes too long to read a given word, the content of the immediately preceding words will have been lost from the Primary Memory and comprehension will be prevented. If the word in question is read aloud, it will necessarily be read as a citation form, and the child's oral reading will sound like a list just because he is, in fact, reading a list. To prevent this, the child who would understand must try to read rapidly, and if he cannot quickly identify a word, he must guess...A guess may be a good thing, for it may preserve the integrity of sentence comprehension. But rather than being a sign of normal reading, it indicates that the child did not decode the word in question rapidly enough to read normally. The good reader need not guess: the bad should not."

This theory seems to be supported by Allington's (1978a) study, in which it was concluded that weak readers appear to need their linguistic skills as an aid to word recognition, and therefore do not have sufficient attention available for using their linguistic skills as an aid to fluent, meaningful reading (see Chapter 7.4).

Gough believed that in order to identify words quickly and accurately, it was necessary to be aware of the individual letters in

each word. He concluded (1972, page 354), "In the model I have outlined, the Reader is not a guesser. From the outside he appears to go from print to meaning as if by magic. But I have contended that this is an illusion, that he really plods through the sentence, letter by letter, word by word."

Baron and Strawson (1976) undertook an experiment which compared the time taken by subjects to read three different kinds of stimuli:

1. regular words, which followed the "rules" of English orthography;
2. exception words, which broke those rules; and
3. nonsense words, which could only be pronounced according to the rules, since they were not genuine words.

Their 30 subjects were students at the University of Pennsylvania. Baron and Strawson found that the subjects read the regular words more quickly than both the nonsense words and the exception words. Their analysis led them to suggest that adult readers continue to use spelling-sound correspondence rules (ie. grapheme-phoneme associations) when reading a word, despite previous learning of the association between the total visual impact of the word and its entire pronunciation.

(c) Some authors have argued that basic word-recognition needs to be quick, accurate and automatic.

LaBerge and Samuels (1974) stated that they viewed reading acquisition as a series of skills. They pointed out that during the execution of a complex skill, it is necessary to co-ordinate many component processes within a very short period of time. If each component process requires attention, performance of the complex skill will be impossible because the capacity of attention will be exceeded. A complex skill can only be performed successfully if enough of the

components can be processed automatically.

They suggested that various sub-skills in the reading process need to be performed automatically so that sufficient attention can be available for higher mental processes. They believed that, although it is possible for a child to learn to distinguish letters accurately after relatively little experience of them, letter recognition nevertheless involves a considerable amount of attention; a child must learn to recognise letters automatically if he is to acquire new skills which involve combinations of these letters. At each level of processing, the reader needs to achieve more than merely accurate responses: the responses must be automatic, so that sufficient attention is available for further, higher levels of processing.

They agreed with most practitioners involved in skill-learning that practice leads to automaticity. They suggested that the fluent reader has presumably mastered each of the reading sub-skills at the automatic level, and has also made the integration of these sub-skills automatic. They concluded that accuracy is not a sufficient criterion for readiness to advance to skills which build on the sub-skills at hand. One should take into account the amount of attention required by these sub-skills.

Samuels, Begy and Chen (1975) undertook two experiments to compare the recognition strategies and speed at which less skilled and more highly skilled readers were able to recognise words presented on a tachistoscope. Their subjects in the first experiment were good and poor 4th grade readers (ie. their ages were from 9.0 - 10.0); undergraduates and 4th grade pupils were used in their second experiment.

Before Samuels et alia undertook their main experiments, the

subjects were tested and found to be able to recognise the words when they were flashed on the tachistoscope: with regard to accuracy of word recognition, the fluent and less fluent readers were equal. The experiments therefore seemed to indicate that what differentiated able and less able readers was the speed of recognition of the individual words.

According to Samuels et alia, their results suggested that, compared with less able readers, more fluent readers were:

1. faster on word-recognition;
2. superior in the ability to generate a target word when given the aid of context and minimal cues from the target word itself; and
3. superior in the awareness when a false recognition had been made.

They warned that their findings were correlational and could not be viewed as cause-and-effect. They suggested, however, that one implication of more rapid word recognition is that better readers are probably getting the decoding done with less load on attention. When decoding can be accomplished automatically, more attention is then available for purposes of comprehension.

Samuels et alia (1975) also demonstrated that at phrase level context can either facilitate or retard the speed of word recognition. They used words presented in pairs (eg. DARK NIGHT, LOUD NOISE) which were sometimes presented together in pairs such as DARK NOISE and LOUD NIGHT, in order to determine whether the incongruous combinations would interfere with the speed of word recognition. This was found to be the case. Statistical analysis indicated that, both for good and poor readers, normally associated pairs of words resulted in quicker word-recognition than the incongruous pairs.

Stanovich, Cunningham and West (1981) found that the overall

pattern of results in their two experiments was reasonably consistent with the automaticity model of reading presented by LaBerge and Samuels (1974). The two experiments involved two separate groups, each of 24 1st grade children (ie. aged 6.0 - 7.0) from the same elementary school. Three times during the school year they were asked to perform a Stroop word-colour interference task. This involved naming the colours of stimuli which were either letters, high-frequency words or low-frequency words. When the amount of interference caused by these stimuli was assessed, it was found that the interference caused by letters exceeded that caused by high-frequency words. Stanovich et alia suggested that their work indicated a sharp increase in the development of automatic recognition of letters and words during the first year of schooling. By the end of the year the development of automaticity had begun to level off. This trend was particularly true for the skilled readers, who appeared to have automatised the recognition of letters, high-frequency words and some low-frequency words to an equal extent.

Biemiller (1977-78) undertook a research study to find relationships between oral reading rates for letters, words and simple texts in the development of reading achievement. His work provided additional support for Goodman's (1965) research in so far that he found that all his subjects, children and adults, read words in context faster than words out of context. Biemiller found, however, that younger and poorer readers differed from older and more able readers in speed - both at the level of reading material consisting of individual, unrelated letters, and at the level of reading individual, unrelated words. In each case the younger and poorer readers responded to the items more slowly than the older and more able readers.

These two sets of results were related: those children who read letters relatively slowly, read words proportionately more slowly. Biemiller also found that there was no evidence that the poor readers used inter-word structure (context) less effectively than their more able peers. He concluded that the results of his study led to two major educational implications:

1. It appears that some minimal level of basic word-identification speed may be necessary for success in reading.
2. Slow readers use context as effectively as abler readers to facilitate speed. They therefore need to be encouraged to concentrate on improving their basic word-recognition skills by spending as much time as possible actually reading.

Biemiller (1979) interpreted the results of this research study as indicating that, when faced with increasingly difficult reading material in relation to their normal reading level, children increase their use of graphic information strategies. He found that on their most difficult passages, the most able readers made higher proportions of graphic errors than other children. Biemiller stated that his results did not support the view that able readers make less use of graphic information than less able readers do.

(d) Some authors have suggested that weaker readers rely on component processing when attempting to read individual words, whereas good readers are able to utilise holistic processing.

Terry (1976-77) used the measurement of response latencies to study the effect of orthographic transformations upon the speed and accuracy of semantic categorizations. She undertook a study which involved using text presented to subjects as a mirror-image. She also used words presented in "degraded print", ie. the individual letters were

not always fully formed.

In her first experiment (using text presented as a mirror-image) the most striking result was the extreme drop in the subjects' speed when reading the transformed text. The rate of reading fell as low as 3.9 words per minute and the subjects' comprehension of the text was significantly lower than usual.

Some subjects complained of eye-strain, which seemed to imply that they were reading the mirror-image text in a manner qualitatively different from their reading of normal text. It seemed possible that these subjects were looking at smaller features of the stimuli, such as individual letters or letter-features, instead of relying more normally on larger units, such as words, configuration clues or phrases.

In the second experiment her subjects were presented with single words on a computer-controlled television screen and were required to press a button each time that a word represented the name of an animal. Since some of the words were more clearly printed than others, they were easier to read. Terry found that there was a positive relationship between ease of decoding and speed of semantic processing. She commented that, depending on the nature of the decoding difficulty of a text and the proficiency of the reader, one can undertake visual processing at different levels of the hierarchy. For example, with regular orthography, letter degradation may be unimportant because the reader is processing higher-order units in a holistic way. With unfamiliar orthography, however, processing may occur serially at the level of individual letters or even features.

Samuels, LaBerge and Bremer (1978) investigated characteristics of word-processing at various stages of reading development. Their

subjects were at grade 2, grade 4, grade 6 and college level, and were required to judge whether visually presented single words were animal or non-animal. The words were in regular orthography and varied in length from three to six letters. Samuels et alia attempted to compare component processing of a word with holistic processing. To this end they employed the technique involving the measurement of response latencies. The assumption underlying their method was that component processing of a word will produce an increase in response latency as the number of letters in the word increases, since the more components that need to be processed the more time will be needed for the recognition of a word. If on the other hand the subject processes the word holistically as a single unit, then the latency of recognition should be constant as the length of the word increases (up to some limit).

The results of their study apparently supported the hypothesis that beginning readers process a word on a component basis and that as skill in reading progresses, the reader processes a word in a manner which approximates more and more to the holistic strategy shown by mature readers.

The articles and papers in this section have supported Guthrie's views by suggesting that good readers probably need to be able to decode individual words quickly and easily as a first step towards reading fluently and with understanding. Various authors have presented views which, though similar to those of Guthrie, provide alternative ideas. A selection of their work is presented in the next section.

5.2 Alternative views to those of Guthrie.

(a) Some authors have suggested that the findings of experimental research studies are limited in their application to an understanding of the reading process.

How subjects respond to individual, random words is not necessarily of direct relevance when attempting to explain the process of reading words in passages of text for the purpose of obtaining meaning. Moreover, within the field of experimental psychological research, various articles have produced contradictory findings about the perception, recognition and understanding of individual written words. Such contradictions may result partly from differences in methodology and terminology.

Samuels, Begy and Chen (1975) pointed out that their research into word-recognition strategies was not an exact duplication of real life reading. They explained that their research method had been derived from a partial model of word-recognition, the hypothesis/test model, which had been proposed by Soloman and Postman (1952), and had been expanded from three stages to four:

Stage 1. (Information Use). Information from the reading material already read is utilised. For example: Father cut the green _____ .

Stage 2. (Hypothesis Formation). Information from the reading material as well as knowledge of the structure and restraints of the language is used to formulate hypotheses; that is, the reader makes predictions concerning the forthcoming word. In the example, Father cut the green _____ , the next word could be emerald, grass, money, plant etc..

Stage 3. (Test). The hypotheses are tested, using new information gathered from visually discriminating the next word. Partial

perceptions of the word or the entire word may be used for hypothesis testing. Information used to test the hypothesis may be a letter, a group of letters, or the whole word. For example, the reader may see the letters "em" which match the word "emerald."

Stage 4. (Accept/Reject). If the new information matches one of the predicated words, the hypothesis is accepted and recognition is rapid. If the new information does not match any of the predicated words, the reader must engage in careful time-consuming visual analysis to recognise the word.

Samuels et alia (1975) pointed out that although this model had been used for over twenty years and had been considered one of the most useful models of word-recognition, it presented a major problem. It takes about 0.2 seconds to generate a prediction at stage 2, and yet it takes less than 0.25 seconds to recognise a word in isolation. For this reason the model did not account for the high-speed recognition responses of fluent readers when reading meaningful material. Samuels et alia suggested that the hypothesis/test procedure is too slow to explain adequately what happens in fluent reading.

Brewer (1972) questioned the accuracy of Gough's (1972) view that reading is essentially a passive process in which the visual analysis of words letter by letter leads to positive recognition of every word through phonemic encoding. Brewer pointed out that if this were so, then proof-readers should notice all the errors which occur in texts produced ready for publication. The fact that proof-readers sometimes overlook mis-prints suggests that they are scanning words in some way that is not, strictly speaking, letter by letter.

Wildman and Kling (1978) suggested that similar criticisms could be

applied equally well to the model of automaticity which had been presented by LaBerge and Samuels (1974), since this model did not deal with the effects of prior semantic context.

Johnson (1975) commented on the controversy as to whether basic word-recognition involves letter-by-letter processing or whether it involves treating words as single-unit display patterns. He undertook three experiments in which a total of 104 psychology students were required to respond to individual letters and individual four- or six-letter words presented on a tachistoscope. He discovered that:

1. his subjects were able to identify a word more quickly than they could identify a letter within a word;
2. words and letters in isolation were identified equally quickly; and
3. word length appeared to have little or no influence on word identification time, even in a pilot study using three- and eight-letter words.

The results seemed to indicate that, so far as adults are concerned, words are processed as single-unit patterns and that individual letters are not identified before the word is identified as a complete entity.

Patberg, Dewitz and Samuels (1981) quoted from previous research, such as Terry, Samuels and LaBerge (1976) and Samuels, LaBerge and Bremer (1978), which had indicated that although skilled readers have the option to use either component or holistic processing when presented with words in isolation, the unskilled reader seems to be limited to component processing. Patberg et alia set out to investigate the effect which context has on the size of the perceptual unit for readers who would ordinarily use component processing.

Their subjects were 12 good and 12 poor 2nd grade readers, and

equal numbers of 4th grade readers in a large elementary school. They were required to read words, which varied in length from three to six letters, under three conditions of exposure:

1. context (eg. green grass);
2. miscue (eg. red grass); and
3. no context (eg. XXXX friend).

The size of the perceptual unit, and therefore the level of processing, was inferred from the duration of response latencies for words of varying length. An increase of response latency for longer words would indicate component processing, while the same response latency for words of different length would indicate holistic processing.

Patberg et alia (1981) found that the poor readers, both at 2nd grade and at 4th grade level, processed words in a component fashion and failed to use context to increase their speed of word-recognition. The poor 4th grade readers did use context, however, to help them increase the size of the word-recognition unit. The good readers at both grade levels were using holistic processing regardless of how the words were presented. The good 2nd grade readers did not appear to use context to help their speed of word recognition or their level of perceptual processing, but the good 4th grade readers seemed able to use context to increase their speed of word recognition.

According to Patberg et alia the findings of their study suggested that the size of the perceptual unit used in word-recognition is affected by:

1. text-driven strategies, ie. "bottom-up" factors such as the graphic features of each individual word; and
2. concept-driven strategies, ie. "top-down" factors such as

information provided by the reader in response to contextual cues within the text.

Patberg et alia suggested that:

1. As the efficiency of text-driven strategies increases, readers are able to shift from component to holistic processing. This increased efficiency could result from a use of word-feature cues in order to recognise words instead of letter or spelling-pattern cues, as suggested by LaBerge and Samuels (1974).
2. The size of the perceptual unit is also affected by concept-driven factors. As readers acquire some skill, they can use the available contextual information and recognise words holistically.

Graham (1980) examined the ability of three groups of subjects to recognise and identify written words. The groups consisted of:

1. 15 learning-disabled students with reading problems (average age = 11.2);
2. 15 average students matched with the learning-disabled group for reading level and intelligence (average age = 9.0); and
3. 15 average students matched with the learning-disabled group for age and intelligence (average age = 11.0).

They undertook two tasks:

1. They read words from the Sundbye Minimal Contrast Phonics Test, which consisted of three- and four-letter nonsense words, and provided a measure of each subject's functional word-attack skills.
2. They read passages of text at a level difficult enough to produce oral reading errors, but not so difficult as to cause extreme frustration.

Their oral reading miscues were noted. Statistical analysis led Graham to believe that the three groups revealed similar functional

word-attack skills. He found that the 4th, 5th and 6th grade learning-disabled students in his study exhibited adequate mastery of symbol-sound associations at the level of single syllables. He therefore suggested that, although direct instruction on symbol-sound associations (such as letters and letter clusters) might be beneficial for some students, the routine use of such instruction in remedial programs was questionable.

He suggested that his study also revealed that the learning-disabled students and the average students used the same cues to recognise words in discourse. He pointed out, however, that he had not compared the groups' speed of reading. Measurements of the speed of oral reading would have provided a measure of the economy with which the words had been recognised and identified.

The purpose of Guthrie's (1973) research was to examine the development of phoneme-grapheme association skills in readers. The tasks which he set his subjects required them to decode from print to sound and from sound to print. The sub-tests which he chose for statistical analysis all stressed the importance of coping with spelling patterns in individual words as an important part of the reading process.

He suggested that phonic decoding involved such sub-skills as the ability to read aloud (1) nonsense words, (2) one-syllable words containing long vowel sounds, (3) one-syllable words containing short vowel sounds, (4) consonant clusters, and (5) single letters of the alphabet. He found that these five skills were highly correlated in his normal readers, but poorly correlated in his disabled readers. He therefore believed that sub-skills such as these were separate components which were essential to the development of reading skills.

(b) Some authors have gone beyond these views by suggesting that readers need to be able to utilise different mental routes to meaning during the process of word-recognition.

Kolers (1970) explained that he had made a number of studies concerned with pattern-recognition and bi-lingualism. He suggested that skilled reading involves three levels of competence:

1. perceptions of characters, and visual operations;
2. perception of syntax, and sensitivity to grammar; and
3. direct perception of the meanings of printed words.

He suggested that the maximum rate of letter-by-letter scanning is 3 - 4 letters per second and that the resulting speed of 30 - 40 words per minute is too slow to enable readers to comprehend texts. His researches led him to believe that there might be two aspects to the correct identification of individual words:

1. an initial schematization, ie. a rough sketch or general frame-work of what the visual system must construct in order to represent mentally what has been presented; and
2. a subsequent impletion, or filling in, which puts the individual letters into order.

He therefore suggested that the perception of serial displays, such as words consisting of letters, consists of three stages:

1. Scanning in order to form a schema;
2. Ordering of the schematic elements; and
3. Impleting, ie. the filling-in of the schematized, but ordered, items.

He suggested that errors in word-identification might occur at the impletion stage rather than at the scanning stage.

He quoted from his previous research study, (Kolers, 1966a), in

which he had presented subjects with lists of words, some of which appeared in English only, some in French only, and some in bi-lingual pairs. The results had suggested that words are perceived and remembered preferentially in terms of their meanings and not in terms of their appearances or sounds.

He also quoted from another article,(Kolers, 1966b), in which he had suggested that when a reader knows the words of a language, he perceives printed words directly in terms of their meanings.

LaBerge and Samuels (1974) discussed the theoretical relationships between visual and phonological systems in their model of automatic information processing in reading. They suggested that a fluent reader's mental responses to a visually presented word could follow five optional routes to reach the final stage of activating a meaning within the mind. Two of the options are as follows:

Option 1: The graphemic stimulus is automatically coded into a visual word code, which automatically activates the meaning code. An example is "bear" or "bare," or any very common word which is not processed by Option 2.

Option 2: The graphemic stimulus is automatically coded into a visual word code, which automatically activates the phonological code. This code then automatically excites the meaning code. An example is any very common word which is not processed by Option 1.

LaBerge and Samuels suggested that these two options represented what many people consider to be the goal of fluent reading, in so far that the reader can maintain his attention continuously on the meaning units of semantic memory, while the decoding from visual to semantic systems proceeds automatically. They quoted Kolers' (1970)

view that a visual word code may be associated directly with a semantic meaning code. Their model included this possibility: a visual input may at times lead directly to a semantic response and thus by-pass the indirect route which involves phonological decoding.

Golinkoff and Rosinski (1976) found that with the common first-grade level words used in their study, even unskilled comprehenders accessed the meanings of the distractor words in semantic memory and therefore experienced interference. They suggested that with common words the reader can by-pass the "phonological code" and access the words directly in semantic memory. They referred to the LaBerge and Samuels (1974) model of automaticity as providing support for their explanation of their findings.

Baron (1977) also referred to the LaBerge and Samuels (1974) model of automatic information processing in reading, which had explained that many complex skills seem to require automatization of their component sub-skills before fluent integration can occur. Baron suggested that the ability to pronounce printed words aloud is a sub-skill of reading which is one of the most difficult to learn and yet apparently one of the most essential. He pointed out that it is possible to read aloud without any awareness of meaning whatsoever, since this is one aspect of reading Hebrew prayers aloud for the Jewish Bar-Mitzvah ceremony in North America.

His researches seemed to indicate that different mechanisms exist for the reading of words, and that fluent readers vary in the extent to which they rely on one mechanism or another. Words with irregular spelling patterns are treated differently from words spelt regularly. He suggested that the mature and fluent utilisation of multiple paths to word-recognition might require considerable intellectual effort in

the early stages of learning that skill. The inexperienced reader might need to acquire strategies for learning how to shift from one mental path to another when attempting to recognise words.

Baron commented that a beginning reader who understands the rules of orthography can in essence teach himself to read without continual feedback from a teacher who tells him the identity of each new word which he encounters.

Barron and Baron (1977) referred to various pieces of evidence which indicated that there are at least two ways in which an adult reader may derive meaning from a printed word:

1. The indirect path involves representing the sound of a word and then using the representation of that sound to obtain access to meaning in a way that is somewhat similar to listening to speech.
2. The direct path involves by-passing sound and using a simple association between the visual pattern of the printed word and its meaning.

Baron and Barron suggested that a child who can decode from print to sound is able to figure out new words for himself and thus, in essence, teach himself to read. Once he has decoded a word he may then use the direct path to meaning from that time on.

They concluded by suggesting that Baron's (1977) article provided evidence that phonemic memory is used in reading extended text. Children might need to rely on phonemic memory more than adults, partly because they read more slowly and therefore need to retain information for a longer time. Such reliance on phonemic memory might help to explain the use of sub-vocalization while reading. Baron and Barron commented that children's use of phonemic representation as a means of obtaining meaning from a text (the indirect path) would be a suitable

topic for further study.

(c) Some authors have provided information which goes beyond the two models of reading.

At least four aspects of reading - which seem relevant to any discussion of word-recognition - were not considered in any depth either by Goodman (1967) or by Guthrie (1973). It seems desirable to examine:

1. the phenomenon of dyslexia;
2. the nature of memory processes;
3. the possible influence of emotional factors; and
4. the reader's cultural background so far as orthography is concerned.

In order to provide a wider perspective on the nature of word-recognition some information concerning these four aspects is presented in the next chapter.

6.0 Beyond the two models of reading.

6.1 Some recent research into deep- and surface-dyslexia.

(a) Deep dyslexia and basic word-recognition.

The previous section presented a selection of views from authors who provided alternative views to those of Guthrie within the field of educational research. Some of the evidence indicated the possible existence of several mental path-ways to basic word-recognition. The field of medical research has also provided evidence which indicates the possibility that readers recognise individual, random words by utilising a variety of mental routes to meaning. Some recent medical research into dyslexia seems to provide additional support for the concept of "two routes" to basic word-recognition.

Marshall and Newcombe (1980) explained that in 1971 they had proposed the existence of a symptom-complex which they called deep dyslexia and which exhibited the following forms of behaviour when individual words were read aloud by patients:

1. The production of semantic errors,

   eg. dinner mis-read as food,
   tall mis-read as long,
   uncle mis-read as cousin.

2. The production of derivational errors,

   eg. wise mis-read as wisdom,
   strange mis-read as stranger,
   birth mis-read as born.

3. The production of visual errors,

   eg. stock mis-read as shock,
   crowd mis-read as crown.

4. The production of one function word instead of another,

eg. for mis-read as and,

his mis-read as she.

Coltheart (1979) described three types of deep dyslexia. He explained that the essential symptom of deep dyslexia is the semantic error, which was first described by the English neurologist Hughlings Jackson, in 1878. Jackson studied a patient in whom damage to the left cerebral hemisphere had produced a reading disorder. When asked to read aloud single printed words, the patient mis-read TABLE as "chair" and mis-read other words in a similar way. This type of error is called the semantic error, because the patient must have understood the meaning of the word to some extent. Although the response is incorrect, it is semantically related to the stimulus.

Deep dyslexics also produce visual errors, in which the response resembles the stimulus visually, rather than semantically,

eg. scandal mis-read as sandals.

The third kind of error is more complex. The patient appears to produce an initial meaning which is related to a word which looks similar to the target-word. This leads to the production of a subsequent meaning, which is similar to the initial meaning, but completely different to the target-word in both sound and meaning,

eg. sympathy (symphony) mis-read as orchestra,

favour (flavour) mis-read as taste,

overturn (overture) mis-read as music.

(b) Some possible causes of deep dyslexia.

Various authors have attempted to explain the reasons for such errors in reading single words, and Coltheart, Patterson and Marshall (1980) suggested that the study of deep dyslexia might be relevant to the study of normal reading and language functions.

Coltheart (1980) explained that a major characteristic of deep dyslexia is the patient's apparent inability to gain access to, or to create, phonological representations of printed letter-strings. This can lead to problems, when reading non-words and pseudo-homophones, such as "brane" and "burd". He commented that until a short time previously there had been no experimental work which provided convincing clarification of the importance of phonological recoding for adult reading, and yet various authors had been willing to make pronouncements on this issue. He quoted ten authors, two of whom are presented below to represent the contrasting views:

1. Reading does not need to proceed by the reader's forming auditory representations of printed words. (Kolers, 1970)
2. The printed word is mapped on to a phonemic representation by the reader. (Gough, 1972)

Coltheart believed that relevant evidence had been emerging from recent experimental studies. He produced a framework which assumes the existence of an internal lexicon which embodies all the knowledge which a person has concerning the words in his vocabulary (see Fig. 2). His diagram is limited to the two processes of comprehension and pronunciation and it is assumed that a word is comprehended when access is gained to its lexical entry.

He explained that there are simple proofs that all three pathways must exist. Path A, the direct path from a printed letter-string via

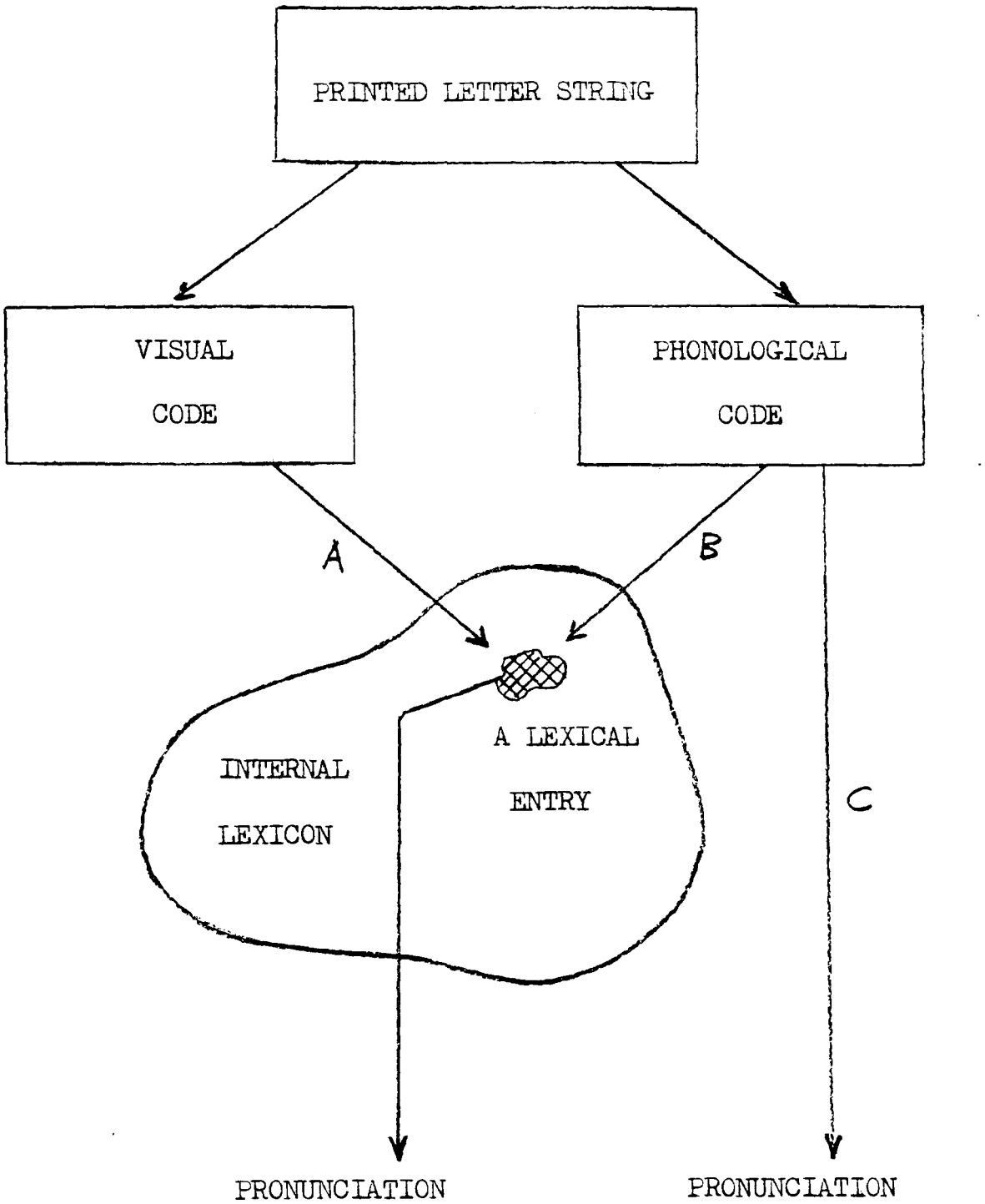


Figure 2. Ins and outs of the internal lexicon.
(taken from Coltheart, Patterson and Marshall, 1980, page 202)

the visual code (by-passing the phonological code) must exist, because normal readers can pronounce exception words correctly. Path C must exist, because normal readers can read non-words. Path B must exist since normal readers can make decisions about pseudo-homophones, eg. does PHOCKS sound like a kind of animal? The answer to this kind of question must depend upon phonological recoding followed by lexical access to the word - fox.

Coltheart's research findings indicated that in a lexical decision task for single words, lexical access is always by direct visual code (pathway A). Only when access to a lexical entry is impossible (ie. when the stimulus is a non-word) can pathway B affect behaviour.

He quoted research by Baron (1973), Kleiman (1975) and Doctor (1978). The last was an unpublished Ph.D. thesis, which repeated and extended Baron's (1973) experiment. Coltheart suggested that their findings indicated that the only situation in which a clear phonological effect was observed was when subjects were asked to judge the meaningfulness of a short piece of text, and this phonological effect was post-lexical. He argued that the effect arose because, when a phrase is being evaluated, the words need to be stored in short-term memory and this short-term storage uses a phonological code.

Coltheart concluded that experimental findings had suggested that the role of phonological encoding in the skilled reading of single words is at best slight. It seemed likely that lexical access in skilled readers relies exclusively on a visual code, even though phonological encoding is occurring. He pointed out, however, that short-term memory is used in the comprehension of continuous text, and it is possible that this involves some form of phonological code.

(c) Surface dyslexia and basic word-recognition.

Deep dyslexia is the label for a particular set of symptoms exhibited by some patients. Some other patients exhibit symptoms which are labelled as surface dyslexia.

Ferry (1985) explained that surface dyslexics fail to recognise written words from their visual appearance. They reconstruct words from the sounds of their individual letters and assign meaning only when they have arrived at a pronunciation via this route.

Coltheart, Masterson, Byng, Prior and Riddoch (1983) described two cases of surface dyslexia. They explained that surface dyslexia means that irregular words such as "broad" or "steak" are less likely to be read aloud correctly than regularly-spelled words like "breed" or "steam". One of their patients was an acquired dyslexic: ie. he had sustained brain damage in an accident. The other patient was a developmental dyslexic: ie. she had not suffered brain damage and seemed normal in intelligence and spoken language skills, but exhibited severe difficulties in dealing with printed language.

Coltheart et alia suggested that the close similarity of the reading and spelling performances of these two patients supported the view that surface dyslexia can occur both as a developmental and as an acquired dyslexia.

Marcel (1980) explained that the nature of the errors made by surface dyslexics appears to be determined largely by spelling-to-sound characteristics. Any comprehension of written texts by a surface dyslexic appears to be based on the reader's oral response. Marcel proposed that the surface dyslexic is functionally equivalent to a beginning reader in what he or she lacks, and in the strategy which he or she uses in order to cope.

(d) A comparison of deep-dyslexia with speed reading.

The following authors presented a view of dyslexic reading which seems reminiscent of Kolers' (1970) idea that the three stages of recognising an individual word involve filling in a mental framework.

Andreewsky, Deloche and Kossanyi (1980) compared elements of deep dyslexia with speed-reading, and made the following suggestions:

1. With single-word reading by deep-dyslexics the graphic input is not analysed into its components (letters or phonemes), but the whole graphic input indicates the meaning of the word, and this meaning in turn leads to the phonological response.
2. With sentence reading by deep dyslexics the sentence is not analysed into its components (words) but from the whole sentence, using the content words as key-words, a framework of related information is retrieved within the mind.

Andreewsky et alia suggested that analysis of the characteristics of reading in deep dyslexia could provide ideas about how a normal reader understands single printed words.

6.2 Some theories concerning aspects of memory.

The previous section indicated that studies of deep- and surface-dyslexia may have some relevance to the consideration of basic word-recognition in non-dyslexia. Goodman and Guthrie each produced a model of reading which implied the need to utilise various types of memory, but neither of them included a detailed analysis of how particular memory processes might influence the perception of written words. At this stage, some theories concerning aspects of memory seem relevant to an analysis of their two models.

Lenneberg (1967) considered all aspects of behaviour to be based upon the modulation of activity in networks of nerve-cells within the brain. He suggested that permanent memories are probably inter-cellular activities.

Gurney (1973) also suggested that many parts of the brain act together in an integrated way. He explained that when we speak, our brain receives feedback information through our ears, and this monitoring process is very important to the continuing control of the utterance. The motor system is also important in initiating, and checking on, speech. He quoted Laver's (1970) list of five principal functions which must be accounted for by any neuro-linguistic model of speech production:

1. Some ideation process which gives the approximate semantic context of the message.
2. A permanent store of linguistic data.
3. A planning process which converts the message into an appropriate neuro-linguistic programme.
4. The execution of the programme by the muscles associated with the articulatory organs.

5. A monitoring system to detect and correct errors.

Gurney explained that it may be that no single mental structure encompasses any one of these processes. Most of the cerebral cortex could be involved in the planning and production of speech.

Hunter (1978) described and explained various aspects of memory. He explained that the word "memory" is a label for a variety of very different kinds of mental behaviour. He mentioned the idea that in trying to recall an item from memory a person needs to reconstruct its salient characteristics. Recall of an item involves a complex interaction of mental activities directed towards representing in the present the salient characteristics of a past occurrence. Recognition of an item, however, involves the person in supplying some characteristic which, in a strict sense, is not present in the event confronting him.

Hunter suggested that an expected event is more easily recognised than an unexpected event. However, being prepared in the wrong direction is worse than being relatively unprepared, since it may impede recognition rather than facilitate it.

He also explained that memory can be influenced by distractions:

1. Research has indicated that immediate (short-term) memory has a very limited time-span which can be influenced by the age and intelligence of the subject, the nature of the task and the material to be remembered, and other factors such as fatigue.
2. When using long-term memory, a person may be distracted by interference between the salient features of two items which have been stored in memory. Pro-active interference is when a past stored memory influences a person's present perception of an item, whereas retro-active interference is when present perception

influences a person's past memory of an item. "The amount of interference is an increasing function of the similarity between the original and the interpolated activity" (Hunter, 1978). In other words, people are more likely to confuse items in memory when they are similar than when they are dissimilar. This seems particularly relevant to those miscues in reading which are visually similar to the original words (eg. "horse" mis-read as "house").

The previous authors are representative of many who have described and explained how the processes of memory may involve complex interactions between various parts of the brain. There are many different kinds of memory and they are so complex that errors are likely to occur when they are used. This is relevant to a consideration of the nature of basic word-recognition.

Steinheiser and Guthrie (1977), for example, found that their learning disabled group and the group of younger readers were slower when reading words which were visually similar than when reading words which were visually dissimilar.

When Dunn-Rankin (1968) investigated the similarity in shape of the lower-case letters of the English alphabet, he found that some groups of letters appeared to be more confusable than others. He required 315 children in Hawaii at 2nd and 3rd grade level to indicate which letters seemed most similar to a series of target letters. The results were used to produce scales of similarity, and analysis of these scales revealed clearly definable clusters of letters which were likely to be confused. He found that the scales which had been developed in his study generally supported the findings of other studies, which had isolated confusing pairs of letters such as b-d, d-p, b-p, c-e and n-u.

He suggested that a word can be thought of as the sum of its parts.

Therefore, two words with highly similar letters should be more confusing than words whose letters are not as perceptually congruent, eg. stop, slop and slap. This seems in accordance with Hunter's (1978) view that a person's memory may be distracted by interference between the salient features of two items.

This section has referred briefly to one omission in the models of both Guthrie and Goodman: the need to consider the complex nature of memory processes and their role in word-recognition. They have also omitted what may be another important factor in word-recognition: the emotional response of the reader to the written words which appear before him or her. The importance of emotional factors in word-recognition is discussed in the next section.

6.3 The possible importance of the reader's emotional state.

Stott (1972-73) suggested that an impulsive reader is likely to produce errors because a sequence is disturbed in the central processes of the behavioural system. This could lead to mistakes in memory which occur for emotional rather than neurological reasons.

Bettelheim and Zelan (1981) suggested that emotional factors could lead to miscues in reading. They suggested that a misreading may occur because of "free associations" in the mind rather than because of ignorance, lack of skills or a neurological deficit. They suggested that it was a worthwhile assumption that not all errors in reading are due to lack of skills, knowledge or attention, but might reflect emotional responses to those words which are consciously or unconsciously important to the child.

They criticised Goodman's (1973) views for not seeing things sufficiently from the pupil's point of view. Goodman had explained that a miscue was an oral response that differed from the expected response, but according to Bettelheim and Zelan the expected response was the response expected by the teacher. They suggested that by correcting what a child has done to project meaning into a story which he is reading, the teacher seems to disapprove of his investing a story with personal significance. Comprehension should be concerned with more than just overt meanings.

Various other authors have suggested that motivation, powers of attention and other emotional factors may influence the reader's ability to read words accurately and with understanding. Any distractions, such as a noisy environment or a stressful learning situation, may also have a detrimental influence on the reader's ability to recognise words.

6.4 Three types of writing-system.

Since Goodman and Guthrie were concerned with the nature of reading for English-speaking people, they concentrated their attention on aspects of English orthography. Goodman (1976) did, however, suggest that his model was likely to be applicable to other languages and writing-systems. It seems relevant, therefore, to refer briefly to the alternative writing-systems employed in the developed countries of the world, especially as the study of other systems may lead to further understanding of how readers recognise English words in texts.

The author has studied Chinese and Japanese for many years and has also made some study of Serbo-Croat, Greek and other non-Latin alphabets.

The three types of writing-system in use today consist of alphabets, syllabaries and ideographs. There are several alphabets, of which the Latin, Greek, Cyrillic, Hebrew and Arabic are used by many millions of people. The Japanese system includes a syllabary, and both Chinese and Japanese writing-systems use ideographs, which are often referred to as 'characters.'

It is possible that readers need to employ different strategies of basic word-recognition depending on the nature of the writing-system with which they are faced. Feitelson (1973) explained that the letters of the Hebrew alphabet are very similar in shape and that words written in Hebrew lack distinctive visual patterns, yet the letters provide a nearly perfect one-to-one symbol-sound relationship. Educational experiences in Israel in the period following World War 11 indicated that the Look-and-Say approach was unsuited to the Hebrew writing-system; on the contrary, phonic drill seemed helpful as providing a suitable strategy for reading.

Over a thousand million people in China and Japan are faced with non-alphabetical writing-systems in their books and journals. Their approach to basic word-recognition may need to be different from that of readers in Israel, who are presented with an alphabetical system.

Chinese characters were originally developed from pictorial representations of things and ideas, but are now abstract shapes which represent concepts. Their configurations do not represent the sounds of the modern language. Most characters in modern Peking Chinese are used to represent language at the level of the syllable, and the possible pronunciation or pronunciations of each character need to be learnt by rote. The Look-and-Say approach is the prime strategy available for acquiring skill in basic word-recognition; a phonic approach is virtually impossible.

The Japanese have used a mixed system of kanji and kana for several hundred years. Kanji are Chinese characters, most of which have at least two pronunciations: a native Japanese pronunciation (kun) and a pseudo-Chinese pronunciation (on). The 'on' is usually a single syllable, but the 'kun' may consist of several syllables. For example, the kanji for "vehicle" (車) may be pronounced /ʃʌ / (on) or /kuːruːmʌ / (kun).

Kana are symbols which stand for the sounds of syllables such as /kuː/, /ruː /, and /mʌ /. They are used as a phonic system, which enables young Japanese to start reading texts before they begin to acquire a knowledge of several thousand kanji. /kuːruːmʌ/, (車), could also be written as くるま, which represents the sounds of the three syllables. Modern Japanese is virtually never written solely in kanji for adults. Kana syllabic script is used in conjunction with kanji in order to provide additional information, such as grammatical

elements, in the text. While attempting to derive meaning from text a mature Japanese reader is continually switching from processing abstract ideographs to processing phonic script and back again.

Coltheart (1979) referred to studies with normal Japanese subjects by Takeshi Hatta, which had indicated that the left cerebral hemisphere is better than the right at dealing with kana (the script in which each symbol stands for a syllable) while the right hemisphere is better than the left at dealing with kanji (the ideographic script).

Coltheart, Patterson and Marshall (1980) predicted that further insights would emerge from comparing the differential aspects of similar brain-injuries upon the ability to read orthographies as dissimilar as alphabets, syllabaries and ideographic scripts.

The author believes that studies of reading processes in some other languages might help to provide further insights into the nature of word-recognition in English. It is possible to argue, for example, that English is similar to Japanese. Regular words such as "cat" could be considered equivalent to words written in kana, whereas irregular words such as "shoe", "yacht" and "butte" could be viewed as equivalent to kanji. In that case it may be that different mental processes are needed to recognise "cat" from those needed to cope with "shoe" irrespective of the linguistic strategies which are employed by readers.

Japanese can be written as a syllabary alone or as a mixed syllabary and ideographic script. Serbo-Croat may be written either in the Latin or the Cyrillic alphabet in different parts of Yugoslavia. The author suggests that such possibilities are fortunate. Miscue analysis on the same linguistic text printed in different scripts, which is possible in Japanese and Serbo-Croat,

might provide fresh evidence concerning the nature of word-recognition.

In the next chapter the author presents his views concerning some of the ideas arising from the two models of reading produced by Goodman and Guthrie.

7.0 The possibility of integrating the two models.

7.1 Some comments concerning the literature.

Psycholinguists such as Goodman and Smith have suggested that linguistic elements are the most important aspects of the reading process. They believe that quick, precise recognition of individual words is not of paramount importance. In contrast to this, Guthrie is one of a number of authors who have suggested that quick and accurate word-recognition is an essential first-step towards the comprehension of written texts. Research into this contradiction has been difficult because one set of skills tends to mask defects in the other. A reader's slowness in recognising and coping with individual words may be disguised to some extent if linguistic skills are used to compensate for this slowness. Linguistic problems, on the other hand, may be disguised to some extent, if the reader is good at recognising individual words quickly and accurately.

Goodman has suggested that a reader's knowledge of phonics plays very little part in mature, fluent reading, and various research studies have supported this view. It seems likely that good readers recognise individual words mostly through the direct visual-semantic route to meaning rather than through the indirect visual-phonological-semantic route. Phonological recoding appears to be necessary only as a strategy for dealing with written words which are new to the reader - either to aid linguistic recognition of words which are part of the reader's spoken vocabulary, or as a guide to the pronunciation of a completely unknown word with a view to entering it in the mental lexicon. It is at the level of connected text that phonological recoding may be necessary as a means of transferring the meaning of words to the reader's memory.

Guthrie's view that reading can only become a holistic process once sub-skills have been mastered and integrated into a total process prompts the question: How does the reader cope until these skills have been mastered? The answer might be that the reader relies heavily on using linguistic skills, together with such basic word-recognition skills as he-she has acquired. This implies that in some respects Goodman's psycho-linguistic approach is more important for beginning readers than for mature readers.

Goodman may be mistaken, however, in suggesting that phonic instruction is relatively unimportant to the reading process. The ability to decode easily and directly from print to sound may at times enable the reader to utilise linguistic skills with less strain on attention.

The phonic approach to reading English involves the assumption that the use of an alphabet provides the reader with an additional source of information unavailable to the reader of an ideographic language such as Chinese. The reader of modern Chinese has only one option for achieving basic word-recognition (ie. context-free recognition): the direct visual-semantic route to meaning. The reader of an alphabetical language, such as English, has the additional option of utilising the indirect visual-auditory-semantic route to meaning.

When faced with a previously unseen word, the reader of English may be able to establish a tentative pronunciation for this word as an auxiliary strategy to that of using contextual cues. It seems desirable that all readers of English should be able to utilise this additional strategy by acquiring a general knowledge and understanding of the various phonic patterns (ie. grapheme-phoneme associations) which are available when using the English alphabet.

Since some pupils seem slower than others at acquiring an understanding of the patterns of English orthography, it seems desirable to ensure that such pupils are given individualised phonic guidance of a kind suitable for their level of development. For some pupils their disabilities in coping with phonic decoding may hinder their attempts to utilise their linguistic skills. Some pupils seem unable to acquire an understanding of grapheme-phoneme associations merely by using their experience of reading, and may need guidance from teachers. An understanding of phonic patterns (ie. grapheme-phoneme associations), either intuitively or through instruction, may be essential if pupils are to teach themselves to read.

A related problem is that of the acquisition of sight vocabulary. When faced with a text, it is impossible for a reader to begin to utilise linguistic skills unless he-she can first recognise or decode some of the words. Evidence from research into deep-dyslexia and other studies of memory has indicated that some readers may find it difficult to acquire a stock of mental associations, whereby they can quickly and easily recognise the connections between a printed word, its possible pronunciations and its range of meanings. It is possible that some pupils may benefit from individualised guidance designed to help them to find ways to develop their range of sight-vocabulary.

The author has found that the following techniques appear to be helpful in encouraging pupils to broaden their range of sight-vocabulary:

1. Book-and-Tape. The pupil looks at a book while listening to a tape-recording of the story. The pupil can pause the tape and ask for the meaning of words which are not in his-her spoken vocabulary.

2. Missing Word Puzzle. The pupil chooses a text and copies it out. While doing so, he-she chooses to omit certain words which are replaced by numbers. The pupil later reads this copy and attempts to spell the missing words from memory. He-she can be encouraged to choose to omit words which were previously unknown, but the meaning of which has been found in a dictionary or by enquiring from the teacher or some other person.

Goodman suggested that all readers are equivalent to each other in so far that they utilise their knowledge of language as the primary strategy for making sense of what they read. In steps 3 (selection) and 4 (perception) of his model he refers to the reader's use of "strategies which he has learned." However, he seems to overlook the possibility that some readers may be slow and inaccurate at basic word-recognition for intellectual and/or emotional reasons. This may cause them to recognise some groups of words so slowly that their short-term memory cannot retain the meaning of what they have just read. They may therefore find it difficult to develop strategies for integrating linguistic cues into the reading process.

Goodman has proposed some answers to the question: Why do readers sometimes not correct their miscues? He suggested that either the miscue makes no real difference to the meaning or the reader has lost sense of the overall meaning of that section of text. This in turn leads to a further question: Why should the reader lose sense of the overall meaning of a piece of text?

One reason could be that the level of vocabulary and/or syntactical structure of the text is beyond the reader's level of experience. If so, then this suggests that Goodman should not assume that all readers may be considered equivalent in their ability to apply linguistic

skills to texts.

Another reason for the reader's loss of understanding might be that he-she is concentrating too much on individual words because of problems involving his-her memory for individual, printed words. If too much attention is needed to obtain basic word-recognition, there may be too little attention available for attending to meaning.

Various authors have suggested that a reader is unlikely to understand a text if he-she reads it too slowly. The reader's ability to utilise automatic word-recognition will help to speed up the process. However, there is also the possibility that linguistic skills enable the reader to read so quickly that he-she does not need to rely on automatic word-recognition. If that is so, then it may be that some poor readers are suffering from weaknesses in their linguistic ability rather than from weaknesses in basic decoding skills.

The author's study of the literature led him to conclude that both Goodman's top-down and Guthrie's bottom-up models present only a partial view of the total reading process. As a teacher he thought it desirable to find a way to integrate the two. During his literature search he discovered a model which seems capable of explaining and resolving the apparent contradictions between the two. In the next section a model of reading is presented which attempts to integrate bottom-up and top-down models of reading.

7.2 An integrated model of reading.

(a) Stanovich's interactive-compensatory model.

Stanovich (1980) suggested that neither bottom-up models (eg. Gough, 1972; LaBerge and Samuels, 1974) nor top-down models (eg. Smith, 1971; Kolers, 1972; Goodman, 1976) described the reading process satisfactorily. He commented that these models had been unable to explain adequately the results of some pieces of empirical research. He believed that a new model was needed which would allow for interactive-compensatory processing by the reader in order to cope with weaknesses at any level in the processing hierarchy. He explained that the essence of the compensatory hypothesis was that a process at any level could compensate for deficiencies at any other level.

(b) Bottom-up models.

According to Stanovich (1980), bottom-up models claim that higher level processes depend on successful low-level processing. It has been found, however, that under certain circumstances, poorer readers show a greater reliance on higher-level processes than do good readers. This seems to invalidate the bottom-up conception that individual differences in reading skill result from differences in ability at lower levels of processing.

Stanovich and West (1979) found that the poor readers among their subjects, unlike the good readers, made a large number of errors where words were confused with each other apparently because they looked similar. These results seemed to indicate that the poorer readers were less likely to complete the internal analysis of an item, and this was probably due to poor letter-analysis mechanisms.

(c) Top-down models.

According to Stanovich there was evidence to suggest that the top-down hypothesis-testing model of reading was unsatisfactory in its view that hypotheses can be generated and tested at a speed which facilitate on-going word-recognition. He pointed out that there are two types of contextual processing (ie. processes which involve the use of context):

1. those which are involved in constructing a knowledge structure from the text (ie. the semantic integration of new information with old); and
2. those which involve contextual hypothesis-testing (as proposed by Goodman, 1976, whereby readers use previously understood material to facilitate on-going word-recognition).

Mitchell and Green (1978) required their subjects to watch a visual display which presented three words of text at a time. The subject pressed a button as soon as he was ready for the next set of three words, and continued in this way. The time between each use of the button (the inter-response time) served as an index of the processing difficulty.

Mitchell and Green failed to confirm an important prediction of the hypothesis-testing view - that processing should be faster in more predictable parts of a text. Since the predictability of most sentences increases from beginning to end, it follows that the difficulty of processing, and therefore the inter-response time, should decrease as the reader progresses through the sentence. The data, however, revealed a tendency for readers to slow down slightly as they progressed through a sentence.

Mitchell and Green concluded that the rate of reading is more

dependent on the speed with which a reader can recognise words and construct a representation than on the ability to use predictions to facilitate word recognition. They did not deny that the preceding context can affect comprehension processes, but they did distinguish between the two types of contextual processing mentioned above.

Stanovich (1980) explained that top-down theorists tend to assume that every higher-level conceptual process must be more implicated in the performance of more fluent readers than in the performance of less fluent readers. He claimed that there was empirical evidence which contradicted this assumption. The finding that in some situations poor readers rely more on context than do good readers presents problems for top-down models, which hypothesise that reading becomes more conceptually-driven as fluency develops. The interactive-compensatory conception, however, allows for the reader with poor letter or word-recognition skills to draw heavily on higher-level knowledge sources.

(d) Comparisons between good and poor readers.

Weber (1970) obtained results which were consistent with those of Biemiller (1970): the better readers appeared to pay greater attention to graphic information than did poorer readers. Juel (1980) suggested that good readers are predominantly text-driven, and poor readers are more context-driven.

Allington and Strange's (1977) study required their subjects to read texts in which one letter had been changed in 5% of the words (eg. "far" was printed as "fan"; "over" was printed as "oven").

Allington and Strange found that:

1. good readers read the actual (mis-spelled) word more often than did the poor readers, which seemed to indicate that better readers

paid greater attention to graphic information; and

2. both good and poor 4th grade readers (ie. aged 9.0 - 10.0) responded for a majority of the time with the contextually appropriate original word rather than the actual (mis-spelled) word.

These two findings seemed to indicate that, while both groups used context to facilitate processing, the good readers paid more attention to graphic information.

Allington (1978a) required his 4th grade subjects (12 good and 12 poor readers) to read a story of 175 words, both as a list of random words and as a passage of meaningful text. His results led him to conclude that good readers were more reliant on context for fluency and poor readers were more reliant on context for accuracy.

Stanovich (1980) suggested that the previous pieces of evidence indicated that all readers appear to use context to facilitate word-recognition, but that there seems to be no strong tendency for more fluent readers to show a greater reliance on context. Indeed, the opposite is often true. He went on to suggest that, if the contextual facilitation observed in poorer readers is of a type that takes attentional capacity, then these readers may have less capacity left over for comprehensional processes.

(e) The Posner-Snyder Theory.

Stanovich stated that some research had supported the Posner-Snyder two-process theory. This hypothesises that semantic context affects recognition via two processes that act differently and have different properties. It is possible that the reader's mind uses whichever process of the two is more suitable for achieving word-recognition as the text is scanned.

(A) The automatic spreading-activation process is:

(1) fast acting,

(2) does not use attentional capacity, and

(3) does not affect the retrieval of information from memory locations unrelated to those activated by the context.

(B) The conscious-attention mechanism is:

(1) slow acting,

(2) utilizes attentional capacity, and

(3) inhibits the retrieval of information from unexpected locations.

West and Stanovich (1978) obtained results in their study which indicated that word-recognition in adults is so fast that a target-word can be named before the slow-acting conscious attention mechanism can have an inhibitory effect. It seems that only the automatic spreading-activation component of contextual processing has time to operate before the word is recognised.

Stanovich suggested that it may be the case that the rapid word-recognition of fluent readers simply short-circuits the conscious-attention mechanism. The facilitation displayed in the performance of the fluent readers is probably due to automatic-activation processes that use no cognitive capacity. Stanovich pointed out that the LaBerge and Samuels (1974) model was similar to the interactive-compensatory model at word level, but did not allow for compensatory processes. Both models agreed, however, that fast and automatic word-recognition is an important determinant of fluent reading.

Stanovich suggested that it may be that good readers use context more effectively to monitor comprehension, whereas poor readers use it as an aid to word-recognition. It is possible that beyond the initial levels of reading fluency it is word-recognition speed, rather than

automaticity, that is the major factor in skill development, since it has been reasonably well established that context-free recognition speed is a major determinant of individual differences in reading fluency (Shankweiler and Liberman, 1972). Stanovich believed that the good reader identifies words automatically and rapidly - whether by direct visual recognition or by phonological recoding.

(f) Conclusion.

Stanovich commented that both top-down and bottom-up models of reading predict that higher-level conceptual processes will be more implicated in the performance of better readers. He claimed that a review of the literature indicated that this prediction had not been borne out. He quoted Rumelhart (1977) as suggesting that an interactive-compensatory model of individual differences in reading ability best accounted for the pattern of results in the literature.

The author believes that it is desirable to continue to investigate the nature of word-recognition in relation to the models of Goodman and Guthrie, but that Stanovich's model should also be considered when analysing the results. The next section describes how the author used a piece of research by Dr. Allington as a starting point for his own research into the nature of word-recognition.

7.3 Research by Allington and McGill-Franzen.

In order to undertake his first piece of research into the nature of word-recognition skills, the author decided to attempt a partial replication of the study by Allington and McGill-Franzen (1980). Their investigation had been in accordance with a well-established procedure for experimental research, in which good and poor readers are compared as to their performance on a task, or set of tasks, and conclusions are then drawn from the results. The rest of this section presents a summary of their research-study.

Allington and McGill-Franzen referred to the practice of using the analysis of errors made by poor readers, when reading isolated words, as a means of attempting to understand the ways in which such readers were deficient in word-recognition strategies. They suggested that this practice resulted from a misunderstanding of several studies, which had reported positive correlations between word identification in isolation and word identification in context. They suggested that these strong correlational results had indeed indicated that one could use a word-recognition task to some extent to predict the general level of reading ability, but that such a task did not necessarily identify specific weaknesses in word identification.

They explained that the purpose of their study was to show the difference between general correlations and the predictive significance of individual errors made in reading words in isolation as opposed to context. They quoted an earlier study by Allington (1978b), which had demonstrated that only 25% of the error in reading the words was common to the two conditions (ie. connected text and isolated words), but they suggested that the generalizability of these results was questionable due to the small size of the sample

(N = 16) and the limited number of stimuli (72 words).

Their (1980) study involved two passages, each of about 200 words, one of which was rated as being at second grade level, and the other as being at fourth grade level, and each of which was presented in two separate conditions:

(a) the original format, and

(b) with the words in random order.

Their subjects were 12 good readers and 12 poor readers chosen randomly from larger groups of good and poor readers in the fourth grade of a rural elementary school. The definitions and selection of "good" and "poor" readers had been obtained by administering the Word Identification sub-test of the Woodcock Reading Mastery Tests. The mean raw scores of these subjects were equivalent to Grade 2.8 for poor readers and Grade 4.9 for good readers, while the mean chronological ages were 9.5 and 9.6 respectively. The group of poor readers consisted of 9 boys and 3 girls, while the good group consisted of 6 boys and 6 girls.

The children were tested individually in a small room, where they were asked to read each of the selections aloud as well as they could. The sessions were recorded on tape for later scoring and analysis. All the subjects read the 2nd grade passage (in both conditions), but the 4th grade level passage (in both conditions) was presented only to the good readers, following the same procedures but on a separate day.

An analysis of variance indicated that:

1. The performance of the good readers was significantly different from that of the poor readers ($F=14.26$, $p<.001$),
2. The random word task produced significantly more errors than the context task ($F=57.73$, $p<.001$), and

3. The interaction was also significant ($F=28.78$, $p<.001$), which indicated that the no-context task was more disruptive for the poor readers.

An analysis of variance was also carried out on the good readers' performance on the 2nd and 4th grade materials, which indicated that:

1. Their performance was significantly poorer on the more difficult 4th grade material ($F=26.46$, $p<.001$),
2. Their performance on the no-context task was significantly poorer than on the context task ($F=28.61$, $p<.001$), and
3. The interaction was also significant ($F=6.32$, $p<.05$).

They referred to the data in their Table 3 (see Table 4). This depicted the commonality of error in the two conditions of context and no-context, which seemed to indicate that in general the poor readers' errors in either condition were more likely to predict specific errors in the other than was the case for good readers. The total common error for Poor Readers was 18% and for Good Readers was 5%.

Spearman Rank Correlation Coefficients were computed for the performances in the two conditions. The method of computing these coefficients was apparently as follows:

1. The good readers were put in order of accuracy with regard to their response to a list of words: ie. those who made the fewest errors were ranked first; those who made the largest number of errors were ranked last.
2. The good readers were then put in rank order with regard to their response to the equivalent text: ie. those who made the fewest errors were ranked first; those who made the largest number of errors were ranked last.
3. The following formula was then applied:

Table 1. Fourth graders' mean errors in word recognition on second grade material

	200 words in context		Same words in random order	
Reading ability	Mean errors	S.D.	Mean errors	S.D.
Good readers	1.83	2.52	4.42	3.03
Poor readers	11.75	12.63	26.75	17.16

Table 2. Means for good readers in both conditions on second and fourth grade materials

	200 words in context		Same words in random order	
Material difficulty	Mean errors	S.D.	Mean errors	S.D.
Grade 2	1.83	2.52	4.42	3.03
Grade 4	5.75	3.22	12.92	5.38

Table 3. Commonality of error in two conditions - context/no context

	Mean number of errors		
Reading ability and material difficulty	Common to both conditions	Unique, in context	Unique, in random order
Good readers, grade 2 material	.08	1.75	4.34
Good readers, grade 4 material	1.00	4.75	11.92
Poor readers, grade 2 material	7.09	4.66	19.66

Table 4. The three tables of statistics presented in their article (Allington and McGill-Franzen, 1980, pages 797 and 798).

$$S_r = 1 - \frac{6\Sigma d^2}{n(n+1)(n-1)},$$

where Σd^2 = the sum of the squares of the difference in rank for each subject when compared for list and text; and n = the number of subjects.

4. This process was then repeated for the weak readers.

Allington and McGill-Franzen obtained the following Spearman rank order coefficients: they were .22 and .28 for the good readers' performances on 2nd and 4th grade materials respectively, and .94 for the poor readers' performances on 2nd grade materials.

A coefficient of .2 indicates that there was a low correlation between the order of the subjects with regard to their accuracy when reading a list as compared with their order when reading the equivalent text. A coefficient of .9 indicates that there was a high correlation between the order of the subjects with regard to their accuracy when reading a list as compared with their order when reading the equivalent text.

Allington and McGill-Franzen commented that:

1. The poor readers' coefficient of .94 was in the same range as that presented by Shankweiler and Liberman (1972); and
2. such a result had been used to support the hypothesis that word recognition in isolation predicts the ability to read in context.

They suggested, however, that their (1980) analysis of the commonality of error indicated that this hypothesis was not necessarily accurate.

Their study supported the results of Goodman's (1965) research in so far that both good and poor groups were significantly more accurate when reading connected text than when reading the same words in random order.

Unlike the earlier Allington study (1978b) none of the poor readers in the 1980 study performed better when reading words in a random list, but this may have been due to the fact that the mean age of the poor readers in the earlier study had been nearly two years higher than that in the 1980 study.

The results of their 1980 study demonstrated the facilitative effects of context on word recognition. Poor readers benefited more than good readers from the additional information provided by context, but even the greater impact of contextual information did not allow the poor readers to attain the accuracy level of the good readers. The differences in accuracy level in this study precluded useful comparisons as to the extent to which good and poor readers relied upon contextual information.

Allington and McGill-Franzen suggested that the results of their 1980 study undermined the widely held assumption that word recognition in either context or isolation could be employed to predict similar errors in the other condition, since the commonality of error was low for poor readers and almost non-existent for good readers (see Table 4). Allington and McGill-Franzen suggested that when word-identification errors were produced during a test of isolated words, this did not provide a solid basis for predicting errors in connected text. Their findings suggested that:

1. it is unprofitable to use word lists to identify which words need to be taught to ensure their recognition in context; and
2. it will be equally inaccurate to use errors from reading connected text to identify words to be taught in isolation.

They remarked in conclusion that the measurement of something as seemingly straightforward as word recognition was no easy matter.

Despite this comment, the author undertook a similar piece of research by comparing the performance of good and weak readers. He chose to use the term "weak readers" rather than "disabled/poor readers." First, however, he communicated with Dr. Allington.

7.4 Correspondence with Dr. Allington.

In reply to a letter from the author, Dr. Allington provided answers to the following three questions:

1. Question: Did you time the reading of each text in order to ascertain each subject's rate of reading?

   Answer: No, unfortunately, we did not (measure the) mean rate of reading in the Reading Teacher study. However, I have enclosed a reprint of another study using different grade four subjects and different materials but a similar experimental procedure. I also measured rate of reading and found an interesting result, as discussed. (Dr. Allington enclosed a reprint of his 1978a study).

2. Question: Did you compare the number of corrected miscues with the number of uncorrected miscues for each subject and group of subjects?

   Answer: No, we did not compare corrected and uncorrected miscues.

3. Question: Did you initially present the Poor Readers with Grade 4 texts and then decide to exclude them from your statistics?

   Answer: No, we decided not to use the grade four difficulty test with the poor readers. We felt that material at that level was simply too demanding for children reading at a second grade level. We included the fourth grade level material for better readers in an attempt to avoid the problem of having poor readers read material "on-level" on good readers reading material that was "below-level", or quite easy for them. (sic)

Allington's (1978a) article commented on the possible relationships between reading ability, accuracy, and rate of reading, when subjects are required to read a list of random words followed by the same words

as a piece of connected text. He suggested that:

1. If the list and text scores are similar with regard to accuracy, and the text is read much more quickly than the list, then it indicates that the reader's knowledge of syntax is being used primarily to increase the rate of reading rather than to increase the accuracy of word-recognition.
2. If the list and text scores are very different with regard to accuracy, and there is little difference in the rate of reading either list or text, then this indicates that the reader's knowledge of syntax is being used primarily in order to improve accuracy of word-recognition, rather than to increase the rate of reading.

Allington commented that the conclusion seems to be that weak readers need to pay attention to the utilisation of linguistic skills as an aid to word recognition and therefore do not have sufficient attention available for the utilisation of linguistic skills as an aid to fluent, meaningful reading.

The author set out to replicate the research study of Allington and McGill-Franzen (1980) in the following respects:

1. He compared the performance of 12 good readers and 12 weak readers.
2. The task involved first reading words in random order as a list, and then reading the same words as a connected text.
3. The author subjected his data to the same three kinds of statistical analysis as Allington and McGill-Franzen.

His study varied from theirs in the following respects:

1. He used four main lists and texts instead of two.
2. He measured the subjects' rate of reading, as well as their accuracy.

8.0 Experiment One. A replication of Allington and McGill-Franzen (1980).

8.1 Introduction.

8.2 Method.

8.3 Procedure.

8.4 Results (a) Statistical analysis.

8.5 Results (b) Descriptive analysis.

8.6 Discussion.

8.7 Conclusion.

8.1 Introduction.

The contradictions between the two models of Goodman and Guthrie are not easy to resolve. The author's classroom experience and his consideration of the literature led him to sympathise with Guthrie's belief that reading is a hierarchical process in so far that good, fluent reading would seem to be possible only once the reader is confident in his-her ability to recognise individual written words.

The author's purpose in undertaking Experiment One was two-fold:

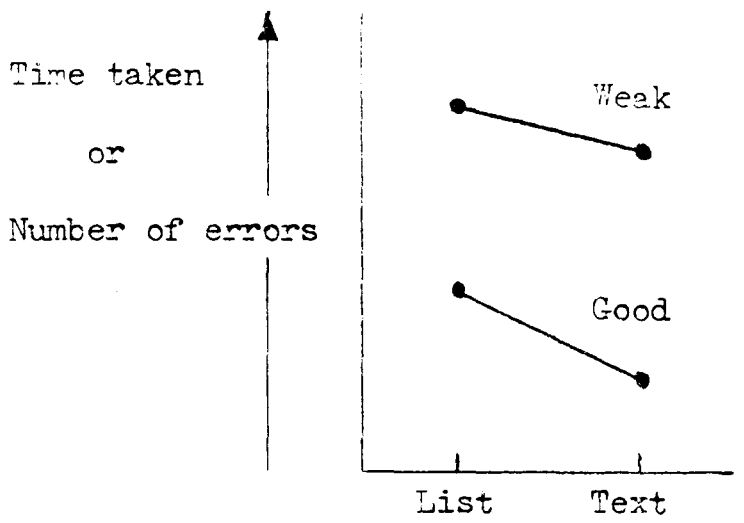
1. To replicate the study of Allington and McGill-Franzen (1980) in order to develop his understanding of research techniques; and
2. To use this replication as a means of comparing the two schools of thought represented by Goodman and Guthrie.

It was expected that the author's results would tend to support either Goodman or Guthrie, since their two models present contrasting theories. In order to produce a hypothesis which could be tested empirically, the following predictions were made (see Fig. 3).

According to Goodman's model there is no fundamental difference between individual readers in so far that all readers rely primarily on their linguistic skills, but it is probable that Beginning Readers need to rely on visual cues more than Experienced Readers. If we equate Good with Experienced Readers, and Weak with Beginning Readers, then Goodman's model presents two possible implications: either

1. there is no fundamental difference between Good and Weak Readers, since all readers rely primarily on their linguistic skills and so there will be no significant difference between Good and Weak Readers in the amount of List-Text Change which each group makes; or
2. if there is a significant difference, it will be that Good Readers

(A) Goodman



(B) Guthrie

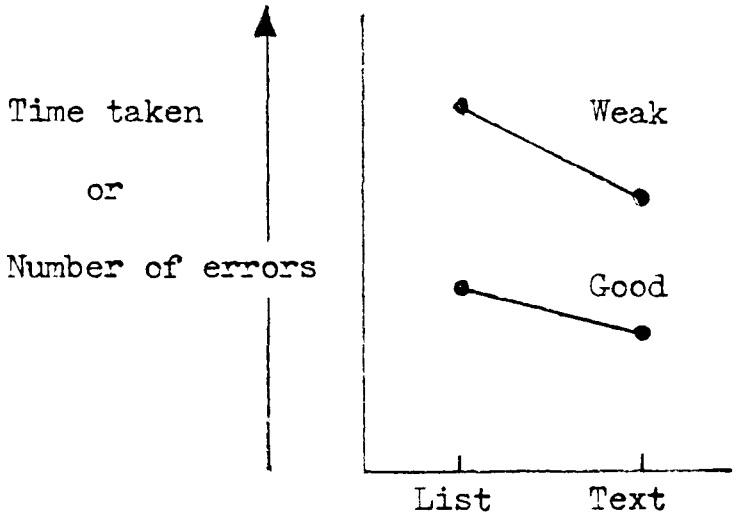


Figure 3. Predictions as to the amount of List-Text Change produced by Good and Weak Readers when reading a List followed by its equivalent Text, as implied by (A) Goodman's model, and (B) Guthrie's model of reading.

improve more than the Weak Readers, when reading a list followed by its equivalent text, because the Good Readers are more experienced at using their linguistic skills (see Fig. 3A).

According to Guthrie's model, Weak Readers should improve more than Good Readers, when reading a list followed by its equivalent text, because they tend to rely on their linguistic skills in order to improve the accuracy of their word recognition. Good Readers are already accurate at basic word recognition and therefore do not need to rely on their linguistic skills so much as Weak Readers in order to improve their accuracy. They will therefore not make as much improvement as the Weak Readers when reading a list followed by its equivalent text (see Fig. 3B).

It was predicted that one group of readers would make significantly more improvement than the other, when reading a list followed by its equivalent text. If the Good Readers made significantly more improvement, this would tend to support the Goodman model of reading. If the Weak Readers made significantly more improvement, this would tend to support the Guthrie model of reading (see Fig. 3).

8.2 Method.

The subjects were twenty-four pupils from a North-London boys' comprehensive school. They were seen individually and tested by the author. Each session lasted for about thirty minutes. There were twelve Good Readers and twelve Weak Readers, who were matched for age but not for intelligence (see Table 5).

In a study of good and weak readers it is usually considered desirable to match both groups for intelligence, but the author was constrained by the need to use pupils available at his school. He was also influenced by two further considerations. Firstly, the article by Allington and McGill-Franzen (1980) did not specify the mean intelligence quotient for each of their groups of subjects, and so it was not apparent as to whether they had been able to match their groups for intelligence. Secondly, several of the studies mentioned previously, in which good and weak readers were compared, made no mention of matching the two groups for intelligence (Katz and Wicklund, 1971; Samuels, Begy and Chen, 1975; Golinkoff and Rosinski, 1976;; Patberg, Dewitz and Samuels, 1981). The author therefore felt justified in using two groups of subjects with widely differing mean intelligence-quotients.

The subjects were required to read lists and texts, and their responses were recorded on to casette-tapes. Each subject read six texts, each of which was presented and read aloud as a list of words, before being read aloud as a meaningful passage. Each list and its equivalent text were 150 words long, and each list consisted of its related text typed out in reverse order. The first two list-texts were used as practice items; the other four constituted the main test, with a total of 600 words. They had been taken from six different

	Mean Reading Quotient[1]	S.D.	Mean Intelligence Quotient[2]	S.D.	Mean Age Years	S.D. (months)
Good Readers	126.5	3.6	115.0	8.7	12.2	4.1
Weak Readers	76.4	8.5	82.4	10.1	12.4	4.0

[1]Wide Span Reading Test, Thomas Nelson and Sons, Ltd.

This involves reading pairs of sentences. The reader is required to choose the most suitable word from the first sentence of each pair to fill a gap in the second sentence.

[2]Non-Verbal Test DH, National Foundation for Educational Research.

Table 5 . Mean Reading Quotient, Mean Intelligence Quotient, and Mean Age of the two groups of subjects in Experiment One.

story books, which the pupils had apparently not seen previously. The four main texts were at a reading level approximately three years below that of the chronological age of the subjects.

After reading each text the subject was asked to re-tell the story in his own words. This provided some indication as to how well he had understood and remembered the passage.

8.3 Procedure.

The performance of each subject was analysed by replaying the tapes. Times and errors were noted on copies of the original texts. The following miscues were counted as errors:

1. insertions,
2. omissions, and
3. substitutions.

When a miscue was corrected by a subject, it was not counted as an error.

The errors in each list and text were totalled to provide the mean number of uncorrected words read by each group of readers. This provided a measure of their inaccuracy (see Fig. 4 and Appendix 1).

The time taken to read each list and text was measured in seconds, and these times were totalled to provide the mean time taken by each group of readers. This provided a measure of speed/rate of reading (see Fig. 5 and Appendix 2).

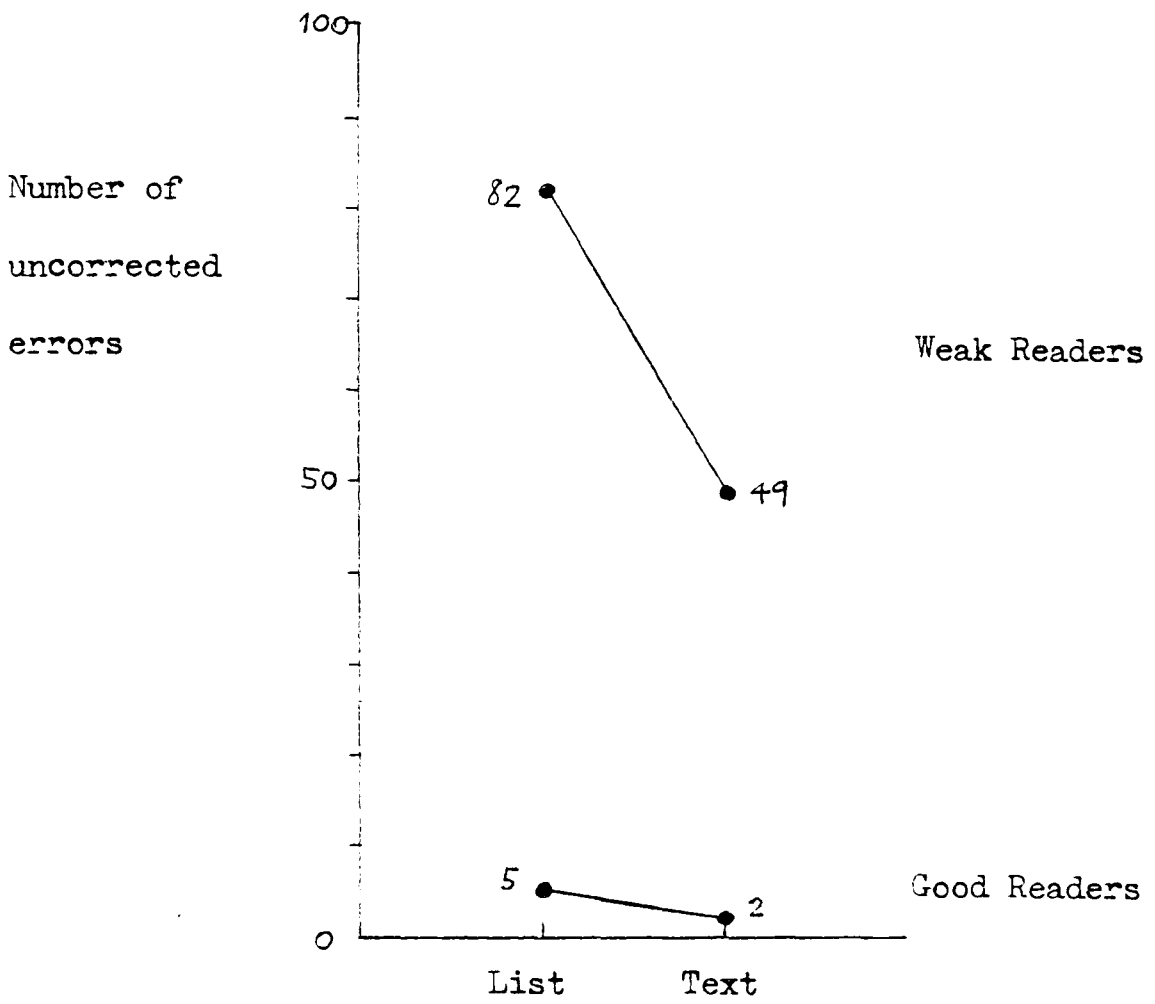


Figure 4. Experiment One: mean scores for the number of uncorrected errors made by Good and Weak Readers when reading a total of 600 words.

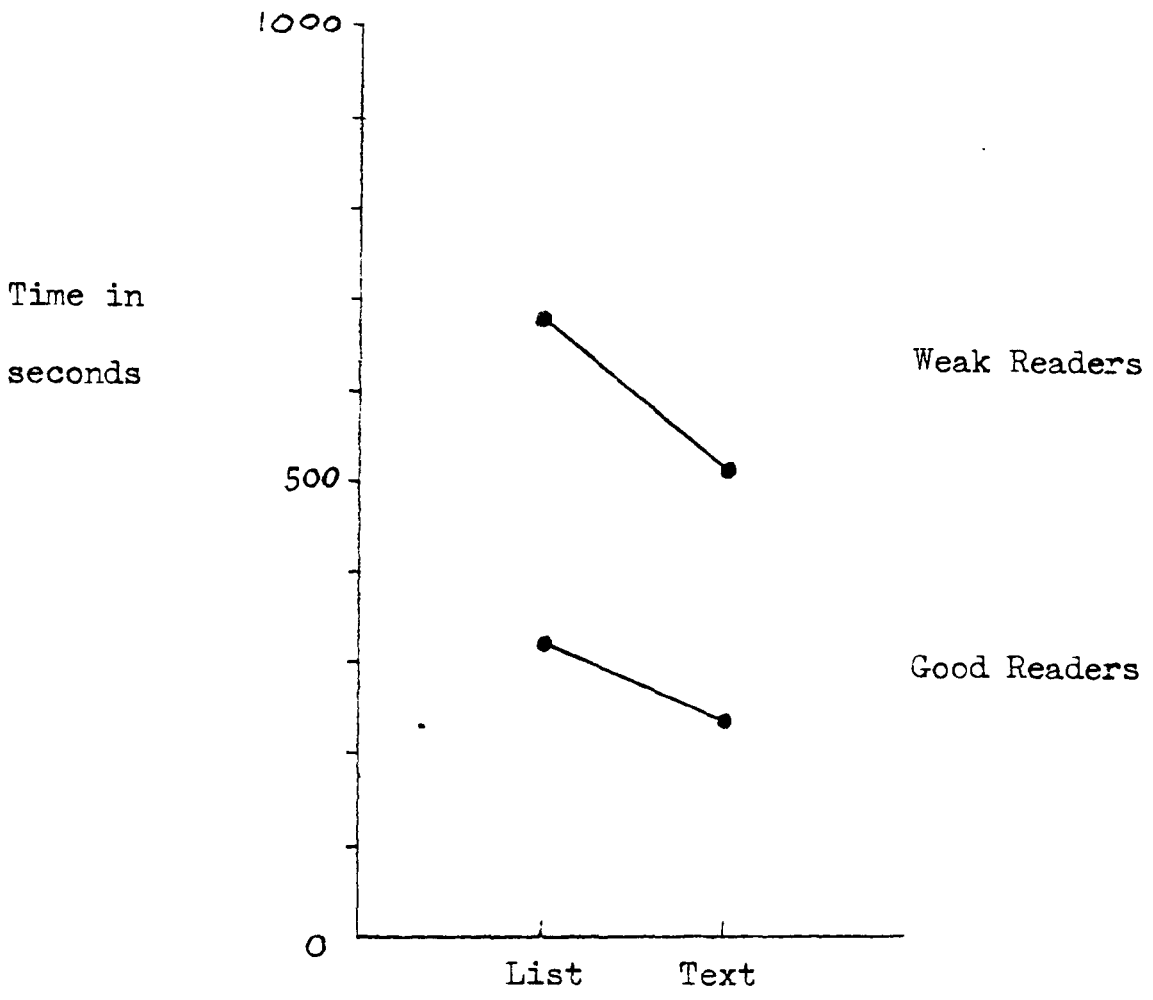


Figure 5. Experiment One: mean time taken (seconds) by Good and Weak Readers to read a total of 600 words.

8.4 Results (a) Statistical analysis.

Allington and McGill-Franzen subjected their data to three kinds of statistical analysis:

1. An analysis of variance to compare Good and Weak Readers with regard to their accuracy when reading a list followed by a text consisting of the same words.
2. A consideration of the commonality of error in the two conditions of context (text) and no context (list).
3. Spearman Rank Order Correlation Coefficients in order to compare the performances of the two groups of readers in the two conditions of context and no context.

The author subjected his data to the same statistical analysis, except that he produced an analysis of variance both for accuracy and for speed/rate of reading, since some authorities have suggested that rate of reading may be an important element in the reading process.

(1) Analysis of Variance.

(a) Accuracy.

The author took his subjects' raw scores for errors (see Appendix 1) and subjected them to a two-way analysis of variance, reading level (Good, Weak Readers) as Factor 1, by type of reading (lists of words, connected texts) as Factor 2, with repeated measures on the last factor. The following results were obtained (see Table 6).

The obtained value for Factor 1, F = 37.8, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that, as expected, the Good Readers scored differently from the Weak Readers so far as accuracy was concerned, to a significant extent.

The obtained value for Factor 2, F = 44.2, exceeded the F of 7.9

Analysis of Variance: Accuracy.

Source of Variation	Sum of Squares	d.f.	Variance	F	p
Factor 1	46252.17	1	46252.17	37.8	.01
Factor 2	3605.42	1	3605.42	44.2	.01
Interaction	2699.84	1	2699.84	33.1	.01
Within Subjects Error	1794.74	22	81.579		
Between Subjects Error	26933.83	22	1224.265		
Total	81286.00	47			

Table 6. Experiment One: analysis of variance for accuracy in the partial replication of Allington and McGill-Franzen's (1980) study.

at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that the difference between the Lists and the Texts produced a significant effect upon the performance of the readers in the test situation. Both Good and Weak Readers read the connected texts significantly more accurately than they read the same words presented as lists.

The obtained value for the Interaction, F = 33.1, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that the combined effects of Reading Skill (Good vs. Weak) and Format of Presentation (Lists vs. Texts) had a significant differential effect upon the performance of the readers in the test situation, so far as accuracy was concerned. The no context task (lists) was significantly more disruptive for the weak readers, which seemed to support the Guthrie model of reading.

(b) Speed/rate of reading.

The raw scores for speed/rate of reading, (see Appendix 2), were subjected to a two-way analysis of variance, reading level (Good, Weak Readers) as Factor 1, by type of reading (lists of words, connected texts) as Factor 2, with repeated measures on the last factor. The following results were obtained (see Table 7).

The obtained value for Factor 1, F = 27.5, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that, as expected, the Good Readers scored differently from the Weak Readers, to a significant extent.

The obtained value for Factor 2, F = 123.9, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that the difference between the Lists and the Texts produced a significant effect upon the performance of the readers in

Analysis of Variance: Speed/rate of reading.

Source of Variation	Sum of Squares	d.f.	Variance	F	p
Factor 1	1225282.5	1	1225282.5	27.5	.01
Factor 2	200079.2	1	200079.2	123.9	.01
Interaction	18447.53	1	18447.53	11.4	.01
Within Subjects Error	35532.77	22	1615.1		
Between Subjects Error	980346.8	22	44561.2		
Total	2459688.8	47			

Table 7. Experiment One: analysis of variance for speed/rate of reading in the partial replication of Allington and McGill-Franzen's (1980) study.

in the test situation so far as rate of reading was concerned. Both Good and Weak Readers read the connected texts significantly more quickly than they read the same words presented as lists.

The obtained value for the Interaction, F = 11.4, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected and it was concluded that the combined effects of Reading Skill (Good vs. Weak) and Format of Presentation (Lists vs. Texts) had a significant effect upon the performance of the readers in the test situation, so far as the rate of reading was concerned. The no context task (lists) was significantly more disruptive for the weak readers, which seemed to support the Guthrie model of reading.

It was therefore concluded that:

1. as expected, there was a significant difference between the Good and Weak Readers in accuracy of reading and in rate of reading;
2. there was a significant difference between the Lists and the Texts in their effect on accuracy of reading and rate of reading; and
3. the combined effects of Reading Skill (Good vs. Weak) and Format of Presentation (Lists vs. Texts) affected the accuracy and rate of reading to a significant extent. This Interaction (expressed in Figures 4 and 5) indicates that there was little difference in the performance of the Good Readers with regard to accuracy and rate of reading lists followed by texts; there was, however, a significantly greater difference in the performance of the Weak Readers. This differential effect suggests that the Weak Readers benefited to a significantly greater extent than the Good Readers from the linguistic cues provided by context. This seems to support the Guthrie model of reading (see Fig. 3).

(2) Commonality of Error.

Allington and McGill-Franzen presented a table which indicated the commonality of error in the two conditions of context and no context (see Table 8A). They gave no indication as to

(a) how they defined 'errors';

(b) how they computed the commonality of error from their data.

The following methods were therefore adopted.

Only "substitutions" were judged as common to both lists and texts; "omissions/insertions" were not considered relevant to this part of the statistical analysis. It was also decided that a substitution did not need to be exactly the same in both list and text in order to be considered common to both conditions. For example, Subject 13 pronounced "madman" as "madam" in both list B3 and text B3, which was therefore counted as an error common to both conditions. He pronounced "frantically" as "frantill" in list B4, but as "franchilly" in text B4. These miscues were also counted as an error common to both conditions.

It was assumed that Allington and McGill-Franzen had used a formula of the kind $Ce = \frac{C}{L + T} \times \frac{100}{1}$,

where Ce = the percentage commonality of error; C = number of errors common to both list and text; L = total number of list-errors; and T = total number of text-errors.

The commonality of error for Experiment One was computed with the following results (see Table 8B and Figure 6B). The Good Readers produced a commonality of error of 9%, which was similar to the findings of Allington and McGill-Franzen, whose Good Readers produced a commonality of error of 5%. The Weak Readers' commonality of error

A. Allington and McGill-Franzen (1980).

Reading ability and material difficulty	Mean number of errors: Common to both conditions	Unique, in context	Unique, in random order	Commonality of error
Good readers, grade 2 material	.08	1.75	4.34	1%
Good readers, grade 4 material	1.00	4.75	11.92	5%
Poor readers, grade 2 material	7.09	4.66	19.66	18%

B. The author's Experiment One.

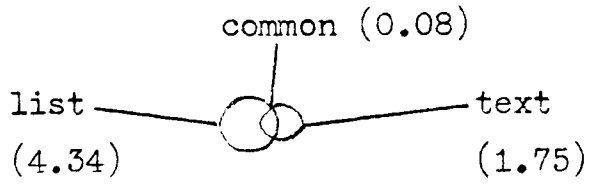
Good Readers	.34	.75	2.25	9%
Weak Readers	24.42	18.08	49.5	21%

Table 8. The commonality of error for the two conditions of context (text) and no context (list) as found by (A) Allington and McGill-Franzen (1980), and (B) the author in his Experiment One.

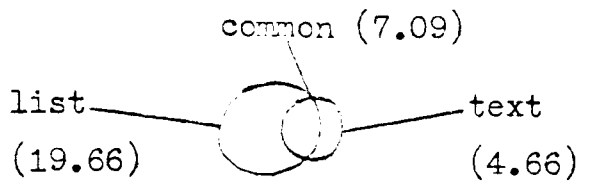
A. Allington and McGill-Franzen (1980).

Grade 2 material

Good Readers

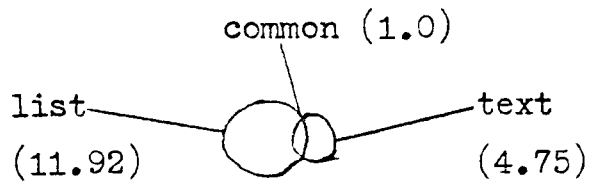


Weak Readers



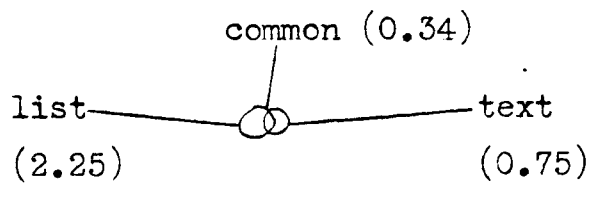
Grade 4 material

Good Readers



B. The author's Experiment One.

Good Readers



Weak Readers

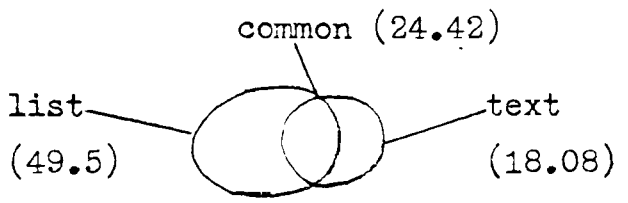


Figure 6. The mean number of errors produced by Good and Weak Readers when reading lists and equivalent texts, as found by (A) Allington and McGill-Franzen (1980), and (B) the author in his Experiment One.

was 21%, which was similar to the 18% produced in Allington and McGill-Franzen's study.

(3) Spearman Rank Order Correlation Coefficients.

Spearman Rank Order Correlation Coefficients were computed for the performances of Good and Weak Readers in the two conditions of context and no context (see Table 9B). The results were similar to those of Allington and McGill-Franzen, and were produced in the following way.

The 12 good readers were put into rank order in accordance with the average number of errors which they had made when reading the four lists: ie. the subject with no mistakes was ranked as number 1; the two subjects with the most mistakes were ranked last as number 11. The 12 good readers were then put into rank order in accordance with the average number of errors which they had made when reading the four texts: ie. the subject with the most mistakes was ranked last as number 12.

Spearman's formula was then applied:

$$S_r = 1 - \frac{6\Sigma d^2}{n(n+1)(n-1)} ,$$

where Σd^2 = the sum of the squares of the difference in rank for each subject when compared for list and text; and n = the number of subjects. This process was then repeated for the 12 weak readers.

The resulting coefficient indicated the amount of correlation between a group's response to the lists and to the texts: ie. a high correlation, such as .9, indicates that those who were most accurate at reading lists were also most accurate at reading texts; a low correlation, such as .2, suggests that those who were most accurate at reading lists were not necessarily most accurate at reading texts.

The results of Experiment One were similar to those of Allington and McGill-Franzen (see Table 9).

A. Allington and McGill-Franzen (1980).

	Spearman Correlation Coefficients	
Reading material	Good Readers	Poor Readers
2nd grade	.22	.94
4th grade	.28	

B. The author's Experiment One.

	Spearman Correlation Coefficients	
Reading material	Good Readers	Poor Readers
grade 3 (approximately)	.27	.99

Table 9. Spearman Rank Order Correlation Coefficients for the performances of Good and Weak Readers in the two conditions of context (text) and no context (list), as found by (A) Allington and McGill-Franzen (1980), and (B) the author in his Experiment One.

8.5 Results (b) Descriptive analysis.

A considerable quantity of descriptive data was produced when the responses of the twenty-four subjects were transcribed from tape on to copies of the two practice-texts and four main-texts. For the purposes of this study it was decided to limit the use of these data to a brief comment about two of the subjects who were dissimilar in their accuracy and rate of reading List B1 and its equivalent Text B1. Mark R. (Subject 17) was a Weak Reader, whereas Stephen B. (Subject 5) was a Good Reader.

Stephen B. made no mistakes when reading the list, nor when reading the text which contained the same words. The list took him 73.0 seconds and the text took him 44.0 seconds. At 2.0 words per second he readthe list four times more quickly than Mark R. At 3.4 words per second he read the text six times more quickly. His improvement in speed of reading, when changing from the list to the text, was 25%, which was twice that of Mark's 12.6% improvement. Stephen read the list quickly, with intonation which suggested that he was responding to the list in a similar way to that of reading a text. He read the words fluently in groups rather than as individual entities. He was clearly quick and accurate at basic word-recognition at this level of vocabulary. He then read the text smoothly and fluently, with meaningful intonation. His re-telling of the story immediately after reading it revealed a clear comprehension of the text in general outline, in details and in some of its implications.

Mark R. read list B1 and text B1 much more slowly and less accurately than Stephen, and rarely produced a sequence of words which flowed together. He read the text in a similar way to that of reading a list.

One of Mark's problems seems to have been that his recognition of written words was slow (see Table 10). Another problem, both when reading the list and the text, was that he used phonic strategies in ways that reveal faulty phonic understanding (see Table 11). It seems that his knowledge of phonic principles (ie. grapheme-phoneme associations) was at a level which did not provide him with effective strategies for aiding his linguistic knowledge.

For example, he read the phonically regular "dog" correctly when it was part of the list, but took 3.0 seconds to recognise it in the context of the text (see Table 10). It took him 13.0 seconds to recognise the word "sometimes" in the text, though it had taken only 7.0 seconds to recognise it in the list (see Table 10).

It is interesting to note that context helped him to read the words "thought" and "pump" more quickly than when they were in a list, but the word "sometimes" took him almost twice as long to read in context as out of context. This is in accordance with the views of some of the authors mentioned previously. For example, Hunter (1978) suggested that being mentally prepared in the wrong direction is worse than being relatively unprepared, since mental expectations of what is to come may sometimes impede recognition rather than facilitate it. Samuels, Begy and Chen (1975) demonstrated that at phrase level contextual cues may sometimes have the effect of retarding the speed of word recognition, rather than improving it.

Despite his difficulties, however, when he was asked to re-tell the story in his own words, Mark seemed to have grasped the gist of the story, even though he seemed less aware of some of the details and implications than Stephen. This is contrary to Smith's (1978) comment that it is impossible to comprehend a written text if it is

List.		Text.	
Word	Time taken to respond correctly (in seconds)	Word	Time taken to respond correctly (in seconds)
remember	4	newspaper	5
watching	5		
from	3		
thought	3	thought	2
burst	3	could	2
rushed	2	dog	3
back	6		
notice	10		
burning	2		
started	2		
swiftly	3		
pump	4	pump	3
water	8	aimed	4
water	2		
sometimes	7	sometimes	13
leave	2		
burning	5		
leave	2		

Table 10. Mark R.'s correct responses to those words in list B1 and text B1 which took longer than one second to produce.

List.			Text.		
Original Word	Approximate Pronunciation		Original Word	Approximate Pronunciation	
newspaper	newspare	(5, No)			
watching	worch	(5, Yes)			
back	dock	(No)			
fire	fear	(No)			
daughter	dun, down, downter	(10, No)	daughter	dainter	(6, No)
struggling	strung, strongly	(5, No)			
excited	ext, excavit	(8, No)	excited	exit	(9, No)
drive	drove	(2, No)			
			act	ask	(No)
grabbed	grabbit	(8, No)	grabbed	grubbled	(3, No)
bicycle	bicky, bickly	(15, No)	bicycle	bickue	(10, No)
pump	poo	(4, Yes)	pump	poop	(3, Yes)
could	cold	(2, No)	could	couldn't	(2, No)
mayor	may-or	(6, No)	mayor	menor	(5, No)
sometimes	some-thing	(7, Yes)	sometimes	smote	(13, Yes)
			leave	live	(3, No)
cigar	ker, kergger, kernel	(10, No)	cigar	chegger	(4, No)

Table 11. Mark R.'s attempts to use phonic strategies as an aid to word-recognition when reading list B1 and text B1 (with time in seconds and whether corrected or not).

read as slowly as one word per second.

One final observation seems pertinent to the investigation of word-recognition skills. When reading list B1, Mark R. revealed difficulties in speed of word-recognition and phonic-attack skills with 42 of the 150 words (28%). 28 of the problems were overcome, leaving 14 uncorrected words (9%). When reading text B1 he revealed difficulties in speed of word-recognition and phonic-attack with 24 words out of 150 (16%). 15 of the problems were overcome, leaving only 9 miscues (6%).

Initial difficulties in word-recognition with 28% of the list and 16% of the text seem to indicate that Mark was at a disadvantage compared with Stephen. Mark appeared to be relying on his linguistic skills as an aid to word-recognition far more than was the case for Stephen. Stephen apparently did not need to depend on his linguistic skills as an aid to word-recognition, since he had previously read the same words fluently as a list. This is in accordance with Allington's (1978a) views that good readers seem to rely on context more as an aid to fluency than as an aid to accuracy, whereas poor readers may rely on context primarily as an aid to accuracy.

8.6 Discussion.

(a) Statistical analysis.

The results of the statistical analysis provided some support for both models of reading - that of Goodman and that of Guthrie.

(1) Analyses of variance.

The analysis of variance of the subjects' scores for accuracy (see Table 6) produced results which were similar to those of Allington and McGill-Franzen (1980). They found that, as expected, the performance of the good readers was significantly different from that of the poor readers ($F = 14.26$, $p < .001$). Experiment One (Factor 1) also indicated that the good readers' performance was significantly different from that of the poor readers ($F = 37.8$, $p < .01$).

Allington and McGill-Franzen found that the random word task produced significantly more errors than the context task ($F = 57.73$, $p < .001$). Experiment One (Factor 2) also indicated that the random word task produced significantly more errors than the context task ($F = 44.2$, $p < .01$). This seems to support the Goodman model of reading, which suggests that readers can read a text more accurately than a list because they can utilise linguistic cues rather than merely rely on graphic cues (see Fig. 3).

Allington and McGill-Franzen found that the interaction was significant ($F = 28.78$, $p < .001$), and Experiment One also indicated that the interaction was significant ($F = 33.1$, $p < .01$). This indicated that the no-context task (list) was more disruptive for the poor readers than for the good readers: ie. the weak readers benefited significantly more than the good readers from the opportunity provided by texts to utilise their linguistic skills. This seems to support the Guthrie model of reading which implies that weak readers will

improve their accuracy more than good readers when reading a list followed by its equivalent text (see Fig. 3).

Similar results were obtained when the subjects' scores for speed rate of reading were subjected to an analysis of variance (see Table 7). (Allington and McGill-Franzen did not measure this aspect of reading in their 1980 study.) Experiment One (Factor 1) indicated that, as expected, the weak readers read words significantly more slowly than the good readers, both in lists and in texts ($F = 27.5$, $p < .01$).

Experiment One (Factor 2) indicated that both Good and Weak Readers took significantly less time to read the texts than the lists ($F = 123.9$, $p < .01$). This seems to support the Goodman model of reading, which implies that readers can read a text more quickly than a list because they can utilise linguistic cues rather than merely rely on graphic cues (see Fig. 3).

The interaction in Experiment One was significant ($F = 11.4$, $p < .01$). This indicated that the weak readers benefited significantly more than the good readers from the opportunity provided by texts to utilise their linguistic skills. This seems to support the Guthrie model of reading which implies that weak readers will increase their rate of reading more than good readers when reading a list followed by its equivalent text (see Figure 3).

(2) Commonality of error.

The analysis of the commonality of error between lists and texts in Experiment One produced similar results to those of Allington and McGill-Franzen (see Table 8 and Figure 6). It was concluded that they had been justified in questioning the assumption that word-recognition in either context or isolation can be employed to predict similar errors in the other condition.

(3) Spearman Rank Order Correlation Coefficients.

The computation of Spearman Rank Order Correlation Coefficients in Experiment One produced results which were very similar to those of Allington and McGill-Franzen (see Table 9), and seem to lead to the same conclusions. Such correlations do not in themselves indicate that one can use word-recognition in lists to predict ability to read the same words in context. The correlations merely indicate that one can predict to a certain extent general reading ability based upon the results of a word-recognition task. This is not the same as using a reader's performance on a word-list as a means of ascertaining specific weakness in word identification.

(b) Descriptive analysis.

The descriptive data also provided some support for both models of reading. Goodman stressed the reader's use of context as the primary element in reading, but some of the findings in Experiment One provided evidence which conflicted with this view and was more supportive of Guthrie's belief that basic word-recognition is the primary element in reading.

Stephen B., a Good Reader, was able to read a list of context-free words quickly, accurately and fluently. His rhythm and intonation were in the style of reading connected text, both when he read the text and when he read the list. Mark R., a Weak Reader, tended to read the words slowly and inaccurately, whether they were in context or not. His rhythm and intonation were in the style of reading a list of unconnected words, both when he read the list and when he read the text. These two examples seem to provide some support for Guthrie's belief that quick, accurate, context-free word-recognition is of primary importance in enabling readers to utilise their linguistic skills.

The descriptive findings of Experiment One also provided some support for Goodman's views. Both Stephen and Mark read text B1 more quickly than they read list B1. Stephen took 73 seconds to read the list, but only 44 seconds to read the text; Mark took 303 seconds to read the list, but only 235 seconds to read the text. Mark made 14 mistakes in the list, but only 9 mistakes in the text; Stephen made no mistakes in either list or text.

Contextual cues apparently helped Mark to read more accurately, and both Stephen and Mark apparently read more quickly because of the presence of context. Improvement in Stephen's accuracy was not

measurable in this case, since he made no mistakes when reading the list.

8.7 Conclusion.

It had been expected that Experiment One would tend to support either Goodman or Guthrie. In the event, the results provided evidence to support some aspects of both models of reading.

The statistical analysis and consideration of some of the descriptive data supported Goodman's model in so far that the results indicated that both the Good and the Weak Readers read the texts significantly more accurately and more quickly than the lists. The same data also provided support for Guthrie's model in so far that the results indicated a significant differential effect between the improvement of the Good and the Weak Readers, when reading lists followed by texts. This improvement was seen in both accuracy and speed/rate of reading, and indicated that the Weak Readers benefited more than the Good Readers from the opportunity to use context as an aid to word recognition.

The results of Experiment One therefore seem to provide support for Stanovich's (1980) view that a new, inter-active model of reading is desirable. Such a model would attempt to integrate bottom-up models (such as Guthrie's) with top-down models (such as Goodman's).

Allington and McGill-Franzen (1980) commented that the differences in the level of accuracy of their two groups precluded useful comparisons as to the extent to which good and poor readers rely on contextual information. The same problem was experienced in Experiment One. Texts which are suitable for weak readers are too simple for good readers. The resulting "ceiling effect" for the Good Readers (see Fig. 4) prevents a meaningful comparison of the relative importance of context and basic word-recognition for each group. The differential effect between the two groups, which seems

to support the Guthrie model of reading, may be unavoidable when using the kind of test instrument described in Experiment One.

It was also unfortunate that the two groups of Good and Weak Readers were not matched for intelligence in Experiment One. The mean intelligence quotient of the Weak Readers was 76.4; that of the Good Readers was 126.5 (see Table 5). Mark R.'s I.Q. was 84, whereas Stephen B.'s I.Q. was 122, and this difference may explain the differences in their fluency and their comprehension when responding to text B1.

Mark's tendency to read the text slowly and inaccurately in the style of a list could be ascribed to his generally low level of intelligence rather than to his slow and inaccurate basic word-recognition. Likewise Stephen's ability to read the text fluently could be ascribed to his generally high level of intelligence rather than to his quick and accurate basic word-recognition.

Mark's apparently poor memory for, and comprehension of, details in the text may also have been a result of his low intelligence. Stephen B. may have been able to understand and remember the details of the text more accurately because of his higher level of intelligence.

It seemed desirable to develop a further test instrument as a means of comparing the two models of reading presented by Goodman and Guthrie. Such an instrument would need to:

1. produce a text which would be suitable for both groups of readers;
2. find a way to compare List-Text Change, so as to allow for the Good Readers' superiority in basic word-recognition.

It would also be desirable to match the two groups for their level of intelligence. Experiment Two was an attempt to achieve this.

9.0 Experiment Two. The effect of Homophones upon Good and Weak Readers when reading Lists and equivalent Texts.

9.1 Introduction.

9.2 Method.

9.3 Procedure.

9.4 Results (a) Statistical analysis.

9.5 Results (b) Descriptive analysis.

9.6 Discussion.

9.7 Conclusion.

9.1 Introduction.

A review of the literature (Chapters Two to Seven) indicates that it is no easy task to produce test instruments which will indicate the relative importance of basic word-recognition skills and linguistic skills in the reading process. One difficulty is that Good and Weak readers vary considerably in their ability to respond quickly and accurately to printed words, whether in isolation or in context. It was decided to use two techniques in order to provide alternative means of comparing these two groups:

1. The amount of improvement within each group was measured when the subjects read lists followed by their equivalent texts; and
2. One of the texts presented to each subject included homophones.

(a) An Index (coefficient) of List-Text change.

Research has indicated that readers are able to utilise their knowledge of language in order to speed up the process of recognising individual words, when these words are part of connected text. There is also, usually, an improvement in accuracy. It was assumed in Experiment Two that the measurement of this List-Text change might provide data to be used for further analysis when testing the performance of readers.

Marshall, Caplan and Holmes (1975) referred to the problem of constructing measures which would cope with the fact that subjects may differ considerably in the overall accuracy of their performance. They suggested a formula to produce a suitable coefficient.

It was decided to use this formula in Experiment Two as a way of coping with the problem of comparing Good and Weak readers, who usually produce widely differing scores when compared directly in response to the same list and text. The formula was modified to produce the following:

$$Ic = \frac{A - B}{A + B} \times \frac{100}{1},$$

where Ic = the Index (coefficient) of the percentage rate of change (improvement) when reading a list followed by its equivalent text; A = the total number of words read correctly from a text (or the time taken to read a list in seconds); and B = the total number of words read correctly from the equivalent list (or the time taken to read the equivalent text in seconds).

This index made it possible to measure each subject's amount of List-Text change in relation to his overall performance. It was used to measure improvements both in accuracy and in speed. The index of change for each subject was then used as a raw score for further statistical analysis. It was assumed that this percentage index-score could be considered as part of an interval scale in so far that no change (Ic = 0.0%) represents a base line, and a change of 20% really does represent a change for one subject which is twice as large as a 10% change for another subject.

The use of this formula provides an alternative means of evaluating the response of Good and Weak readers to the same list and text. The two groups are not judged directly by the speed or accuracy of their reading: Good Readers can be expected to read lists and texts more quickly and accurately than Weak Readers. Each group

is first evaluated within itself: one set of scores is compared with another to ascertain the amount of improvement in speed or accuracy for that group when changing from a random set of words (list) to the same words as a connected passage (text). Then the two groups may be compared to ascertain whether there is a significantly greater improvement by the Good Readers or by the Weak Readers, or whether there is no significant difference in their amount of improvement.

The two models of reading presented by Goodman and Guthrie imply that there are alternative possibilities as to the amount of improvement which Good and Weak Readers will make when changing from a list to its equivalent text. According to Guthrie's model, Weak Readers should improve more when reading a list followed by its equivalent text, because they tend to rely on their linguistic skills in order to improve the accuracy of their word recognition. Good Readers are already accurate at basic word recognition and therefore do not need to rely on their linguistic skills so much as Weak Readers in order to improve their accuracy. They will therefore not improve so much when reading a list followed by its equivalent text as the Weak Readers (see Fig. 3B).

According to Goodman there is no fundamental difference between individual readers, in so far that all readers rely primarily on their linguistic skills, but it is probable that Beginning Readers need to rely on visual cues more than Experienced Readers. If we equate Good with Experienced Readers, and Weak with Beginning Readers, then Goodman's model presents two possible implications: either

1. there is no fundamental difference between Good and Weak Readers, since all readers rely primarily on linguistic skills and there will therefore be no significant difference between Good and Weak

Readers in the amount of List-Text change which each group makes; or

2. if there is a significant difference, it will be that Good Readers reveal more improvement when reading a list followed by its equivalent text than the Weak Readers, because the Good Readers are more experienced at using their linguistic skills (see Fig. 3A).

(b) The inclusion of homophones.

It seemed desirable in Experiment Two to find a way to compensate for the differences in word-recognition ability between Good and Weak Readers. Experiment One had suffered from the same problem as that of Allington and McGill-Franzen (1980): a text which was suitable for Weak Readers was too easy for the Good Readers and therefore precluded meaningful comparisons. One of the ways in which Good and Weak Readers are distinguishable is that the latter group usually cannot respond as quickly and accurately as the Good Readers to a particular list of words.

LaBerge (1972, page 244) quoted a sentence from Samuels, which contained several homophones used incongruously: "The buoy and the none tolled hymn they had scene and herd a pear of bear feat in the haul." This seems to imply that the incongruous use of homophones within a text could be used to examine the possible role of visual cues on the process of reading. Much of the controversy between the two schools of thought represented by Goodman and Guthrie has centred around the relative importance within the reading process of being able to decode individual words quickly and accurately solely on the basis of their visual impact.

The two models of reading imply that alternative predictions are

possible as to the amount of improvement which Good and Weak Readers may make when changing from a list to its equivalent text, if that text includes homophones used incongruously. The pattern of predictions is similar to that presented in section (a) when explaining the use of the Index of List-Text change.

According to Guthrie's model, Weak Readers should improve more than Good Readers when reading a list followed by its equivalent text. Good Readers are apparently able to recognise words quickly and accurately before using their linguistic skills, and therefore are likely to be adversely influenced by the inclusion of incongruous homophones within a text. Weak Readers tend to need to use their linguistic skills as a means to, and therefore before, recognising words, and therefore should be less affected by the inclusion of homophones within a text, because they do not look at the spelling patterns of each word as accurately as the Good Readers (see Fig. 3B).

According to Goodman there is no fundamental difference between individual readers in so far that all readers depend on their linguistic skills as their primary source of obtaining cues when reading. He does suggest, however, that it is probable that Beginning Readers need to rely more on visual cues than Experienced Readers. Goodman's model therefore seems to imply that there will be no significant difference between Good and Weak Readers in the amount of List-Text change which each group makes. If there is a significant difference between the two groups, it will be that the Good Readers make more improvement than the Weak Readers when reading a list followed by its equivalent text, since they do not need to look at individual words as accurately as Weak Readers and therefore will not be so affected by a text which includes incongruous homophones (see

Fig. 3A). All readers, but particularly the Good Readers, will tend to skim words without being aware of the precise spelling of each word.

Experiment Two therefore consisted of a comparison of the amount of List-Text change within each group of Good and Weak Readers in response to homophones used incongruously in a text which was at a suitable level for the Weak Readers.

9.2 Method.

The subjects were twenty-four pupils from a North-London boys' comprehensive school. They were seen individually and each test session lasted for about twenty minutes. There were twelve Good Readers and twelve Weak Readers, who were matched for age and intelligence (see Table 12).

Experiment One had been unsatisfactory in so far that Good and Weak Readers had not been matched for intelligence. In Experiment Two, pairs of Good and Weak readers were matched as closely as possible for intelligence, but their levels of reading ability were as different as possible.

Each subject was presented with a text of 600 words, which had been devised specially for this experiment. This text was divided into three shorter texts, each of 200 words. Each short text was presented in one of three ways:

1. it could be listened to as a tape-recorded passage, with no visual display (L);
2. it could be seen as a typed text consisting solely of words spelt according to standard English orthography (S); and
3. it could be seen as a typed text which included approximately seventy homophones in place of standard spellings (H).

The homophones were heterographic: ie. each homophone was pronounced in the same way as the original word in the text, but was spelt differently from it and had a completely different meaning, eg. blew and blue. There were seventy homophones in Text One, sixty-five homophones in Text Two, and seventy-five homophones in Text Three. These 210 homophones constituted 35% of the total text, and had been chosen from a specially prepared list.

	Mean Reading Quotient[1]	S.D.	Mean Intelligence Quotient[2]	S.D.	Mean Age (Years)	S.D. (Months)
Good Readers	113.75	3.9	106.75	11.2	12.0	4.9
Weak Readers	89.92	3.3	105.8	10.3	12.0	3.6

[1]Wide Span Reading Test, Thomas Nelson and Sons, Ltd.

[2]Non-Verbal Test DH, National Foundation for Educational Research.

Table 12. Experiment Two: Mean Reading Quotient, Mean Intelligence Quotient, and Mean Age of the two groups of subjects.

A suitable list of homophones was lacking. Such a list was therefore devised by choosing sets of words from Collins Dictionary of the English Language (1979). This was used to provide material for Experiment Two and was then published: Terrell and Meadows, (1985 (see Appendix 3).

In order to assess the subjects' comprehension of the texts, several questions were asked immediately after each text had been read by each subject. It was thought that if questions were asked which involved the production of certain "target-words", this would provide a more effective way of assessing the affects of homophones than if each subject were asked to re-tell the passage in his own words, as had been done in Experiment One.

However, the process of oral reading produces an additional load on the reader's attention, and this may affect both comprehension and recall. When a reader pronounces written words aloud, this requires mental processes beyond those used for the normal comprehension of spoken language. Reading aloud may be considered a process of simultaneously looking, speaking and listening. The reader pronounces written words aloud and then needs to monitor what has been heard as one way of extracting meaning from it.

Each subject was therefore required to listen to a text and answer questions about it without seeing the printed words either as a list or as a text. It was thought that this would provide a base-line from which to compare the relative effect on comprehension produced by reading homophone-texts and standard-texts.

9.3 Procedure.

Each subject was required to listen to one of the texts, read aloud a second text printed in standard English, and read aloud a third text which included homophones. The three short texts were always presented in the same order so as to produce a continuous story.

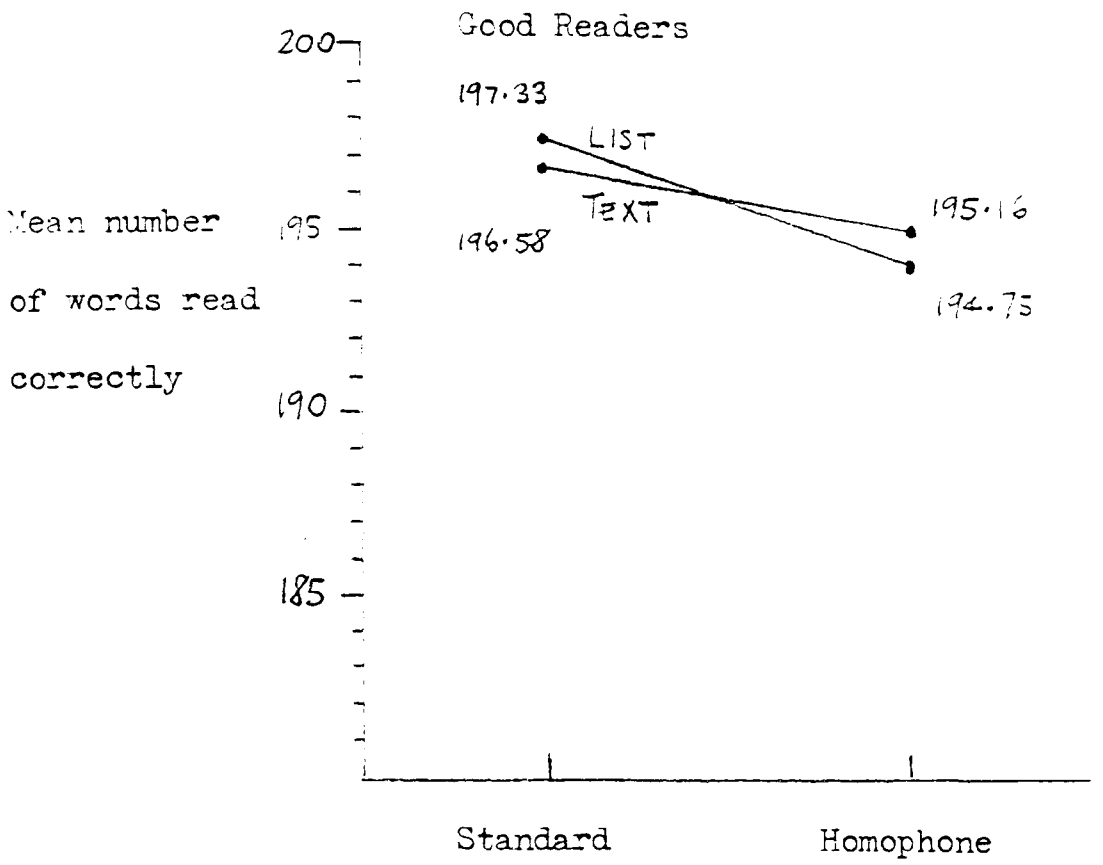
Where a text was to be read aloud, the subject was first required to read the 200 words of the text presented as a list of words in random order mounted on a separate card from that of the text.

After a text had been heard or seen, the subject was asked several questions about it, and certain "target-words" were required as part of the answer. Each target-word existed as a homophone, eg. fort and fought.

After each subject had been exposed to the three texts and had answered questions about them, three final questions were asked in order to obtain information about the subjects' perceptions of the experiment.

Each twenty-minute session was tape-recorded and later transcribed as follows:

1. Errors were transcribed on to copies of the lists and texts. A non-standard reading of the expected word, if uncorrected, was considered to be an error. The mean number of words read correctly was calculated for the two groups of Good and Weak Readers when reading lists and texts in the two formats involving Standard Spelling and Homophone Spelling (see Fig. 7, and Appendices 4 and 5).
2. The time taken by each subject to read each list and text was noted, and the mean time taken by the two groups of Good and Weak



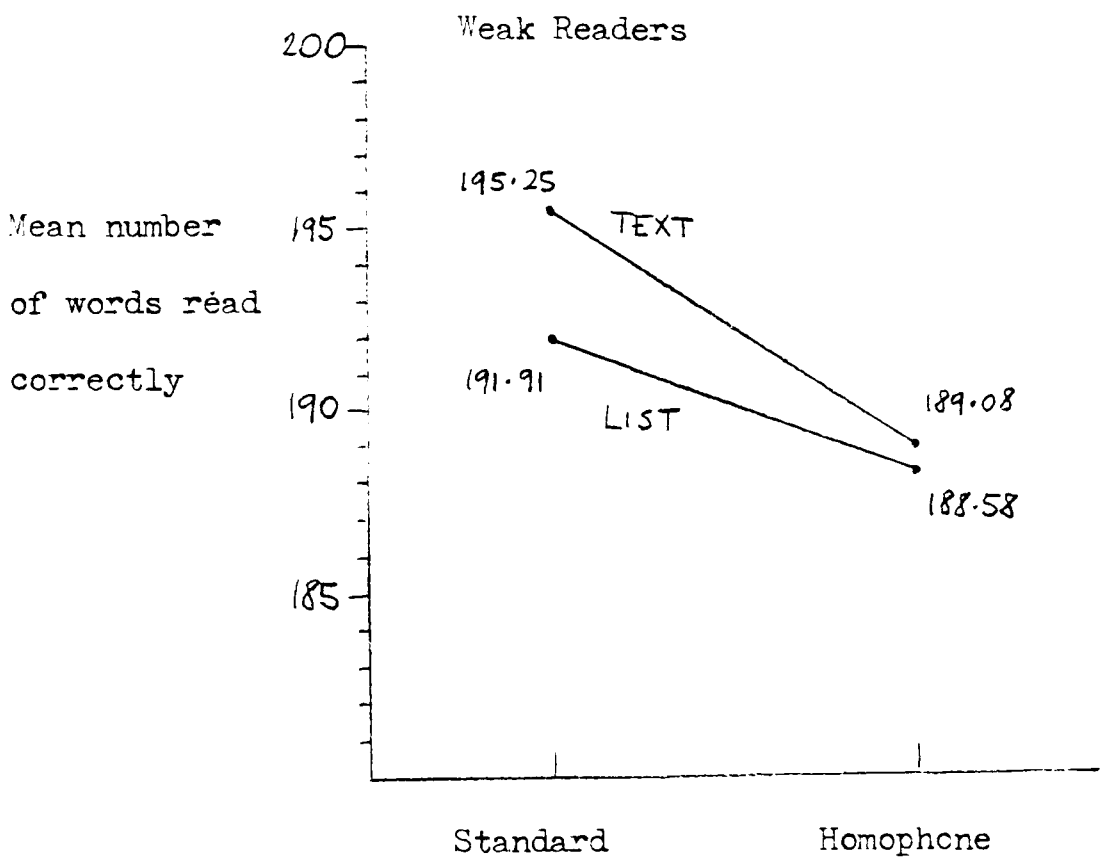
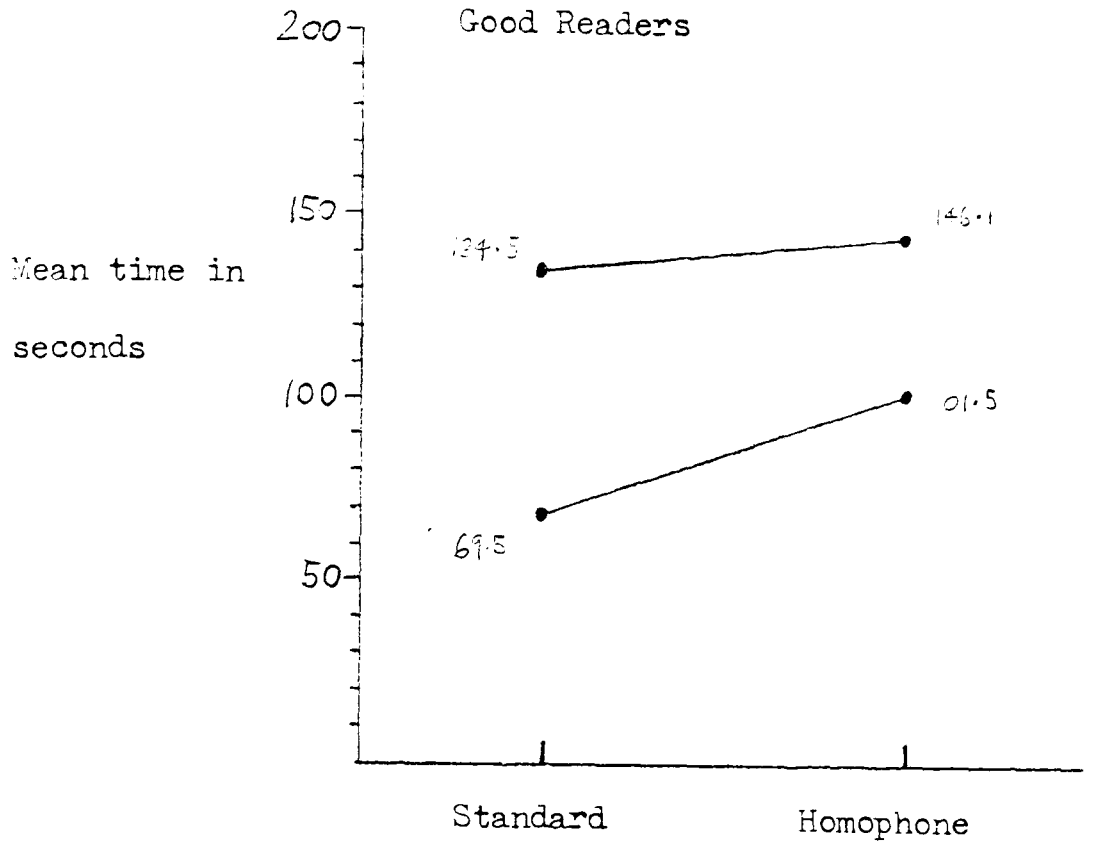


Figure 7. Mean number of words read correctly by Good and Weak Readers when reading lists and texts in the two formats involving Standard Spelling and Homophone Spelling.

Readers to read lists and texts was calculated for the two formats involving Standard Spelling and Homophone Spelling (see Fig. 8, and Appendices 6 and 7).

3. The subjects' answers to all the questions related directly to the texts were transcribed. A mark was given for each target-word which the subject was able to produce as his answer or part of an answer. There were ten target-words for each text. The total number of target-words achieved by Good and Weak Readers in response to the three formats was then calculated (see Fig. 9).



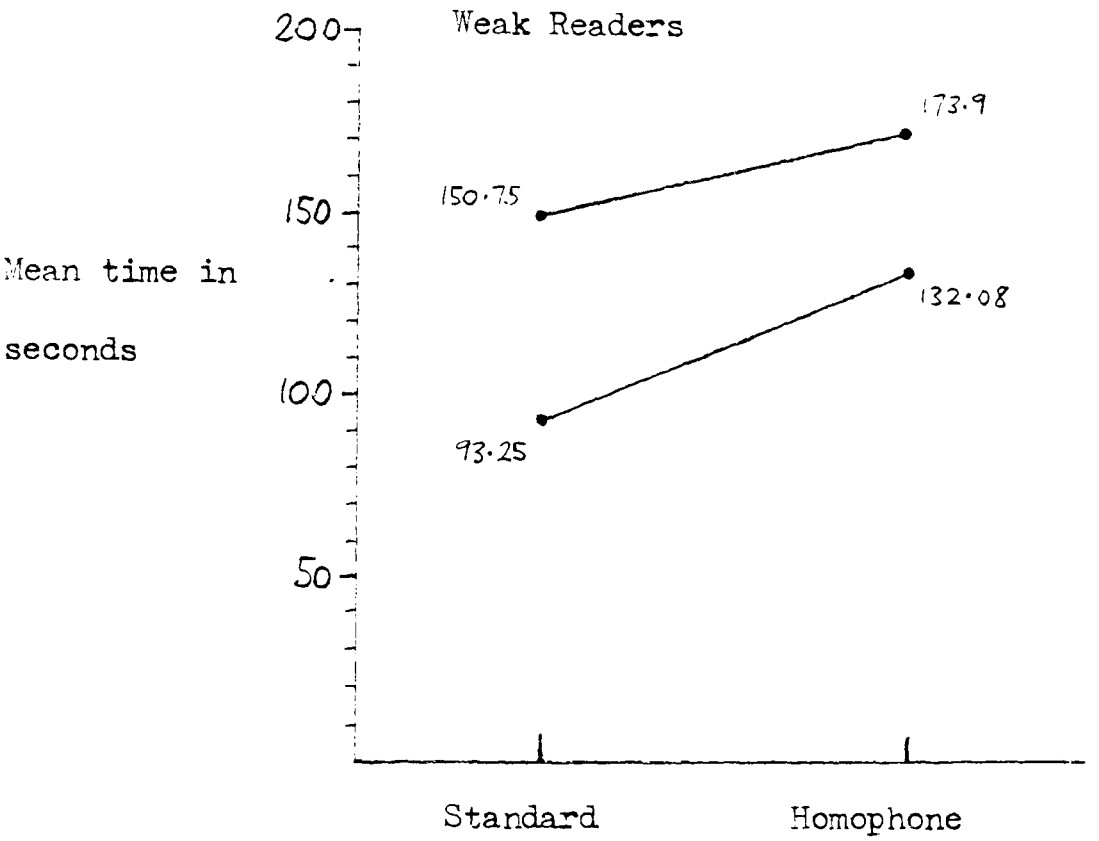


Figure 8. Mean time taken by Good and Weak Readers to read lists and texts in the two formats involving Standard Spelling and Homophone Spelling.

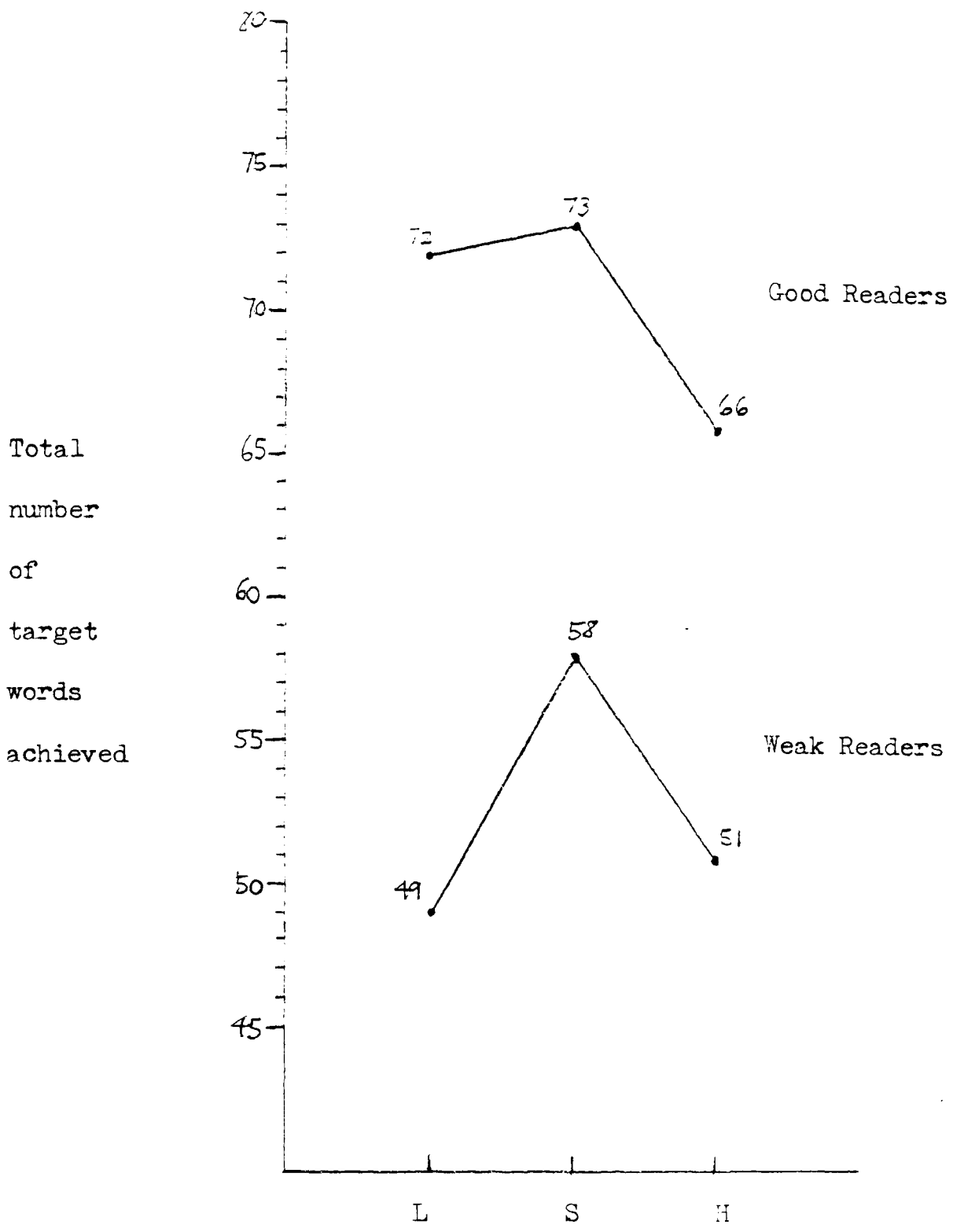


Figure 9. Total number of target-words achieved by Good and Weak Readers in response to questions relating to the three texts in the three formats of Listening (L), oral reading of a text printed in Standard Spellings (S), and oral reading of a text including Homophone Spellings (H).

9.4 Results (a) Statistical analysis.

The formula $Ic = \frac{A - B}{A + B} \times \frac{100}{1}$ was applied to the raw scores of each reader in response to each list and text (ie. Standard Spelling, Homophone Spelling). In the case of Accuracy, A = the number of text-words read correctly and B = the number of list-words read correctly (see Appendices 4 and 5). In the case of Speed/rate of reading, A = the time taken to read the list (in seconds) and B = the time taken to read the text (see Appendices 6 and 7).

The resulting index (Ic) represented each subject's percentage change (improvement or deterioration)(see Figures 10 and 11). The index scores were then used as data for further statistical analysis, as explained in the Introduction to Experiment Two.

These index-scores were subjected to a two-way analysis of variance, reading level (Good, Weak Readers) as Factor 1, by type of spelling (Standard Spellings, Homophone Spellings) as Factor 2, with repeated measures on the last factor. The following results were obtained (see Tables 13 and 14).

(1) Accuracy.

The obtained value for Factor 1, F = 3.08, did not exceed the F of 7.9 at the 0.01 level. The null hypothesis was therefore accepted. It was concluded that there was no significant difference between the Good and Weak Readers in the improvement of their accuracy when reading the two lists (Standard Spellings, Homophone Spellings) followed by the equivalent texts.

The obtained value for Factor 2, F = 0.78, did not exceed the F of 7.9 at the 0.01 level. The null hypothesis was therefore accepted. It was concluded that there was no significant difference between the Standard Spellings and the Homophone Spellings in their effect on the

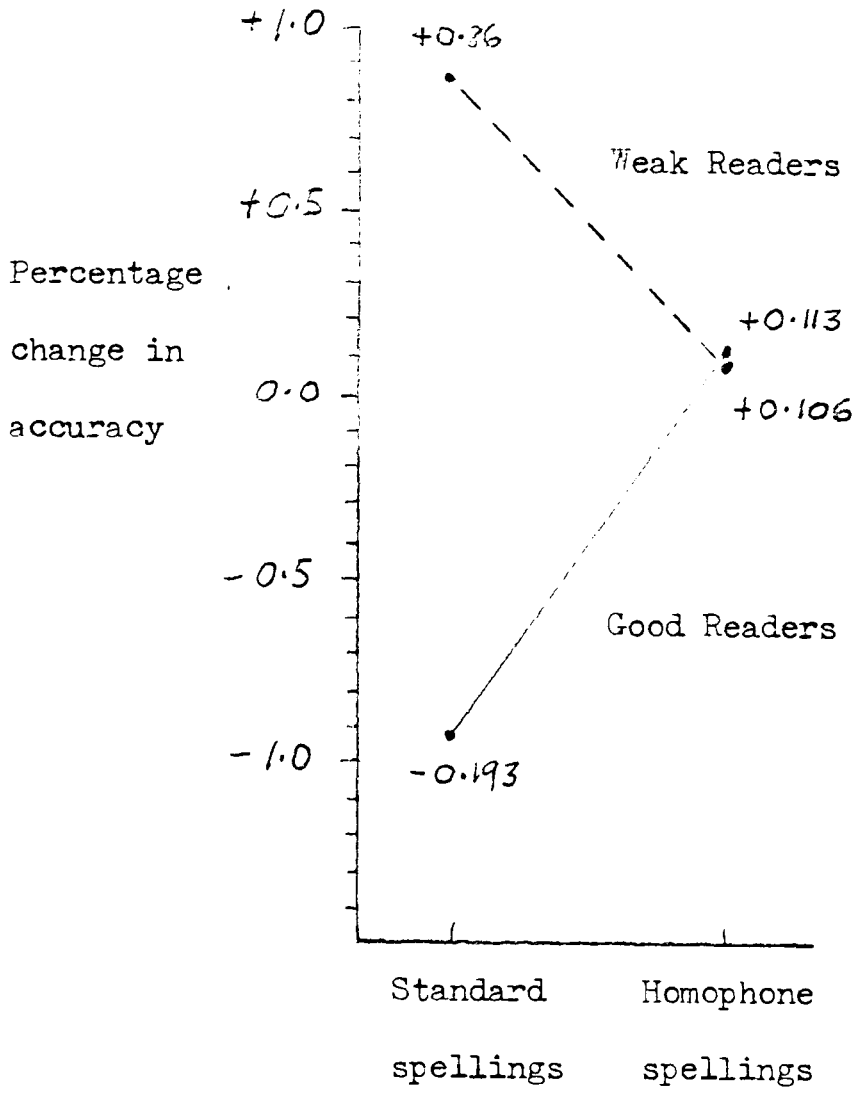


Figure 10. Experiment Two: mean scores of the accuracy indices for Good and Weak Readers when orally reading lists followed by equivalent texts presented either in standard spelling or in texts including homophones.

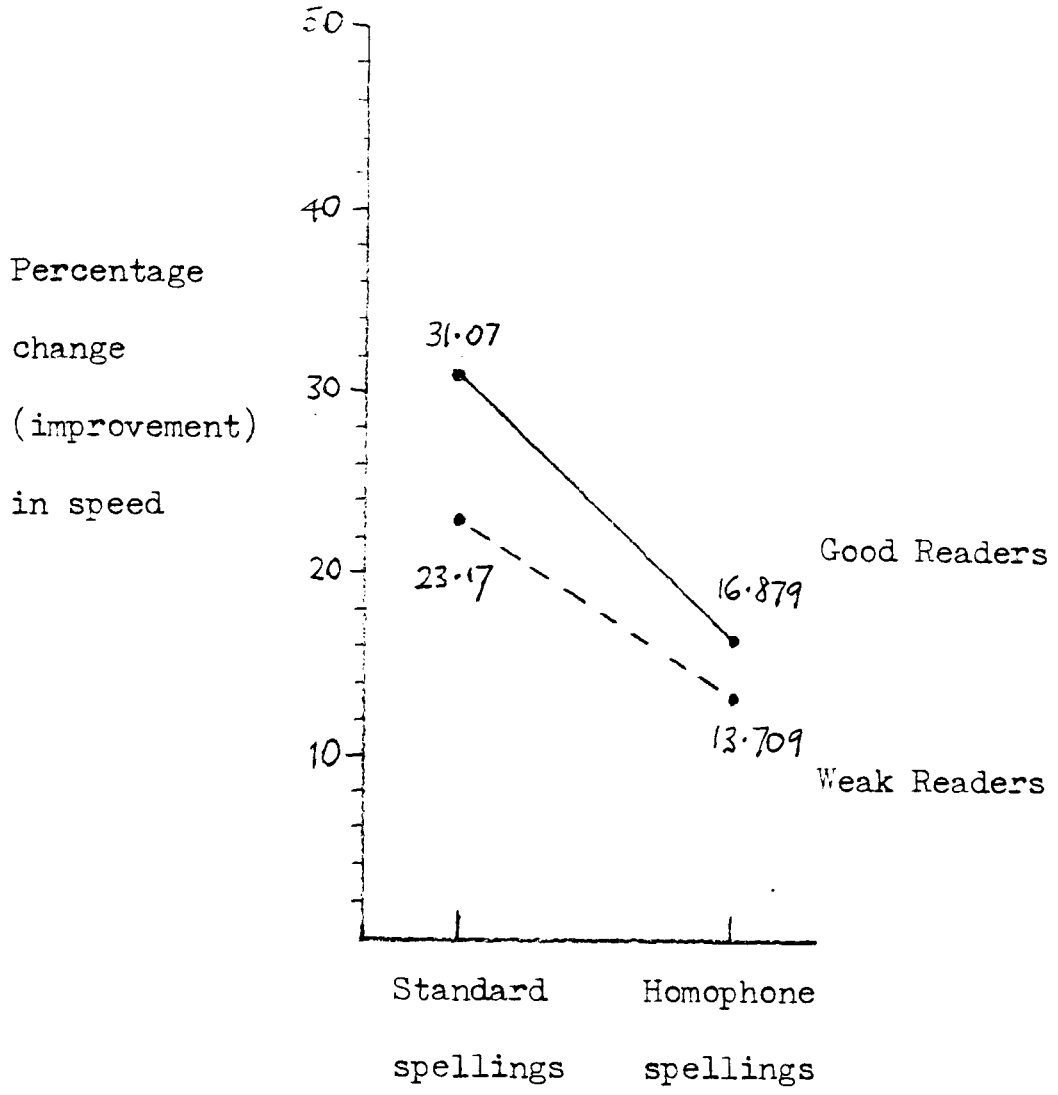


Figure 11. Experiment Two: mean scores of the <u>speed indices</u> for Good and Weak Readers when orally reading lists followed by equivalent texts presented either in standard spelling or in texts including homophones.

Analysis of Variance: Accuracy.

Source of Variation	Sum of Squares	d.f.	Variance	F	p
Factor 1	328.3	1	328.3	3.08	N.S.
Factor 2	60.3	1	60.3	0.78	N.S.
Interaction	337.2	1	337.2	4.38	N.S.
Within Subjects Error	1696.0	22	77.0		
Between Subjects Error	2340.2	22	106.4		
Total	4762.0	47			

Table 13. Experiment Two: analysis of variance for accuracy in the study into the effects of Homophones on the amount of change in the performance of Good and Weak Readers when reading lists followed by their equivalent texts.

Analysis of Variance: Speed/rate of reading.

Source of Variation	Sum of Squares	d.f.	Variance	F	p
Factor 1	367.6	1	367.6	2.9	N.S.
Factor 2	1678.4	1	1678.4	97.0	.01
Interaction	67.2	1	67.2	3.9	N.S.
Within Subjects Error	379.9	22	17.3		
Between Subjects Error	2757.1	22	125.3		
Total	5250.2	47			

Table 14. Experiment Two: analysis of variance for speed/rate of reading in the study into the effects of Homophones on the amount of change in the performance of Good and Weak Readers when reading lists followed by equivalent texts.

change in accuracy when the subjects read the two lists followed by the equivalent texts.

The obtained value for the Interaction, F = 4.38, did not exceed the F of 7.9 at the 0.01 level. The null hypothesis was therefore accepted. It was concluded that the combined effects of Readers' Ability and Style of Spelling made no significant difference to the change in accuracy when subjects read lists followed by the equivalent texts. This seems to support the Goodman model of reading, which implies that there should be no significant difference between Good and Weak Readers in response to texts which include homophones.

(2) Speed/Rate of Reading.

The obtained value for Factor 1, F = 2.9, did not exceed the F of 7.9 at the 0.01 level. The null hypothesis was therefore accepted. It was concluded that there was no significant difference between the Good and Weak Readers in the improvement of their rate of reading when reading lists followed by the equivalent texts.

The obtained value for Factor 2, F = 97.0, exceeded the F of 7.9 at the 0.01 level. The null hypothesis was therefore rejected. It was concluded that there was a significant difference between the Standard Spellings and the Homophone Spellings in their effect upon the improvement in the rate of reading when subjects read lists followed by the equivalent texts.

The obtained value for the Interaction, F = 3.9, did not exceed the F of 7.9 at the 0.01 level. The null hypothesis was therefore accepted. It was concluded that the combined effects of Readers' Ability and Style of Spelling made no significant difference to the improvement in the rate of reading when subjects read lists followed by the equivalent texts. This seems to support the Goodman model of

reading, which implies that there should be no significant difference between Good and Weak Readers in response to texts which include homophones.

(3) Listening compared with Reading Aloud.

The results of the comprehension questions (see Fig. 9) were subjected to t-tests. Listening was compared with Standard-Texts and with Homophone-Texts; Standard-Texts were compared with Homophone-Texts.

When a two-tailed t-test was applied to the indices for each pair of conditions, the results indicated that there was no significant difference between the Good and Weak Readers with regard to the amount of change in their comprehension when answering questions about Homophone texts as compared with answering questions about Standard texts. Nor was there a significant difference between the Good and Weak Readers with regard to the amount of change in their comprehension when answering questions after listening and after reading aloud (see Table 15).

Listening - Standard Spelling: Indices (Comprehension)

	Mean	S.D.	d.f.	t	p
Good Readers	-2.091	19.72	11	+0.89	N.S.
Weak Readers	-10.866	27.88			

(A) Mean indices showing the rate of change in Comprehension when changing from Listening to Oral Reading of texts involving Standard Spellings.

Listening - Homophone Spelling: Indices (Comprehension)

	Mean	S.D.	d.f.	t	p
Good Readers	+3.766	17.26	11	+0.829	N.S.
Weak Readers	-6.452	39.03			

(B) Mean indices showing the rate of change in Comprehension when changing from Listening to Oral Reading of texts involving Homophone Spellings.

Standard Spelling - Homophone Spelling: Indices (Comprehension)

	Mean	S.D.	d.f.	t	p
Good Readers	+6.121	16.06	11	-0.134	N.S.
Weak Readers	+7.447	30.39			

(C) Mean indices showing the rate of change in Comprehension when changing from oral reading of texts involving Standard Spellings to texts involving Homophone Spellings.

Table 15. Experiment Two: listening compared with reading aloud.

9.5 Results (b) Descriptive analysis.

As part of the investigation each session ended with three questions. The main purpose of this was to ascertain how far the subjects had been aware of the homophones and to obtain their subjective impressions as to how far, and in what ways, their reading had been affected. Their answers were transcribed in full from the tapes, classified, and tabulated in order to indicate the ideas which they expressed (see Tables 16, 17, 18 and 19).

Question 1: What do you feel about this experiment?

1. Non-committal response 5

   EXAMPLES: (1) Nothing really (S1)...(2) All right (S2)... (3) No special feelings (S8)...(4) I don't know (S15).

2. Didn't find it easy 3

   EXAMPLES: (1) I suffer from asthma, and so it was heavy going (S4)...(2) It was quite tiring (S9)...(3) I'm not hiding that I'm not a very good reader. It's easier to listen to something than to read it - and remember (S16).

3. Enjoyed it 9

   EXAMPLES: (1) It was fun really (S5)...(2) It was good (S10) ...(3) I enjoyed it (S24).

4. Implied that some words were spelt wrongly 4

   EXAMPLES: (1) In the last story I read, the words were - they said the right thing, but they meant other things (S14) ...(2) The words weren't written properly - as they would be (S18)...(3) Some of the words were the wrong words! (S23)... (4) I got a bit muddled up with the words, the say they were - the spelling of them (S24) Note: S24 mentioned incorrect spellings after mentioning enjoyment and so has been included in both groups.

5. Stated that some of the words were spelt wrongly 4

   EXAMPLES: (1) on one of the cards some things were spelt wrong (S6)...(2) The spellings are all wrong! (S13)

25

Table 16. The first of three final questions, presented separately in conversation at the end of each session, and the responses to it, with some examples.

Question 2: Were any of the words unusual in any way?

1.	Had mentioned spelling in reply to question one	5
2.	Commented on unusual words without using the word "spelling"	7
	EXAMPLES: (1) A couple of them were. Would was spelt W-O-O-D when it should be W-O-U-L-D (S1)...(2) They looked different to what I would usually say (S20)...(3) Instead of - say - "bear", they spelt the wrong "bare" (S23).	
3.	Stated that some words had been spelt wrongly	11
	EXAMPLES: (1) Yes. Bald/balled and things like that. They were spelt wrong (S3)...(2) Mis-spelt (S4)... (3) They were spelt wrong. A different way (S7)... (4) Yes. Like in the first story - "son" is the opposite spelling (S8)...(5) Yes. In one of the stories they were spelt wrongly, but they were the same meaning (S9)... (6) Yes. They were spelt incorrectly. And some were the different kind of other word (S15).	
4.	Commented that some words had not made sense, but had no idea why	1
		24

Table 17. The second of three final questions, presented separately in conversation at the end of each session, and the responses to it, with some examples.

Question 3 (a) Did you find that the unusual spellings affected your reading?

(b) If so, in what way?

1.	The unusual spellings had affected the subjects' reading	13
2.	Subjects had been affected by some of the words	5
3.	Some words had affected the subject; most of them had not	1
4.	Unaffected (S4 = Weak Reader; S17 = Good Reader)	2
		24
5.	Subjects' understanding of the text had been slowed down	11
6.	Subjects implied item 5	9
7.	Subjects S4 and S17 were not slowed down	2
8.	Subjects S9 and S10 were not specific concerning speed	2
		24
9.	Subjects had found that saying the unusual word aloud helped comprehension	9
10.	S18 had found that item 9 helped a little	1
11.	S2 didn't know whether item 9 was true or not	1
12.	Subjects didn't comment on this aspect	13
		24
13.	Subjects believed that the homophones had made them think in the wrong direction on some occasions so that they had needed to think again	15
14.	Subjects didn't comment on this aspect	9
		24

Table 18. The third of three final questions, presented separately in conversation at the end of each session, and the responses to it.

Item 5: Subjects' understanding of the text had been slowed down.

1. You had to work out what they meant (S5).
2. It slowed you down, because you had to concentrate on the words (S6).
3. It's not what I expected to see. I said it how it was spelt (S11).
4. Well, I was thinking of the words they really meant (S14).
5. They slowed it down considerably. I didn't recognise those words in the situation. I would have expected the proper words, and so I was ready to read the proper kind of words, but those caught me off guard (S19).
6. I could do it better when I was looking at it than when I was listening to it (ie. he felt that he was quicker when reading visually than when needing to listen to himself read aloud)(S21).

Item 13: Homophones led subjects to think in the wrong direction.

7. It was the other kind of words, and you were used to saying the right kind of words. It was very difficult because - if you had a "but", it was B-U-T and a T on the end, and you got mixed up in your brain and you had to adjust your brains to what the letters were (S15).
8. Like "when" - W-E-N, that was difficult. You have to pause to think, "Oh, that's what it was." (S18).
9. Stopped quickly, then realised what the word was. I would think it was a different story (S20).
10. They were the wrong type - and I couldn't quite get the meaning that they meant (S23).

Table 19. Some examples of the responses to the third of the three final questions.

9.6 Discussion.

The results of this study provide some support for Guthrie's view that readers are aware of the internal structure of words, but also support Goodman's view that linguistic skills are of paramount importance.

Guthrie's model implies that both groups should be influenced by homophones and that the Good Readers should be more strongly influenced than the Weak Readers. The Speed indices indicate that both groups were influenced by the homophones (see Table 14, Factor 2). The Good Readers appeared to be more strongly influenced by homophones since they suffered a 14% drop in list-text improvement, whereas the Weak Readers suffered only a 9% drop in list-text improvement (see Fig. 11). This result, taken by itself, might seem to support Guthrie's model.

Statistical analysis of the Speed indices, however, indicates that there was no significant difference between the two groups in the extent to which they were affected by the homophones (see Table 14, Interaction). This result seems in accordance with Goodman's model, which implies that there should be no great difference between Good and Weak Readers in response to texts which include homophones.

The Accuracy indices indicate that the Good Readers became more accurate in response to the homophone texts, whereas the Weak Readers became less accurate (see Fig. 10). These results tend to support Goodman's model since they imply that the Good Readers deteriorated slightly when reading standard texts because they were reading for meaning rather than looking closely at each word, whereas they were sufficiently aware of the homophones that they were inclined to take more care.

Statistical analysis of the Accuracy indices indicates no significant difference between the two groups (see Table 13). This seems to support Goodman's view that Good and Weak Readers respond to texts in a similar way by using their linguistic skills rather than by close attention to each individual word.

The responses to the comprehension questions produced unexpected results. It had been assumed that the subjects would score most highly on the listening task. In the event, both Good and Weak Readers scored most highly in response to reading the texts in Standard Spelling (see Fig. 9). However, statistical analysis of the Comprehension indices indicated no significant difference between the Good and Weak Readers in their ability to answer questions about the Homophone texts as compared with the Standard texts (see Table 15 and Fig. 9). This seems to support Goodman's view that reading is a holistic process in which linguistic skills will transcend consideration of small units such as individual words.

These statistical results may be contrasted with some non-statistical evidence. When asked whether the homophones had affected their reading, only two subjects claimed that they had been unaffected (see Table 18). Discussion with each subject at the end of his session indicated that both Good and Weak Readers had been aware of homophones and that they felt that their ability to read had been adversely affected. This tends to support Guthrie's view that readers are aware of the internal structure of words, so that they may then utilise their linguistic skills.

This part of the investigation provides support for those authors, such as Gough (1972), who have suggested that in some respects reading must involve the perception of each letter in a word. Fifteen

subjects believed that the homophones had made them think in the wrong direction on some occasions, so that they had needed to think again about the meaning of a particular word. This seems to support Clay's (1969) suggestion that the reader not only needs to predict what word is likely to appear next in a sequence, but should mentally check that his-her perception fits previous linguistic expectations, so far as that reader's knowledge of spelling patterns makes possible.

No reader could know in advance which words would be presented as homophones. Both Good and Weak Readers believed that they were sometimes mis-led and slowed down by the inclusion of homophones. This seems to indicate that the constituent parts of some words must have been perceived, as a stage towards obtaining meaning from text. Otherwise the homophones should not have distracted the readers from using the auditory elements of their linguistic skills, which are commonly used during speech. It is equally possible that some words were not perceived as accurately as others, since some subjects believed that they had been unaffected by the homophones, and the test did not include a technique to assess the individual effect of every single homophone on each subject.

Some of the subjects' comments also supported the views of Kolers (1970) and those other authors who have suggested that direct visual-semantic associations are possible when people read words. Several subjects implied that the visual aspect of a word was more important for rapid reading than its auditory equivalent. This is a view which is apparently shared by such psycholinguists as Goodman and Smith.

9.7 Conclusion.

The results of Experiment Two were similar to those of Experiment One in so far that they provided some evidence to support Goodman's top-down model of reading, and other evidence which supported Guthrie's bottom-up model.

The Index-scores of List-Text change (which results when lists and equivalent texts are read aloud) were subjected to statistical analysis. This statistical analysis indicated no significant difference between the Good and Weak Readers, which is in accordance with Goodman's psycholinguistic model.

The comments of the subjects in conversation were also subjected to analysis. This descriptive analysis indicated that most of the readers:

1. had been aware of the use of incongruous homophones, and
2. believed that they had been mis-led and slowed down by them.

This tends to support Guthrie's model, which suggests that readers need to respond to the spelling patterns of individual words.

Experiment Two therefore provided additional support to the results of Experiment One. Each of the author's research studies seemed to indicate that reading is too complex a process to be explained solely by the models of either Goodman or Guthrie. The two experiments seem to provide some support for Stanovich's (1980) view that a compensatory, inter-active model of reading is desirable, which should be an attempt to integrate top-down and bottom-up models.

10.0 General Conclusion.

10.1 Some possible implications of the author's research.

In general, the statistical analysis of the author's two experimental studies seemed to support Goodman's view that reading is a holistic process, in which linguistic skills are of paramount importance. The author's original opinions, however, were sympathetic to the Guthrie school of thought, which suggests that the reading process is hierarchical in so far that effective basic word-recognition skills are necessary as a step towards using linguistic skills. In order to help his pupils improve their word-recognition skills the author has used a modern analytical approach to phonic instruction as part of his teaching technique.

Morris (1983) explained that she had been somewhat shocked to discover that Smith (1978b) apparently believed that the old-fashioned synthetic phonic approach was still used in education. The synthetic approach involves pronouncing a word letter by letter. Morris agreed with Smith's comment that "phonics itself is almost useless for sounding out words letter by letter, since every letter can represent too many sounds." She stated that this synthetic approach could now be considered out-of-date.

She explained that teachers today use an analytical approach to phonic instruction. Children are encouraged to learn sound-symbol relationships in the context of whole-word recognition. She pointed out that Daniels and Diack (1954) had incorporated analytical phonics into their series of books, Royal Road Readers, and that this had marked the beginning of modern analytical phonics.

The author has used this series as a teaching aid. The analytical phonic approach includes the technique of introducing spelling

patterns in relation to words used in meaningful contexts. In Royal Road Readers, Book 3, for example, Daniels and Diack introduced groups of words such as book, cook, foot, boot; screen, tree, feet, street; brush, shelf, shed, fish; which were presented as lists before being used in sentences and passages of connected text. This method may help readers to acquire an understanding of the relationship between printed words and their possible pronunciations.

The author has also been impressed by the book, Alpha to Omega, produced by Hornsby and Shear (1975). This presented a carefully structured programme of work for dyslexic pupils, designed to help them to cope with the complexity of English spelling. The author believes that English school-teachers employ phonic schemes as one way of providing pupils with strategies which can help them to develop and use their sight vocabulary.

Another reason for providing phonic instruction, however, is that it enables the teacher to take control of the pupil's progress. It seems less easy for teachers to provide well-structured programmes to enable pupils to broaden their general and linguistic experience than it is to help them to gain phonic understanding. The Guthrie school of thought, with its emphasis on phonics, is likely to lead to "teacher-centred control," whereas the Goodman school of thought, with its emphasis on language, is possibly more likely to lead to "pupil-centred control."

In some respects, phonic teaching is a closed-system, with finite items to be learnt. An understanding of the usage of the letter "e" is likely to be relevant to any piece of connected text, as in this sentence, for example. Semantic understanding of texts, on the other hand, is an open-ended process in so far that it depends on such

factors as the reader's general knowledge and linguistic knowledge. A pupil with sufficient phonic knowledge may understand how to pronounce the word "tide", but fail to understand Shakespeare's speech in Julius Caesar, "There is a tide in the affairs of men..." (even when it has been translated into modern English), because he has insufficient knowledge of some words and their meaning.

If Goodman's views are correct, and a knowledge of phonics is relatively unimportant compared with a knowledge of one's native language, then the difference between Good and Weak Readers might be the result of linguistic weaknesses among the latter. In that case, it might be difficult to evolve schemes of remediation which are as well-structured as phonic schemes can be. Since some of the statistical results in Experiment One and Experiment Two support Goodman's view that reading is essentially a holistic process, it seems likely that tape-recorded stories will provide a suitable, psycholinguistic technique for helping those pupils who are considered to be weak at reading. The author's pupils are now encouraged to listen to a story while looking at the text in a way similar to that described by Gamby (1983). They are thus able to pay attention to the language and the ideas, with less need to pay attention to decoding from print to sound. This enables them to approach reading in a holistic way, and is similar to the experience traditionally provided by mothers when reading aloud to their children.

Some of the author's research results tend to support the Guthrie school of thought. This is particularly so for some of the descriptive evidence in both experiments. The author believes that there are two reasons why his study did not produce results which

clearly supported one model rather than the other:

1. The author's research techniques were themselves experimental to some extent. He believes that it is desirable to develop further test-instruments which will be more suitable for investigating the nature of the recognition of printed words (see Section 10.2).
2. The reading process is so complex that no one model can adequately encompass its nature. Jorm (1983), for example, suggested that readers combine "bottom-up" and "top-down" techniques when reading. He compared it with finding one's way to a particular place both by using a map and by looking at the world around. This is similar to the view advanced by Stanovich (1980), in so far that it indicates the need to utilise both top-down and bottom-up techniques during the process of reading. As a result of his research study, the author sympathises with these views (see Section 10.3).

10.2 Some possible directions for further research.

The author's experimental studies indicated some possible directions for further research:

1. It would be interesting to compare Good and Weak Readers from the point of view of the total number of miscues which they make, rather than judge them solely by their ability to correct the miscues. Is the correction of miscues correlated with the rate of reading? Are Good Readers better at "first-time guesses" than Weak Readers? If so, is this because of more effective linguistic skills, basic word-recognition skills, or both?
2. It was surprising to find that at least one weak reader could remember the gist of a passage despite his snail-pace reading. Is there a difference between reading aloud for oneself at the rate of one word per second, and listening to a passage read by someone else at the same rate? To what extent is rate of reading less important than motivational and attentional factors?
3. It would be interesting to develop a series of investigations into the effects of incongruous homophones in texts. Since these sometimes lead readers in the wrong mental direction, it might also be useful to produce pseudo-homophones in English in a way similar to that of Reitsma (1983) in Dutch.
4. It might be valuable to produce descriptive data concerning miscues in a language such as Japanese, in which the same spoken text could be written in two, three, or even four different writing systems.

10.3 Final conclusions.

The author's review of the literature and his own experimental studies have led him to the following conclusions:

1. Goodman's holistic, psycholinguistic model of reading seems to be the most useful model available for teachers to follow, because it is "child-centred": ie. it suggests that the reader interacts creatively with a text by using language skills and knowledge of the world as the primary means by which to "guess at" meaning.
2. Guthrie's model is a useful ancillary to that of Goodman, because it focuses attention on the reader's need to utilise grapheme-phoneme association skills as an additional source of cues. Whether the pupil's acquisition of phonic knowledge is "teacher-centred" or "child-centred" will depend to some extent on the teacher's sensitivity to the needs of each individual pupil.
3. Neither Goodman's top-down model, nor Guthrie's bottom-up model, is sufficient, by itself, to explain the observed differences between good and weak readers, because neither model concerns itself in depth with such aspects of behaviour as specific memory processes and emotional responses to texts.
4. Teachers are therefore likely to benefit from the information provided by continuing research into the nature of reading. In order to be of practical value to teachers, this research should involve a variety of academic disciplines and may well include neurological, psychological, linguistic and psycholinguistic studies.
5. Such research may lead to the construction of further models of reading, which might enable teachers to help their pupils more effectively.

REFERENCES

Allington, R.L. (1978a) "Effects of contextual constraints upon rate and accuracy," Perceptual and Motor Skills, 46, 1318.

Allington, R.L. (1978b) "Word identification abilities of severely disabled readers: a comparison in isolation and context," Journal of Reading Behavior, 10, 409-446.

Allington, R.L., and McGill-Franzen, A. (1980) "Word identification errors in isolation and in context: apples vs. oranges," The Reading Teacher, 33, 795-800.

Allington, R.L., and Strange, M. (1977) "Effects of grapheme substitutions in connected text upon reading behaviors," Visible Language, 11, 285-297.

Andreewsky, E., Deloche, G., and Kossanyi, P. (1980) "Analogies between speed-reading and deep dyslexia: towards a procedural understanding of reading," in Coltheart, M., Patterson, K., and Marshall, J.C. (eds.), Deep Dyslexia. London: Routledge and Kegan Paul.

Baron, J. (1973) "Phonemic stage not necessary for reading," Quarterly Journal of Experimental Psychology, 25, 241-246.

Baron, J. (1977) "Mechanisms for pronouncing printed words: Use and acquisition," in LaBerge, D., and Samuels, S.J. (eds.), Basic Processes in Reading: Perception and Comprehension. Hillsdale, New Jersey: Erlbaum.

Baron, J., and Strawson, C. (1976) "Use of orthographic and word-specific knowledge in reading words aloud," Journal of Experimental Psychology: Human Perception and Performance, 2, 386-393.

Barron, R.W., and Baron, J. (1977) "How children get meaning from printed words," Child Development, 48, 587-594.

Bettelheim, B., and Zelan, K. (1981) On learning to read: the Child's fascination with Meaning. London: Thames and Hudson.

Biemiller, A. (1970) "The development of the use of graphic and contextual information as children learn to read," Reading Research Quarterly, 6, 75-96.

Biemiller, A. (1977-78) "Relationships between oral reading rates for letters, words and simple text in the development of reading achievement," Reading Research Quarterly, 13, 223-253.

Biemiller, A. (1979) "Changes in the use of graphic and contextual information as functions of passage difficulty and reading achievement level," Journal of Reading Behavior, 11, 307-318.

Blanchard, J. (1979) "Research revisited: A linguistic study of cues and miscues in reading," Reading Psychology, 1, 66-72.

Brewer, W.F. (1972) "Is reading a letter-by-letter process?" in Kavanagh, J.F., and Mattingly, I.G. (eds.), Language by Ear and by Eye. Cambridge, Mass.: M.I.T. Press.

Cambourne, B. (1977) "Getting to Goodman: an analysis of the Goodman Model of Reading with some suggestions for evaluation," Reading Research Quarterly, 12, 605-636.

Chomsky, C. (1969) The Acquisition of Syntax in Children from Five to Ten. Mass.: M.I.T. Press.

Clark, H.H., and Clark, E.V. (1977) Psychology and Language. New York: Harcourt Brace Jovanovich.

Clark, M.M. (1976) Young Fluent Readers. London: Heinemann.

Clay, M.M. (1968) "A syntactic analysis of reading errors," Journal of Verbal Learning and Verbal Behavior, 7, 434-438.

Clay, M.M. (1969) "Reading errors and self-correction behaviour," British Journal of Educational Psychology, 39, 47-56.

Collins Dictionary of the English Language. (1979) London: Collins.

Coltheart, M. (1979) "Mysteries of reading in brain defects," New Scientist, 8.2.1979, 368-370.

Coltheart, M. (1980) "Reading, phonological recoding, and deep dyslexia," in Coltheart, M., Patterson, K., and Marshall, J.C. (eds.), Deep Dyslexia. London: Routledge and Kegan Paul.

Coltheart, M., Masterson, J., Byng, S., Prior, M., and Riddoch, J. (1983) "Surface dyslexia," Quarterly Journal of Experimental Psychology: Human Experimental Psychology, 35A, 469-495.

Coltheart, M., Patterson, K., and Marshall, J.C. (eds.), (1980) Deep Dyslexia. London: Routledge and Kegan Paul.

Daniels, J.C., and Diack, H. (1954) Royal Road Readers. London: Chatto and Windus.

Davis, F.B. (ed.), (1972) The literature of research in reading with emphasis on models. New Jersey: Iris Corporation.

Dunn-Rankin, P. (1968) "The similarity of lower-case letters of the English alphabet," Journal of Verbal Learning and Verbal Behavior, 7, 990-995.

Feitelson, D. (1973) "Israel," in Downing, J. (ed.), Comparative Reading: Cross-national studies of behaviour and processes in reading and writing. New York: Macmillan.

Ferry, G. (1985) "Dyslexia and the psychology of the written word," New Scientist, 26.9.1985, 41-44.

Festinger, L. (1958) "The motivating effect of cognitive dissonance," in Lindsley, G. (ed.), Assessment of Human Motives. New York: Grove Press.

Fowler, R. (1974) Understanding Language. London: Routledge and Kegan Paul.

Gamby, G. (1983) "Talking books and taped books: Materials for instructions," The Reading Teacher, 36, 366-369.

Golinkoff, R.M. (1975-76) "A comparison of reading comprehension processes in good and poor comprehenders," Reading Research Quarterly, 11, 623-659.

Golinkoff, R.M., and Rosinski, R.R. (1976) "Decoding, semantic processing, and reading comprehension skill," Child Development, 47, 252-258.

Gollasch, F.V. (ed.) (1982) Language and Literacy: The selected writings of Kenneth S. Goodman. London: Routledge and Kegan Paul.

Goodman, K.S. (1965) "A Linguistic Study of Cues and Miscues in Reading," Elementary English, 42, 639-643.

Goodman, K.S. (1967) "Reading: A psycholinguistic guessing game," Journal of the Reading Specialist, 6, 126-135.

Goodman, K.S. (1973) "Miscues: Windows on the Reading Process," in Gollasch, F.V. (ed.) (1982) Language and Literacy: The selected writings of Kenneth S. Goodman. London: Routledge and Kegan Paul.

Goodman, K.S. (1976) "What is universal about the reading process," in Gollasch, F.V. (ed.) (1982) Language and Literacy: The selected writings of Kenneth S. Goodman. London: Routledge and Kegan Paul.

Gough, P.B. (1972) "One second of reading," in Kavanagh, J.F., and Mattingly, I.G. (eds.), Language by Ear and by Eye. Cambridge, Mass.: M.I.T. Press.

Graham, S. (1980) "Word recognition skills of learning disabled children and average students," Reading Psychology, 2, 23-33.

Gurney, R. (1973) Language, Brain and Interactive processes. London: Edward Arnold.

Guthrie, J.T. (1973) "Models of reading and reading disability,"

Journal of Educational Psychology, 65, 9-18.

Horning, A.S. (1979) "On defining redundancy in language: case notes," Journal of Reading, 22, 312-320.

Hornsby, B., and Shear, F. (1975) Alpha to Omega. London: Heinemann Educational Books.

Hunter, I.M.L. (1978) Memory. (2nd ed.) Harmondsworth, Middlesex: Penguin Books.

Johnson, N.F. (1975) "On the Function of Letters in Word Identification: Some data and a Preliminary Model," Journal of Verbal Learning and Verbal Behavior, 14, 17-29.

Johnson, D., and Myklebust, H.R. (1967) Learning Disabilities: Educational Principles and Practices. New York: Grune and Stratton.

Jorm, A.F. (1983) The Psychology of Reading and Spelling Disabilities. London: Routledge and Kegan Paul.

Juel, D. (1980) "Comparison of word identification strategies with varying context, word type, and reader skill," Reading Research Quarterly, 3, 358-376.

Katz, L., and Wicklund, D.A. (1971) "Word scanning rate for good and poor readers," Journal of Educational Psychology, 62, 138-140.

Katz, P.A., and Deutsch, M. (1963) "Relation of auditory-visual shifting to reading achievement," Perceptual and Motor Skills, 17, 327-332.

Kleiman, G.M. (1975) "Speech recoding in reading," Journal of Verbal Learning and Verbal Behavior, 14, 323-339.

Kolers, P.A. (1966a) "Interlingual facilitation of short-term memory," Journal of Verbal Learning and Verbal Behavior, 5, 314-319.

Kolers, P.A. (1966b) "Reading and talking bilingually," American Journal of Psychology, 79, 357-376.

Kolers, P.A. (1970) "Three stages of reading," in Levin, H., and Williams, J.P. (eds.), Basic Studies on Reading. New York: Basic Books.

Kolers, P.A. (1972) "Experiments in reading," Scientific American, 227, 84-91.

LaBerge, D., and Samuels, S.J. (1974) "Toward a theory of automatic information processing in reading," Cognitive Psychology, 6, 293-323.

Lassen, N.A., Ingvar, D.H., and Skinhøj, E. (1978) "Brain function and blood flow," Scientific American, 239, 62-71.

Laver, J.D.M. (1970) "The production of speech," in Lyons, J. (ed.), New Horizons in Linguistics. Harmondsworth, Middlesex: Penguin Books.

Lenneberg, E.H. (1967) Biological Foundations of Language. New York: Wiley.

Marcel, T. (1980) "Surface dyslexia and beginning reading: a revised hypothesis of the pronunciation of print and its impairments," in Coltheart, M., Patterson, K., and Marshall, J.C. (eds.), Deep Dyslexia. London: Routledge and Kegan Paul.

Marshall, J.C., Caplan, D., and Holmes, J.M. (1975) "The measure of laterality," Neuropsychologia, 13, 315-321.

Marshall, J.C., and Newcombe, F. (1980) "The conceptual status of deep dyslexia: an historical perspective," in Coltheart, M., Patterson, K., and Marshall, J.C. (eds.), Deep Dyslexia. London: Routledge and Kegan Paul.

Mitchell, D.C., and Green, D.W. (1978) "The effects of context and content on immediate processing in reading," Quarterly Journal of Experimental Psychology, 30, 609-636.

Morris, J.M. (1983) "Focus on phonics," Reading, 17, 131-138.

Mosenthal, P. (1976) "Psycholinguistic properties of aural and visual comprehension as determined by children's abilities to comprehend syllogisms," Reading Research Quarterly, 12, 55-92.

Newman, H. (1979) "Psycholinguistics and Reading: a dissenting point of view," Reading World, 18, 368-375.

Niles, J.A. (1975) "The use of featural and letter dependency information in word recognition by elementary school children," Reading Research Quarterly, 11, 198-202.

Patberg, J., Dewitz, P., and Samuels, S.J. (1981) "The effect of context on the size of the perceptual unit used in word recognition," Journal of Reading Behavior, 13, 33-48.

Recht, D.R. (1976) "The self-correction process in reading," The Reading Teacher, 29, 632-636.

Reitsma, P. (1983) "Word specific knowledge in Beginning Reading," Journal of Research in Reading, 6, 41-56.

Rumelhart, D.E. (1977) "Toward an interactive model of reading," in Cornic, S. (ed.) Attention and Performance VI. Hillsdale, New Jersey: Erlbaum.

Samuels, S.J., Begy,G., and Chen, C.C. (1975) "Comparison of word recognition speed and strategies of less skilled and more highly skilled readers," Reading Research Quarterly, 11, 72-86.

Samuels, S.J., LaBerge, D., and Bremer, C.D. (1978) "Units of word recognition: evidence for developmental changes," Journal of Verbal Learning and Verbal Behavior, 17, 715-720.

Shankweiler, D., and Liberman, I.Y. (1972) "Misreading: a search for causes," in Kavanagh, J.F., and Mattingly, I.G. (eds.), Language by Ear and by Eye. Cambridge, Mass.: M.I.T. Press.

Slobin, D. (1966) "Grammatical Transformations and Sentence Comprehension in Childhood and Adulthood," Journal of Verbal Learning and Verbal Behavior, 5, 219-227.

Smith, F. (1971) Understanding Reading: A psycholinguistic analysis of reading and learning to read. New York: Holt, Rinehart and Winston.

Smith, F. (1978a) Reading. Cambridge: Cambridge University Press.

Smith, F. (1978b) Understanding Reading: A psycholinguistic analysis of reading and learning to read. Revised edition. New York: Holt, Rinehart and Winston.

Soloman, R., and Postman, L. (1952) "Frequency of usage as a determinant of recognition thresholds for words," Journal of Experimental Psychology, 43, 195-201.

Sperling, G. (1960) "The information available in brief visual presentations," Psychological Monographs, 74, Whole No. 498.

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., Cunningham, A.E., and West, R.F. (1981) " longitudinal study of the development of automatic recognition skills in first graders," Journal of Reading Behavior, 13, 57-74.

Stanovich, K.E., and West, R.F. (1979) "The effect of orthographic structure on the word search performance of good and poor readers," Journal of Experimental Child Psychology, 28, 258-267.

Steinheiser, R., and Guthrie, J.T. (1977) "Perceptual and linguistic processing of letters and words by normal and disabled readers," Journal of Reading Behavior, 9, 217-225.

Stott, D.H. (1972-73) "Some less obvious cognitive aspects of learning to read," The Reading Teacher, 26, 374-383.

Terrell, C.D., and Meadows, B.R. (1985) "A list of English Homophones," Quarterly Journal of Experimental Psychology, 37A, 627-631.

Terry, P.R. (1976) "The effect of orthographic transformations upon speed and accuracy of semantic categorizations," Reading Research Quarterly, 12, 166-175.

Terry, P., Samuels, S.J., and LaBerge, D. (1976) "The Effects of Letter Degradation and Letter Spacing on Word Recognition," Journal of Verbal Learning and Verbal Behavior, 15, 577-585.

Thompson, G.B. (1984) "Self-corrections and the reading process: an Evaluation of Evidence," Journal of Research in Reading, 7, 53-61.

Tinker, M.A. (1958) "Recent studies of eye movements in reading," Psychological Bulletin, 54, 215-231.

Weber, R.M. (1970) "First graders' use of grammatical context in reading," in Levin, H., and Williams, J. (eds.) Basic Studies in Reading. New York: Basic Books.

West, R.F., and Stanovich, K.E. (1978) "Automatic contextual facilitation in readers of three ages," Child Development, 49, 717-727.

Wildman, D.M., and Kling, M. (1978) "Semantic, syntactic and spatial anticipation in Reading," Reading Research Quarterly, 14, 128-164.

Wixson, K.L. (1979) "Miscue Analysis: a Critical Review," Journal of Reading Behavior, 11, 163-175.

APPENDIX 1.

	Good Readers			Weak Readers	
	Number of incorrect words out of 600			Number of incorrect words out of 600	
Ss	List	Text	Ss	List	Text
1.	11	3	13.	52	34
2.	0	0	14.	78	45
3.	3	1	15.	129	76
4.	1	1	16.	102	40
5.	1	0	17.	111	83
6.	1	3	18.	129	89
7.	4	3	19.	15	12
8.	7	3	20.	39	18
9.	10	5	21.	103	62
10.	7	5	22.	31	16
11.	5	2	23.	137	84
12.	6	2	24.	55	34
	56	28		981	593
Mean	4.7	Mean 2.3	Mean	81.75	Mean 49.4
S.D.	3.7	S.D. 1.7	S.D.	42.3	S.D. 28.4

Experiment One: raw scores of the number of uncorrected errors made by Good and Weak Readers when reading a total of 600 words.

APPENDIX 2.

	Good Readers			Weak Readers	
	Time taken to read 600 words (in seconds)			Time taken to read 600 words (in seconds)	
Ss	List	Text	Ss	List	Text
1.	280	223	13.	743	561
2.	285	216	14.	620	468
3.	266	208	15.	575	477
4.	274	220	16.	610	379
5.	318	240	17.	1198	1004
6.	373	250	18.	877	611
7.	330	231	19.	325	279
8.	272	202	20.	663	442
9.	464	264	21.	613	519
10.	283	205	22.	588	400
11.	373	249	23.	900	662
12.	335	268	24.	448	338
	3853	2776		8160	6140
Mean	321	231	Mean	680	512
S.D.	58.9	22.7	S.D.	228.0	190.6

Experiment One: raw scores of the time taken (in seconds) by Good and Weak Readers when reading a total of 600 words.

APPENDIX 3.

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A List of English Homophones

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A list of 382 sets of English heterographic homophones compiled from *Collins Dictionary of the English Language* (1979).[1]

INTRODUCTION

Heterographic homophones are words that have the same pronunciation but different spellings and meanings. They are being increasingly used as a research tool in a number of subject areas in psychology and education. The present authors, as part of a series of experiments concerned with the psychology of reading, required a comprehensive list. As no extensive list was available, one was compiled by systematically working through *Collins Dictionary of the English Language* (1979).[1] The list, comprising 382 sets of English heterographic homophones, is for use by speakers of Standard English; in other dialects some of the words may not be homophonic.

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The authors are interested in updating this list and would be pleased to receive additional words.

[1] *Collins Dictionary of the English Language* (1979). London: Collins.

Table I

A List of 382 Sets of English Heterographic Homophones Taken from *Collins English Dictionary* (1979)

aunt	aren't			canon	cannon	
awe	oar	or	ore	canvas	canvass	
all	awl	orle		cast	caste	
aloud	allowed			cede	seed	
bail	bale			cell	sell	
baize	bays			cellar	seller	
bald	balled			cedar	seeder	
ball	bawl			cent	sent	scent
base	bass			cents	scents	sense
balmy	barmy			cereal	serial	
band	banned			chased	chaste	
bark	barque			cheap	cheep	
beach	beech			check	cheque	
bean	been			choir	quire	
bare	bear			chord	cord	
beer	bier			chough	chuff	
beat	beet			chute	shoot	
berth	birth			cite	sight	site
bay	bey			clack	claque	
bight	bite	byte		clause	claws	
blew	blue			climb	clime	
bloc	block			coarse	corse	course
boar	boor	bore		coat	cote	
board	bored			coal	cole	
bode	bowed			conker	conquer	
bole	bowl			caw	core	
bold	bowled			cores	cause	caws
boos	booze			council	counsel	
boarder	border			caught	court	
bough	bow			creak	creek	
born	bourn			crews	cruise	cruse
boy	buoy			curb	kerb	
braid	brayed			currant	current	
braise	brays			cymbal	symbol	
brake	break			dam	damn	
bread	bred			days	daze	
brewed	brood			dear	deer	
brows	browse			dew	due	
brews	bruise			done	dun	
berry	bury			doe	dough	
berries	buries			does	doughs	doze
but	butt			draft	draught	
buy	by	bye		ducked	duct	
cache	cash			die	dye	
calendar	calender			earn	urn	
call	caul			ewe	yew	you

eye	aye	I	high	hi	
fail	faille		higher	hire	
faint	feint		hoar	whore	
fair	fare		hole	whole	
fain	feign		hoard	horde	
farther	father		hoarse	horse	
feat	feet		hour	our	
find	fined		hew	hue	
fir	fur		him	hymn	
firs	furs	furze	in	inn	
fern	firn		ion	iron	
firry	furry		cue	kew	
flair	flare		key	quay	
flaw	floor		knave	nave	
flea	flee		knead	kneed	need
flew	flu	flue	knight	night	
flight	flite/flyte		knit	nit	
floe	flow		knot	not	
flour	flower		knows	nose	
for	four	fore	know	no	
forth	fourth		kop	cop	
fort	fought		knew	new	
foul	fowl		lade	laid	
franc	frank		laager	lager	
freeze	frees	frieze	laik	lake	
friar	fryer/frier		lakh	lac	lack
gait	gate		lakhs	lacks	lax
gays	gaze		lam	lamb	
genes	jeans		lain	lane	
gilt	guilt		laps	lapse	
gin	jinn		larva	lava	laver
gloze	glows		laud	lord	
gnaw	nor		law	lore	
grate	great		lea	lee	
grays	graze		leach	leech	
greave	grieve		leaf	lief	
grisly	grizzly		leak	leek	
groan	grown		lay	lei	
guessed	guest		leaver	lever	
gild	guild		links	lynx	
guys	guise		lo	low	
gyve	jive		load	lode	lowed
hail	hale		loan	lone	
hall	haul		lawn	lorn	
hair	hare		loot	lute	
hart	heart		liar	lyre	
heal	heel		made	maid	
here	hear		mail	male	
heir	air		main	mane	
herd	heard		maize	maze	
hay	hey		mall	mawl	
heys	haze		manna	manner	manor

marc	mark	marque		profit	prophet		
mare	mayor			plum	plumb		
maw	moor	more		pole	poll		
meat	meet			pray	prey		
medal	meddle			praise	prays	preys	
metal	mettle			prise	pries	prize	
mean	mien			quean	queen		
mined	mind			rack	wrack		
miner	minor			raid	rayed		
might	mite			rain	reign		
missed	mist			raise	raze	rays	
moan	mown			rail	rale		
mode	mowed			rapped	rapt	wrapped	
mooed	mood			raw	roar		
morn	mourn			read	reed		
morning	mourning			real	reel		
moat	mote			reave	reeve		
muscle	mussel			red	read		
nacre	naker			rest	wrest		
naval	navel			retch	wretch		
neap	neep			rhyme	rime		
nay	neigh			right	rite	wright	write
nome	gnome			road	rode	rowed	
none	nun			roe	row		
one	won			role	roll		
oh	owe			rood	rude		
packed	pact			rheum	room		
pain	pane			root	route		
pair	pare	pear		rose	rows		
pail	pale			rough	ruff		
panda	pander			rouse	rows		
passed	past			rye	wry		
paced	paste			sac	sack		
pause	paws			sail	sale		
paw	poor	pore	pour	sauce	source		
pawed	poured			saw	soar	sore	
pawn	porn			sawed	soared	sword	
packs	pax			scene	seen		
peace	piece			sea	see		
peal	peel			seam	seem		
pearl	purl			sear	sere		
pedal	peddle			seamen	semen		
peer	pier			seize	seas		
perse	purse			serf	surf		
phial	file			serge	surge		
philtre	filter			sew	sow	so	soh
pi	pie			sewn	sown		
peek	pique			shake	sheik		
pitta	pitter			shear	sheer		
plaice	place			shoe	shoo		
plain	plane			shore	sure		
pleas	please			side	sighed		

sighs	size		ton	tun	
sign	sine		to	too	two
sleight	slight		tore	tor	
sloe	slow		tracked	tract	
soak	soke		troop	troupe	
soled	sold		tough	tuff	
some	sum		vain	vane	vein
son	sun		vale	veil	
sole	soul		wade	weighed	
spayed	spade		way	whey	weigh
spoor	spore		wail	wale	whale
staid	stayed		waist	waste	
stair	stare		wait	weight	
stake	steak		waive	wave	
steal	steel		wain	wane	
stile	style		ware	where	wear
storey	story		warn	worn	
stalk	stork		wax	whacks	
straight	strait		weak	week	
succour	sucker		weather	whether	
suite	sweet		weave	we've	
tacked	tact		we'd	weed	
tael	tail	tale	we	wee	
taper	tapir		we'll	wheel	weal
tare	tear		what	wot	
tear	tier		when	wen	
taught	taut	tort	wet	whet	
tea	tee		which	witch	
team	teem		who	hoo	
tern	turn		whig	wig	
their	they're	there	whine	wine	
throe	throw		whirl	whorl	
through	threw		weald	wield	
thyme	time		white	wight	
tide	tied		woe	whoa	
tire	tyre		wood	would	
tired	tyred		wart	wort	
toe	tow		wring	ring	
toed	towed	toad	yaw	yore	your you're
toes	tows		yoke	yolk	
tolled	told		you'll	yule	

APPENDIX 4. Experiment Two: raw scores for accuracy.

GOOD READERS

Number of words read correctly (out of 200) and Index of Change

	Standard Spelling			Homophone Spelling		
Ss	List	Text	Ic	List	Text	Ic
1.	198	189	-2.325	191	194	+0.779
3.	198	198	0.0	198	197	-0.253
5.	199	197	-0.505	198	196	-0.508
7.	195	198	+0.763	187	192	+1.319
9.	199	197	-0.505	200	196	-1.01
11.	195	196	+0.256	194	192	-0.518
13.	195	198	+0.763	189	192	+0.787
15.	195	193	-0.515	194	192	-0.518
17.	199	199	0.0	196	199	+0.759
19.	198	199	+0.252	199	200	+0.251
21.	199	198	-0.252	198	196	-0.508
23.	198	197	-0.253	193	196	+0.771
			-2.321			+1.351
		Mean	-0.193		Mean	+0.113
		S.D.	0.807		S.D.	0.749

APPENDIX 5. Experiment Two: raw scores for accuracy.

WEAK READERS

Number of words read correctly (out of 200) and Index of Change

	Standard Spelling			Homophone Spelling		
Ss	List	Text	Ic	List	Text	Ic
2.	191	190	-0.262	178	173	-1.425
4.	190	194	+1.042	197	193	-1.026
6.	191	199	+2.051	192	197	+1.285
8.	189	191	+0.526	186	188	+0.535
10.	193	197	+1.026	182	191	+2.413
12.	194	197	+0.767	189	195	+1.563
14.	191	195	+1.036	184	186	+0.541
16.	188	192	+1.053	181	170	-3.134
18.	193	197	+1.026	193	194	+0.258
20.	195	198	+0.763	196	195	-0.256
22.	191	195	+1.036	191	191	0.0
24.	197	198	+0.253	194	196	+0.513
			+10.317			+1.267
		Mean	+0.86		Mean	+0.106
		S.D.	0.553		S.D.	1.467

APPENDIX 6. Experiment Two: raw scores for speed/rate of reading.

GOOD READERS

Time taken to read 200 words (in seconds) and Index of Change

	Standard Spelling			Homophone Spelling		
Ss	List	Text	Ic	List	Text	Ic
1.	136	73	30.14	146	114	12.31
3.	121	68	28.04	129	110	7.95
5.	167	74	38.59	234	118	32.95
7.	139	89	21.93	137	102	14.64
9.	121	58	35.20	149	88	25.74
11.	98	60	24.05	101	91	5.21
13.	131	78	25.36	159	118	14.80
15.	112	72	21.74	118	90	13.46
17.	102	64	22.89	95	86	4.97
19.	150	64	40.19	165	105	22.22
21.	141	66	36.23	146	90	23.73
23.	196	68	48.48	175	106	24.56
			372.84			202.54
		Mean	31.07		Mean	16.879
		S.D.	8.61		S.D.	8.898

APPENDIX 7. Experiment Two: raw scores for speed/rate of reading.

WEAK READERS

Time taken to read 200 words (in seconds) and Index of Change

	Standard Spelling			Homophone Spelling		
Ss	List	Text	Ic	List	Text	Ic
2.	239	115	35.03	246	190	12.84
4.	145	92	22.36	151	115	13.53
6.	154	109	17.11	171	143	8.92
8.	173	109	22.70	202	151	14.45
10.	121	94	12.56	155	145	3.33
12.	136	112	9.68	140	148	-2.78
14.	132	75	27.54	167	123	15.17
16.	121	70	26.70	135	89	20.54
18.	173	90	31.56	227	119	31.21
20.	123	67	29.47	154	105	18.92
22.	122	85	17.87	148	105	17.00
24.	170	101	25.46	191	152	11.37
			278.04			164.5
		Mean	23.17		Mean	13.709
		S.D.	7.674		S.D.	8.54