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**LA THÈSE A ÉTÉ
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The Morphology and Syntax of the
Spontaneous Speech of Reading
Disabled Children: An Exploratory
Study.

A thesis submitted to the Graduate School,
University of Ottawa, in fulfillment of
the requirements for the M.A. (Linguistics)
degree, Fall, 1979.

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0 INTRODUCTION

In the past fifteen years, intense research on Specific Reading Disability (SRD) has brought progress on a number of contentious issues. These include refinement of both theoretical (Benton, 1975) and operational definitions (Rutter, 1978; Valtin, 1978); general acceptance of the idea that no single cause of the disorder exists (Boder, 1973; Mattis, French, & Rapin, 1975; Vellutino, 1978, presents a dissenting opinion); and the realization that SRD may reflect deficits not just in primary sensory function, but also in higher level processing (Vogel, 1975; Rutter & Yule, 1975; many others could be mentioned). Progress has also occurred in assessment of prevalence (Benton, 1975), and in testing specific hypotheses about the locus of difficulty (Shankweiler & Liberman, 1972; Perfetti, 1977).

In this research, various standardized reading tests have been used to categorize SRD subjects as deficient in particular skills, and many tasks have subsequently been used to assess other skill levels for comparison. In a paper only indirectly related to

reading research, Hunt, Lunneborg, & Lewis, (1975), addressed the question of how performance on intelligence tests is related to the sort of abilities in which cognitive psychologists could be interested.

"It would be interesting if we found that the psychometric tests require one sort of ability and the cognitive psychologist's tests require another, but the same individuals who possess (or lack) one set of abilities possess or lack the other." (195)

This passage succinctly describes the idea behind most SRD research. At the same time, the passage suggests a dimension of commonality in previous studies where change might prove profitable. In addition to the substantive goals explained below, it is hoped that the present work will have some value as an exploratory study with some originality on that dimension, which is the selection of independent variable. How this will be done is drawn out by the following review of the literature.

1 REPORT OF PREVIOUS FINDINGS

1.1 Definition of the Disorder

In his appraisal of current definitions of SRD, Eisenberg writes,

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"...as a clinician, I am convinced...
that a disorder... (better, a group
of disorders) exists which does
somehow correspond to a category of
patients who fail to learn to read
in the absence of any of the
ordinary causes for poor reading."
(1978, 31)

While there is general agreement that SRD exists as a clinical entity, its precise definition has been the subject of much debate. The sense that there is no apparent reason for a child's failure to learn to read is at the heart of all associated research. It is, as might be expected, a difficult sentiment to convey in scientific language, though that, of course, is no reason not to attempt a definition.

Michael Rutter (1978) dissects the World Federation of Neurology characterization of SRD, concluding that it is "unsatisfactory and unworkable."
(14) The WFN definition, for instance, implies that SRD cannot be diagnosed in poor children. In other respects, such as specifying dependence on 'fundamental cognitive disabilities,' the definition is too vague to be useful.

While it is not the goal of this paper to add to the continuing discussion of a suitable definition, or even to report all the arguments adduced thus far,

it is certainly necessary to offer a definition.

Though reasonable and carefully considered, the following is neither final nor universally accepted.

In Benton's words, SRD is,

"Inexplicable failure to learn to read by a child whose intelligence level, oral language development, and sensory capacities appear to be fully adequate to permit the development of reading skills; who has had the benefit of conventional classroom instruction in reading; and who, at the beginning of his schooling, had normal motivation to learn to read." (1975,2)

The operational definition of subject groups for this work appears below.

Before moving on, however, it is worth noting a further point related to definition, a point also made by Rutter (1978). SRD and general reading backwardness are entirely different. The latter refers to an assessment which does not take intelligence into account. The former refers to reading backwardness which cannot be explained in terms of IQ. On the average, children suffering the general condition will be of lower intelligence than SRD children. Rutter cites his recent epidemiological studies in Britain as evidence of such a distribution.

The importance of IQ as one of the diagnostic criteria creates problems in the assessment of reading ability, problems which are well treated in Valtin (1978). The decision regarding which form of IQ score to use in delimiting a population, Verbal, Performance, or Full Scale, inevitably biases the group chosen in some way. Measures of severity of disability are subject to regression effects, for example. As Rutter explains, (1978, 183), with an imperfect correlation of mental and reading ages, children above average on one measure will be closer to the mean on the other (similarly for below average children). The first hurdle facing SRD researchers, therefore, is delimiting a sample or samples.

Once this is done, group reading levels are considered the dependent variable, permitting comparison of groups on an independent variable, usually performance on a task considered critical to the reading process. Much work not touched upon here has been devoted to the refinement of that initial grouping, in full awareness of the statistical complexities of predicting criterion levels of achievement. Rather less attention has been paid to

the other end, to selection and administration of the task. This is not to say that many tasks haven't been used. Rather, there seems to be less concern with the theoretical aspects of choice of task, and with explanation of why predicted and observed effects occur. This may stem from the relative lack of communication between students of normal and of pathological reading, which seems to have cost the latter a model of the reading process. Alternatively, it may result from what Perfetti refers to as a "general disenchantment with attempts to describe cognitive processes by reference to linguistic structures." (1977, 1) In any event, here we will be more concerned with process than with definition. Consequently, a major focus below will be justifying the choice of comparison test.

1.2 Prevalence

Prevalence can vary widely from country to country. This variation might be explained in terms of the structure of writing systems. For example, a (comparatively) reduced incidence of SRD in Spain and Italy (Makita, 1968; Faglioni, et al., 1969; both cited in Benton, 1975,3) could be a function of

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the greater regularity of representation of phonemes by graphemes in Spanish and Italian than in English orthography. Different arguments of structural advantage can be advanced in the case of Japanese. Though Benton (1975,5), for one, dismisses the idea that SRD is not recognized as such in countries claiming lower rates, research is not yet sufficiently far advanced for strong opinions on the disoarity to be well-defended. The problem of data compatibility stemming from uncertainty in definition and measurement of underachievement must be exacerbated in comparing reports from several countries.

Nonetheless, the hypothesis presented below is relevant to discussion of the representation of linguistic units in orthographic structure. If sustained, the hypothesis will remind us that phonetic regularity is not the only sort critical to the reading process, and perhaps suggest further avenues of investigation into these international differences. In the meantime, specific findings are presented.

Benton (1975,3) reports a rate of about 30/1000 boys and 5/1000 girls of elementary school age in the United States and Britain. The sex difference is

"established beyond doubt," but occurs only in the specific condition. That is, there is no appreciable sex difference among disabled readers suffering generalized learning difficulties. Rutter and his colleagues, through epidemiological studies in Britain, have demonstrated regional differences in incidence. Rutter (1978, 25) reports 4% of 10-year-olds on the Isle of Wight and 10% of 10-year-olds in London were diagnosed as having SRD. (This was previously reported as 3.5% for the Isle of Wight and 6% for London (Rutter & Yule, 1975, 185). I am not aware of any reason for the discrepancy.) The sex difference was also observed in these studies, with a ratio of 3.5 boys to 1 girl. As with the international variation, the regional differences are fascinating. One hopes they will stimulate further research.

1.3 On a Unique Basis for the Disorder

As suggested above, an element of progress in the study of SRD is the growing realization that no single cause exists. Though in almost a century of research many possible causes of 'congenital word blindness' (as it was once called) have been posited, the idea that more than one of these might be

required for a full account is relatively recent.

Boder (1973, 664) cites papers by Myklebust (1965) and Quiros (1964) in which two syndromes, or patterns of deficit, are described. In each case, the division is between auditory and visual process dysfunctions. As important as the exact nature of the split is the emerging notion of dyslexics as a 'heterogeneous' group.

The impetus for this rethinking was observation by many investigators of several characteristic patterns of performance differentiating SRD subjects on tasks aimed at hypothesized loci of difficulty. Vellutino (1978, 67) suggests, without elaboration, that the results of sight word learning and word analysis skills reflect the amount of exposure a child has to either strategy. This idea, he claims, is more parsimonious than appeals to neurological dysfunction, which it is, as an idea. Unfortunately, very little is offered in support of the claim. Since it would be difficult to develop a measure of 'exposure to strategies' sufficiently precise for a test of the hypothesis, Vellutino's idea lacks fallibility, and cannot be accepted simply on the basis of parsimony.

In the swing to multi-factor theories, papers by Boder (1973), Mattis, French & Rapin (1977) and Doehring & Hoshko (1977) are most important for our purposes. Mattis, et al. tested 113 children ranging in age from 8 to 18 years. The children were divided into three groups: brain-damaged without reading disability (n 59); brain-damaged with reading disability (n 31); and non-brain-damaged with reading disability (n 29). Across the two dyslexic groups, no significant differences were found, but rather, similarity in the existence of three syndromes or patterns of performance. The patterns were labelled (i) Language Disorder; (ii) Articulation and Grapho-Motor Dyscoordination; (iii) Perceptual Disorder.

The first of Mattis' groups was characterized by significantly lower Verbal than Performance IQ.¹

A second symptom was anomia, which the authors suggest interferes by impeding acquisition of a 'recognition vocabulary.' It is interesting to note

1. Warrington (1967) suggested that such a discrepancy is a superior indicator of SRD. Mattis, et al. do not use it as such because it is also apparent in "disadvantaged and disturbed" children with normal reading skills.

that within this group of children, the most severely impaired are unable to name the letters, a widely reported finding. Vellutino, in what little explicit argument he presents against Mattis, et al., claims that poor readers confuse letters (i.e., reading b for d) because of failure to learn the names of the letters (1978, 108). His point is that the problem is not one of sensory function, but his argument against Mattis falls down on methodological grounds. What he has done is take one symptom, letter confusion, and associate it with another, inability to name letters, explaining the first in terms of the second.

In the framework of the present thesis, confusion of, and failure to name letters would be explained by a common, substrate dysfunction. It is unfortunate that Vellutino uses this example of a linguistic failing against the theories of Boder, and Mattis, et al. (among others). In ascribing to these authors the theory that "dyslexia is caused by disorder either in visual or auditory functioning, " (108; his emphasis), Vellutino is misrepresenting them. This can be judged in Boder's case after the discussion of her work which follows. As for Mattis, et al., 39% of

their subjects were included in the 'Language Disorder' group, and their description of subtypes does indeed allow for what Liberman, et al. 1971) call 'linguistic intrusion errors.'

Returning to description of the syndromes, the second of Mattis, et al.'s groups contained children with roughly equivalent Verbal and Performance IQs. These subjects had difficulty blending phonemes, and typically omitted consonants or syllables when reading or writing. The third group, while possessing intact language and speech, could not associate letters with sounds or words (i.e., could not associate graphic with either physical or linguistic forms), due to extremely poor visual processing.

Boder (1973) had similar results in her attempt to identify clinical subtypes of SRD. Her first group, the 'dysphonetic dyslexics,' were characterized by problems in word analysis and synthesis. Such children, while able to sight read words learned as wholes, were unable to break down new words into segments. Boder referred to syllables and letters, specifically, as segments. Any child who could not break a word into such segments, might also have

difficulty analysing into other subword units, at, for example, the morphological level. This foreshadows subsequent arguments.

The second of Boder's groups, the 'dyseidetic dyslexics', was deficient in perception of whole words as gestalts, and of letters, but was capable of analysis and synthesis. Such children are able to read and spell phonetically, but have difficulty decoding phonetically irregular words. Given a phonetically irregular alphabet, these children would be in much the same position as the dysphonetic dyslexics, having difficulty with analysis into subword units.

The last of the divisions encompasses the mixed dyseidetic-dysphonetic dyslexics. As the label suggests, these children were deficient in both analytic and gestalt function. They failed to read by sight or 'by ear' (670). According to Boder, they were more likely to make the reversal errors with letters than are children of the first category. Since the statistical analysis was incomplete at the time of her writing, Boder could not present quantitative support for this impression. She does, however, report subgroup numbers for 107 children, ranging in age from 8 to 16,

selected from a pool of 300 originally chosen with reference to a "standard operational definition." Of these, 7 fell into an 'undetermined' group; 67 manifested dysphonetic patterns of reading and spelling; 10 were dyseidetic; and 23 fell in the mixed category. Clearly, Boder, like Mattis, et al., believes that SRD reflects various higher processing difficulties, which include language disorder. Having provided reasonable grounds for claiming that at least some portion of the specifically reading disabled population can be considered 'language-disordered', we can now narrow our focus to that group alone. The spirit of the following attempt to specify how a language disability affects reading is captured in a passage from Valtin (1978), in which it is recommended that,

"...research be based on an explicit theoretical model of the reading process, one in which the individual subskills are identified and their interactive connections laid open to view." (219)

Since D.G. Doehring is explicitly in agreement with these sentiments (1978), and since he kindly provided subjects of the present research, an excellent way to begin the next section is to consider Doehring & Hoshko's (1977) monograph.

1.4 Reading Disability and Language Disorder -- (i)

Doehring & Hoshko (1977) obtained subjects from summer programmes for reading and learning disordered children, and from public school programmes directed at learning and language disorders. The children were placed in one or other of two groups: 'R' (n 34), containing those with reading problems; and 'M' (n 31), those with mixed problems. We are concerned here only with the 'R' group.

The motivation for applying as many as 31 tests of reading-related skills to these children is to permit use of the 'Q-technique' of factor analysis. This technique groups children according to patterns of performance, rather than grouping tests by 'patterns of children.' Though allowing groups to fall out in test results is a post-hoc approach, it is effective, and paralleled in other disciplines, such as biology, which has its 'numerical taxonomy' approach to classification.

On the basis of test results, 31 children were divided into three subgroups. 3 children could not be classified, as their loadings were not high enough on any factor. The tests dealt with visual matching, auditory-visual matching, visual scanning, and oral

✓ reading of letters, syllables, words, pseudowords, and sentences. Children in the first subgroup did well on visual matching, but ~~poorly~~ on oral reading tests involving words and syllables. The second group performed well on visual scanning and poorly on auditory-visual matching and oral reading of words. For these children, Doebling & Hoshko posit "difficulty in rapidly associating printed and spoken letters." (285) The last subgroup performed well on the matching of letters (in contrast with the second), and poorly on matching of words and syllables (in contrast with the first). For this group, the authors infer a problem with the perception of sequential information.

One of the interesting differences noticeable in Doebling & Hoshko's results is that only in the third group do we find a real polarization, with performance within one set of tests ranging from very good (letters) to very bad (syllables) on the visual matching and auditory-visual matching tests. Closer inspection reveals more specific within-battery differences of some interest. For example, there is a gap of almost two factor scores between CVC words and CCC strings on

visual matching. Also, scores on auditory-visual matching of words and CVCC syllables are considerably below letter scores. While the score for CCV² syllables on this test is higher than word or CVCC scores, it is a smaller difference. Nonetheless, it is 'in the right direction', which is sufficient for our present, speculative purposes.

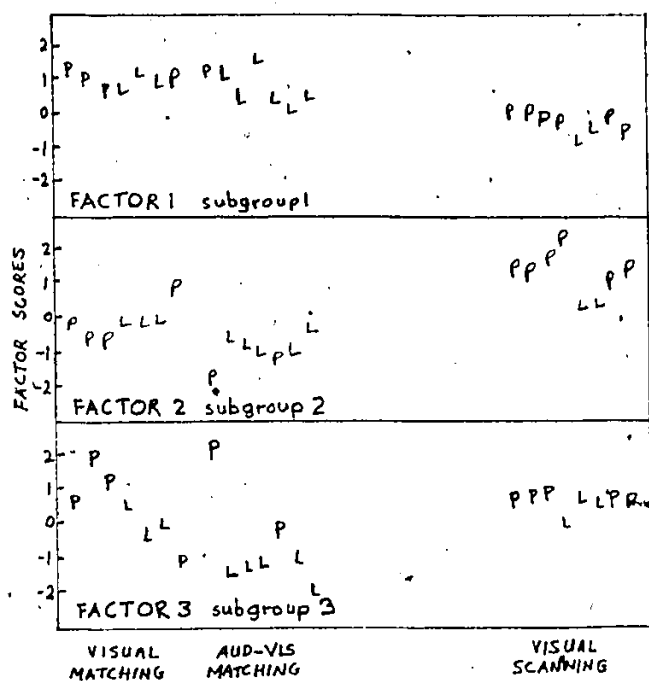
Interesting effects are also observable in the second subgroup's scores. In auditory-visual, the trend was for letters and CCV strings to be more difficult than CVCC syllables, which is the reverse of the effect found for the third group. In visual matching and scanning, however, performance with vowel-less strings is again superior to that with words or CVCC syllables. These differences are small but consistent. However, potential significance of the trends might be lost by too narrow a focus on individual subtests at the cost of more molar qualities. That is, there seems to be one major distinction between the various stimuli. Some, like the letters and the CCC and CCCC strings might be thought of as pictures, their orthographic nature secondary to their existence as shapes. Others,

obviously including words and syllables, are more 'linguistic.' These are less likely to be dealt with simply as shapes.

A similar distinction exists among the tasks, too. Visual scanning can be performed on almost any sort of stimuli. Oral reading and auditory-visual matching are clearly linguistic, and therefore, are qualitatively different tasks to the scanning.

Visual matching is rather harder to characterize, and might be thought of as a mixed pictural-linguistic task, for reasons discussed below.

These gross distinctions do have some validity in the within-battery differences described above. However, teasing the distinctions out of the data might be simpler, were it not for some confounding potential interactions between task and stimulus type. Figure 1 is a rough analogue of Doehring & Hoshko's Figure 1. For the sake of this speculative diversion, several elements of the original have been dropped, and others emphasized, to bring out the linguistic-pictural dichotomy. The figure hints at an answer to the question, which do the children perform better, linguistic or pictural tasks? With the first



P : pictorial stimulus

L : linguistic stimulus

Fig 1.

(Based on Doehring & Hoshko's Fig. 1,
(1976, 285))

group, there is a neat result: they perform the linguistic tasks better than the pictural. The second group also has a reasonably clean cut difference: they perform better on pictural tasks. We can also see that both these groups make a decision about the visual matching task: they treat visual matching as linguistic, with predictable consequences for their performance. The third group has rather more variance than the others. Clearly, they do well on the pictural task of scanning, and poorly on auditory-visual matching. But in the 'dual-natured' visual matching area, the tests are divided into pictural and linguistic, with the former (involving letters) being easier than the latter (which involve words and syllables).

In this way of looking at things, we see an interaction between what kind of task a child finds easier, linguistic or pictural, and how the child categorizes a stimulus with respect to that dichotomy. Parenthetically, Evoked Potential research provides an interesting, related observation. The brain-wave pattern measured in response to the stimulus will be different when the child is expecting a

letter than when she is expecting a number. That is, the primary sensory registration pattern will be much the same, but the subsequent, cognitive-process patterns will be quite dissimilar.

If some subjects are having more difficulty in matching tasks with words and word-like stimuli (i.e., 'rild', a CVCC sequence, could be a word), we might be able to capture that behaviour with a levels-of-processing type recall task, as used by Craik & Lockhart (1975). In any event, putting speculation aside, we are ready to consider some further results on linguistic processing in disabled readers, before moving on to an actual model of the reading process.

1.5 Reading Disability and Language Disorder - (ii)

Perfetti and his colleagues in Pittsburgh, and Vellutino and his colleagues in Albany have sought differences in what they call 'verbal coding,' with quite similar results. Perfetti, Bell, Hogaboam, & Goldman looked at naming time for four kinds of stimuli: colours, digits, picture, and words. Reaction time (RT) in this naming task was considered to reflect "the availability and usefulness of codes that are constantly used in normal reading." (1977,2)

Finding no differences between their skilled and less-skilled readers on the naming of colours, digits, and pictures, the authors ruled out simple naming problems for the less-skilled. They infer difficulties in verbal coding (here, presumably, decoding) at the word and syllable levels, since increasing the number of syllables increases the gap between subject groups. The ability to use context was said not to differentiate the groups, however, since both showed facilitation of response through presentation of a written context in vocalization latency measurements. While the test situation is not described in any detail, such facilitation strikes one as rather odd, since the less-skilled readers, for whom less of the context should have been available, improved their scores by 19%, as opposed to 6% for the skilled readers. Whatever the locus of difficulty, the disadvantaged group should not have been able to take so much advantage of written information, unless, of course, their original VL scores were so low that any improvement would be comparatively large as a percentage.

One drawback to Perfetti's work is that all

disabled readers are lumped together, in spite of evidence that there are several quite separate patterns of underlying dysfunction. However, the concept of verbal coding difficulties also receives support from Vellutino. His subjects, ranging in age from 7 to 14, both poor and normal readers, were required to copy, pronounce, and (where appropriate) spell out stimuli, including three, four, and five item words, scrambled letters, numbers, and geometric designs. The poor readers were "considerably better" in copying than naming verbal stimuli, often mispronouncing words that they spelled correctly. Interestingly, the latter error also happened with normal readers on the word 'loin', which was read as 'lion' (1978, 83). That strikes the observer as being the effect of word frequency on guessing.

Fox & Routh (1975) performed a developmental study of the ability to segment spoken language into words, syllables, and phonemes. The longest period of development was found to be necessary for segmenting syllables into phonemes. Improvement on this task was recorded from ages 3 to 6. This skill has also been associated with reading recognition and comprehension

(Zurova, 1973, cited in Patel, 1978, 24).

Much of the research considered so far has found poor performance by disabled readers on tasks involving separation or blending of linguistic segments. At this point, we could begin to build a theory incorporating this poor performance, arguing for the influence of maturational lag, intersensory integration difficulties, and problems with sequences of symbols. No doubt such deficits are critical in some cases of SRD. However, we may be ignoring the possibility of another, under-researched dysfunction, the effect of which is lost in our focusing on particular levels of linguistic analysis. Phonemes, syllables, and words, after all, are used to code meaning. The meaning, as it were, goes in before the code goes on. Therefore, when we look at children's segmenting and blending skills, we should include segmenting meaning as a crucial, early part of code analysis.

At first blush, this notion seems counterintuitive: presumably, meaning is the goal, the end-product of reading. But that is too simple a view. Most people do not extract meaning in 'gestalts,' processing whole

passages in a flash. Rather, a reader is constantly 'understanding' and 'seeing', piece by piece. These two processes, which share cortical time and attention, are not remote from each other, but, in the view of Goodman (1976) and Lesgold & Perfetti (1978), interactive. According to Goodman, reading is guessing, based on a number of clues which affect the probability of a word occurring. These clues include word frequency, grammatical and semantic context information, as well as such physical features as overall word shape, and familiar bi- and tri-grams of letters. This model is reminiscent of Rumelhart's work on structural interactions in reading, of which Lesgold & Perfetti wrote,

"He has proposed a model in which words are recognized according to a Bayesian process that makes use of conditional probabilities that what was seen is a particular word, given a particular processing context and given particular sets of subword features." (1978, 3)

Implicit in this passage, and of great importance for the present research, is that as any of the sets of subword features, or the processing context, become less (or more slowly) accessible, the conditional probabilities become too low to be useful. Other decoding techniques then have to be relied upon more. Further,

a word recognized and accessed for meaning becomes part of the processing context when stored in working memory. There the word is available to the time-sharing process which constantly switches attention between the print and what has gone before (i.e., decoded text.) Clearly, in any task involving working memory, rapidity is vital. In this sense, there is a stalling speed, a minimum speed at which each of the interactive processes must progress. If the word features are obtained too slowly, the context stored in working memory can be lost.

An important aspect of this model is that some processing for meaning is going on all the time, not just after visual clues are extracted. Meaning is a fundamental aid to that clue extraction, since it creates context. At this point, the structure of English orthography becomes salient. A primary characteristic of English spelling is its morpho-phonemic regularity. Morphological relationships are represented, at the expense of strict phonetic regularity. Awareness (not necessarily conscious) of this quality can facilitate the attempt rapidly to derive morphemes from strings of graphemes. It may not be overstating the case to say that such awareness

is a necessary (though not sufficient) condition for being able to read, particularly if the unit of lexical storage is the morpheme. John Morton has provided interesting evidence of such storage units, in facilitating recognition of test words by pre-training with derivatives of the same root morphemes (Murrell & Morton, 1974):

A propos of this idea, Vogel (1975) investigated morphological skills in children. She found that her dyslexic subjects were inferior to their normal counterparts on 7 of 9 measures of oral syntax, one of which was 'morphological usage.' This discrepancy was also found by Wiig, Semel, & Crouse (1973), using the well-known Berko (1958) paradigm for testing morphological skills. It is of particular importance, as Vellutino points out in his discussion of the subject, that such effects are found early in the development of dyslexics (Vogel's subjects were 7 years of age.) The pattern of impairment, further, is mirrored in neurological patients of 4 years of age. This answers to some extent the cavil that results on these tests reflect different reading experience, rather than underlying dysfunction. Apart from these

papers, there is a dearth of published work dealing with morphological analysis, though Fry, Johnson, & Muehl (1970) refer to some unpublished articles with rather provocative titles.² Because of their obscurity, these papers have had no influence on the present work. The references are included only for the convenience of the interested reader.

1.6 Predictions

The logical successor to a theory is a set of predictions, in this case, about how the child who is developing a reading process might run into trouble. The following predictions revolve around the ideas of the reader as a limited-resource system, and of the

-
2. Barnes, M.D. 1962. An analysis of the oral language of second grade children with emphasis on patterns of sentence structure and verbs and their relationship to factors of reading age, mental age, sex, and socio-economic status. Unpublished doctoral dissertation, University of Indiana.

Evertts, E.L. 1962. An investigation of the structure of children's oral language compared with silent reading, oral reading, and listening comprehension. Unpublished doctoral dissertation, University of Indiana.

Shire, Sister M.L. 1945. The relation of certain linguistic factors to reading achievement of first grade children. Unpublished doctoral dissertation, Fordham University.

'stalling speed' of interactive processes. Clearly, according to the model sketched above, the reader must be able to do several things, including:

- 1 See the print;
- 2 Recognize the letters;
- 3 Sort the letters into morphemes;
- 4 Access and use grammatical and lexical information;
- 5 Sort the morphemes into meaning units;
- 6 Store the meaning units in working memory;
- 7 Access the working memory to develop context.

This list is a simplification, intended to represent the relevant operations, not necessarily in their actual order of application. Why might the child fail in any of these operations? The two most obvious reasons are because of poor visual acuity, and lack of knowledge of the alphabet. These can be discarded as uninteresting at present. Difficulty accessing a working memory would also be detrimental, but presumably would have more serious consequences than reading disability, such as conduction aphasia. Toubke in actually storing meaning in working memory would impair reading, but is more properly the

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subject of studies of the hypothesized phonological recoding operations necessary for working memory storage. This leaves three areas of possible dysfunction for our attention: deriving morphemes from groups of letters; deriving meaning from these morphemes; and accessing and using a functionally complete grammar and lexicon.

Two theoretical points should not be forgotten here. First, these interactive processes are time-dependent, and all operations accessing and applying information must proceed rapidly, as was emphasized above. Second, there is (at least hypothetically) a difference between sorting letters into morphemes and extracting the meaning from those morphemes. That is what is meant by the notion of taking advantage of morphophonemic regularity in the orthography: deriving the morphemes on the basis of spelling similarities (and other clues, of course), then using morphemes to gain access to lexical information.

These are reasonably clear predictions about the possible loci of reading difficulties. A further idea entailed by the model should now be made explicit, as it generates a method of testing these

predictions. The idea is that the types of linguistic dysfunction described above should be reflected in a reading disabled child's speech. If such dysfunction is apparent, capturing it will require a suitable technique of linguistic analysis. One such is described below, after a formal statement of the hypothesis.

2.0 STATEMENT OF HYPOTHESIS

Though a formal statement is presented immediately below, the primary goal of this research is breaking new ground methodologically. This is an exploratory study of naturally occurring speech, adapting a recently-published disordered language assessment procedure. The intent is to quantify natural speech with respect to a number of syntactic and morphological elements, in the hope of assembling sets of linguistic features which can be used in further research on SRD, and which might give some insight into the linguistic bases of reading disability. Natural speech is used because we have no guarantee that the ability revealed in laboratory testing adequately represents spontaneous ability. As Crystal, Fletcher, and Garman (1976, 86) write of the typical imitation task used in lab studies,

"...devising a scheme for use in assessment and remediation needs a wider range of data than imitation tasks can provide - especially when sentence length gets longer than a certain point."

While remediation is not of immediate concern here, assessment certainly is.

More specifically, it is hypothesized that for some definable subgroup of a sample of specifically reading disabled children, there will be evidence in their natural speech of the linguistic dysfunctions which hinder their reading development. The quantifiable differences in the use of certain sub-sentence and subword units will be investigated with a procedure described below. The concept of SRD is discussed and tentatively defined above. Underachievement in reading is defined operationally below, along with the method of obtaining samples of child speech.

3.0 PROCEDURE

3.1 Subjects

The subjects in this study are 63 children taking part in a research project headed by Dr. D.G. Doehring, of the McGill University School of

School of Human Communication Disorders. The children are in 9 groups: 7 in each of grades 1 to 6, and 7 in each of the reading disabled groups described in Doebling, et al. (forthcoming). For the SRD children, in addition to age and grade, sex, full scale Durrell Reading, and Wide Range Achievement Test scores are listed in Table 1. These children were classed as normal with respect to IQ, and socio-economic status, and were without debilitating emotional problems. They were referred to the Royal Ottawa Hospital for being two years behind in reading level.

The controls were from English-language schools in the Ottawa area. Age and grade data for these children are reported as means in Table 2. Controls were chosen randomly from those available, while the top 7 children among each SRD group were selected.

3.2 Materials

For each child, data gathered were based on taped interviews in which subjects were required to tell a story in response to each of four 'Doug Wright' cartoons, the sort appearing in a weekend newspaper supplement in Canada. These taped stories were transcribed by the present writer, with random checks

Table 1
SRD non-experimental scores

Subj.	Sex	Age	Grade for age	Oral	Sil	Durrell LC	WR	WA	Read	W.R.A.T. Spell	Arith
01	M	13.09	8	5	0	0	0	0	7	6	7
2	F	14.01	9	3	3	0	4	4	4	5	7
3	M	14.02	9	5	5	0	0	0	9	5	9
4	M	11.10	6	4	0	0	0	0	8	5	5
5	M	13.05	8	5	5	0	0	0	7	3	7
6	M	13.08	8	3	3	0	5	5	5	4	6
7	M	15.08	10	3	3	0	0	0	5	4	4
A1	F	12.02	7	2	3	2	4	4	5	4	5
2	M	12.11	7	2	2	3	2	2	3	3	1
3	F	14.06	9	3	2	4	4	4	5	3	4
4	M	10.03	5	2	1	5	2	2	1	2	3
5	F	11.10	6	2	2	5	3	3	3	2	3
6	F	8.11	3	2	1	3	2	2	2	2	2
7	M	9.07	4	1	1	-	1	1	1	1	2
S1	M	10.04	5	3	2	5	4	4	5	2	3
2	M	9.05	4	2	2	3	3	3	2	2	2
3	M	12.00	5	2	2	5	2	2	2	2	2
4	M	14.11	9	2	3	5	2	2	2	2	5
5	M	10.03	5	2	2	4	3	4	3	2	4
6	M	10.06	5	3	3	3	2	3	2	2	3
7	F	10.01	5	3	3	3	2	2	2	2	3

Durrell and W.R.A.T. scores are grade levels. C: scored at test ceiling (Grade 6 on Durrell.) Source: Dr. D.G. Doehring, personal communication.

Table 2
Controls, mean ages by grade

Grade	Mean age	S.D.
1	7.01	.3
2	7.11	.2
3	8.03	.6
4	9.03	.5
5	10.10	.5
6	11.09	.3

of accuracy effected by a second transcriber, a graduate student in Linguistics at the University of Ottawa, who worked on roughly one tape in five. At the beginning of the work, grade one children were included, some of whom said very little. Since it was desired to have some sort of equivalence in length of protocol, and since the least talkative young child uttered twenty sentences, that number of sentences was scored for every child.

The matter of protocol length brings up two further questions. First, Fry, et al., (1970), in a less-detailed study of sentence patterns than the present one, stated that, "For purposes of reliability, it was desired to have 50 responses" for each subject (126). Therefore, responses were defined as what they werelike to get 50 of: called Communication Units, they correspond to clauses. Here, no estimate of the number of responses necessary for a desired level of reliability was attempted. In 20 sentences, 50 clauses would be rather a lot for children. Actual mean scores for the 9 groups range from about 21 clauses to 26 clauses. We therefore analyze what data we have.

The second point relating to protocol length is that defining sentences in actual speech is rather

difficult. A focus of the problem is conjunction. When should 'and' be considered the linguistic realization of a logical operator, and when a filled pause? In practice, it was deemed necessary, during the revision of quantification to reduce the amount of uncertainty by erring on the side of caution. Almost all cases of 'and' were treated as filled pauses, with very few exceptions, in which it appeared absolutely necessary to consider two large grammatical units one sentence.

Since other words such as 'then' were used habitually by many subjects, particularly at the beginning of sentences, these too were treated as filled pauses, and ignored. Thus, the data for analysis consisted of 20 sentences for each of 63 subjects. The sentences were quantified by means of the Language Assessment, Remediation, and Screening Procedure developed by Crystal, Fletcher, and Garman (1976).

3.3 L.A.R.S.P.

The Language Assessment, Remediation, and Screening Procedure (L.A.R.S.P.), according to its authors, has several advantages over other systems,

such as Lee's 'Developmental Sentence Scoring' (Lee, 1974). There are two primary objections to the other systems: that they are not broad enough in the range of syntactic features scrutinized; and that they do not mine the useful information to be had from colloquial speech (Crystal, et al., 1976, 13).

A major fault of Lee's DSS system is that it does not deal with sentence fragments or elliptical patterns, insisting that a sentence be complete in every detail. As Crystal, et al. point out, during development, much of the most interesting material occurs in fragments. Fragments represent the areas with which children are actually developing familiarity, and it is possible to discriminate children partly on the basis of such strings. Lee also deals only with a limited range of syntactic features, not including clause and noun-phrase structure, which reduces the value of a syntactic profile generated by the DSS (Crystal, et al. 1976, 17).

With reference to colloquial speech, Lee does

not count most elliptical patterns, and omits such unremarkable and frequent usages as intonational questions. Her system is clearly not based on a good approximation to everyday speech. The LARSP itself is not immune to criticism on this point, though the text contains an extensive exposition of the syntactic framework underlying it. The authors complain that with some other assessment systems, the therapist

"...is continually being left to make his own decisions about questions of analysis - whether an item should be analyzed as X or Y - particularly as regards the more restricted grammatical patterns."
(17)

This is a problem even with the LARSP, and reflects the fact that all such systems are functional, and ride roughshod over the finer points of linguistic theory. In practice, consistency of analysis was found to be of as much importance as doctrinal purity, since the results for each child were to be used in comparisons.

3.3.1 The LARSP Syntactic Framework

The LARSP operates with a relatively simple

'syntactic framework.' Readily definable elements such as Subject, Verb, and Adverbial Phrase, together with a catch-all category, Complement, are used to define clause structure. This level of detail permits comparison of subjects on important sub-sentence units. The major quantitative divisions at clause level are into 2, 3, and 4 element strings. A self-evident example of the latter would be:

He took the boy home

(Level)

S V O A

Clause

(The symbols are defined below).

The division into 2, 3, and 4 element strings also holds at the phrase level, at which the sentence above would be analyzed as:

He took the boy home

S V O A

Clause

Pron Det N N

Phrase

Finally, at word level, the use of 7 morphemes was recorded, 4 of the original 11 being discarded from the analysis because no exemplars occurred. At this level, the sample sentence would be analyzed as:

Table 3a
Symbols

Sentence

S	Subject
V	Verb
A	Adverbial Phrase
O	Object
s	Subordinator
(s)	Underlying s
C	Complement

Phrase

Det	Determiner
N	Noun
Adj	Adjective
Pr	Preposition
Pron	Pronoun

Word

-ed	Past tense inflection
-pl	Plural inflection

Table 3b
Measures

No.	Measure	Abbreviation	Example
1	Number of two-element phrases	(2 Elt. Phr.)	Pr Pron
2	Number of three-element phrases	(3 Elt. Phr.)	Pr Det N
3	Number of four-element phrases	(4 Elt. Phr.)	Pr Det Adj N
4	Number of noun phrases	(Noun Phr.)	
5	Number of verb phrases	(Verb Phr.)	
6	Number of adverbial phrases	(Adv. Phr.)	
7	Average noun phrase length (morphemes)	(Noun Phr. Length)	
8	Average verb phrase length (morphemes)	(Verb Phr. Length)	
9	Average adv. phrase length (morphemes)	(Adv. Phr. Length)	
10	Number of two-element clauses	(2 Elt. Cla.)	S V
11	Number of three element clauses	(3 Elt. Cla.)	S V O
12	Number of four element clauses	(4 Elt. Cla.)	S V O A
13	Number of subordinate clauses	(Subord)	S S V O
14	Morphological composite score consisting of instances of:	(Morph)	
	i ing (verb final)	(-ing)	
	ii plural ending	(-pl)	
	iii third singular ending	(3s)	
	iv past tense ending	(-ed)	
	v contracted auxiliary	(.aux)	
	vi contracted copula	(.cop)	
	vii contracted negative	(n't)	
15	Pronouns - Determiner/noun strings	(Pron-DN)	
	A qualitative measure affected by a child's skill with reference. Some subjects used object pronouns where the referent was unclear, or had not been introduced. Such a practice would be reflected in a high positive score. (Here, the hyphen is an arithmetic operator, subtraction.)		

He took the boy home					
S	V	O	A		Clause
Pron		Det	N	N	Phrase
	-ed				Word

Only section C of the LARSP report form illustrated on page 85 of the handbook was used. All problematic and unanalyzable sentences or fragments were discarded. Since there were so few questions or responses to questions, these were scored as sentences, with any 'question element' considered a variable X. Sections C6 and C7 of the report form were also not used, since it was not thought necessary to develop a comprehensive picture of subjects' stylistic and discourse abilities. In addition, such analyses for all 63 subjects would have taken more time than was available. Counts of sentence length and numbers were not made because of the standardization of length of protocol. However, length in morphemes and number of phrases (noun, verb, and adverb) were counted, to give some sense of sentence complexity.

Natural speech is notoriously hard to codify, and there was much that was idiosyncratic in my scoring of these protocols. Additionally, scoring

became more consistent towards the end of the first run-through, as my understanding of and familiarity with the Procedure increased. For these reasons the protocols were scored twice, the first set of results being discarded unanalyzed. The idiosyncracies were, thus, consistently applied.

Though it is not possible to list all of the personal conventions used, two important ones, relating to frequently-occurring sentence types, should be mentioned. Sentences of the form,

He asked his dad to fix the wheels

were considered to have the underlying form, and
analysis,

He asked of his dad that he fix the wheels

S	V	A	s	C	
			S	V	O
Pron		Pr Det N	Pron	Det	N
	-ed				-pl

The symbols are explained in the complete list of

measures used, in Table 3. As suggested above, in studies such as this, consistency of approach is of greater importance than fine points of linguistic theory. The analysis for this sentence type will not be defended in greater detail here.

The second convention is similar, and deals with sentences of the form,

He told the boy to come home.

Such sentences were analyzed as,

He told to the boy to come home.

S V (s) C

		S		V	A
			N		N
Pron		Det			
	-ed				

These two conventions were made because the sentence types were extremely common, but there was no explicit analyses in the LARSP for them. The examples above also demonstrate how the analysis proceeded at three levels.

3.4 Caveat

An issue that might cause some concern is subject sample size, which at 7 is quite small. Because of the amount of work involved in scoring one protocol, it would not have been practical to use more than 7 children in each group, given 9 groups. It was originally hoped that the controls, since they represented grades 1 to 6, might yield evidence of roughly linear development, providing a scale against which the experimental subjects might have been measured. Though sample size, consequently, was small, it was considered by several skilled resource people to be sufficient for parametric testing of the hypothesis.

4.0 RESULTS

Table 4 presents group means for each of the 15 measures and 9 groups. All further analysis was performed on these data. The significance level was set at .10 throughout because, with such small samples, it was felt necessary to reduce the likelihood of Type II error, since this is an exploratory study.

Analysis of variance was performed on scores for all measures, first on grades 1 to 6 children, then on groups O, A, and S. The results appear in Table 5.



Table 4

Group means for all 15 measures

Measure	Group								
	1	2	3	4	5	6	0	A	S
2 elt. phr.	19.7	20.0	25.4	24.7	26.0	23.9	24.7	23.0	21.0
3 elt. phr.	15.1	20.1	16.1	15.7	19.4	18.1	19.9	15.9	15.4
4 elt. phr.	3.3	1.9	1.9	1.9	4.1	2.6	3.3	2.1	1.6
noun phr.	24.4	24.0	24.0	23.1	23.4	23.9	23.7	22.3	21.9
verb phr.	25.7	25.3	24.9	24.7	26.1	25.1	27.6	26.3	23.9
adv. phr.	12.0	9.3	12.4	11.6	16.3	14.4	15.6	12.4	11.7
noun phr. length	1.7	1.6	1.7	1.8	1.8	1.8	2.0	1.7	1.7
verb phr. length	3.4	3.4	3.5	3.5	3.5	3.1	3.5	3.4	3.2
adv. phr. length	2.5	2.8	2.5	2.4	2.9	2.7	2.7	2.4	2.4
2 elt. cla.	8.0	7.6	5.7	5.7	4.3	5.1	6.4	6.9	5.9
3 elt. cla.	13.3	13.7	12.3	13.1	11.4	13.7	12.9	13.0	14.1
4 elt. cla.	4.6	3.4	6.1	5.9	9.7	6.0	7.7	5.7	3.1
subord.	4.6	4.3	4.1	3.1	4.3	3.3	5.3	3.3	1.9
morph.	30.0	31.7	27.3	28.0	29.6	23.1	32.1	23.6	26.4
pron-DN.	2.1	6.0	4.6	3.0	-1.9	-1.4	5.7	1.3	4.6

Table 5
Analyses of variance for controls, and for SRD subjects

Measure	Control 'F' (5, 36)	SRD 'F' (2, 13)
2 elt. phr.	2.006	.677
3 elt. phr.	1.379	1.498
4 elt. phr.	1.347	2.667*
noun phr.	.523	1.149
verb phr.	.171	2.949*
adv. phr.	3.571	1.930
noun phr. length	.410	1.872
verb phr. length	1.070	1.482
adv. phr. length	1.940**	3.781**
2 elt. cla.	3.104**	.432
3 elt. cla.	.461	.668
4 elt. cla.	5.592***	7.904***
subord.	.330	3.286
morph.	1.106	2.486
pron-DN.	1.034	.778

*: $p < .10$ **: $p < .05$ ***: $p < .01$

For the Composite Morphological Score, all the control group means fall within the range of experimental group means. Therefore, we have not yet found evidence of any reduced ability in morphological analysis in SRD children. Since so little variation was found across grades 1 to 6, the idea of locating SRD children along a developmental line defined by control scores was abandoned.

The 5 measures for which significant differences were found within the experimental groups were used in the next step of the analysis. First the O, A, and S group means were ranked for each of these 5 measures, as shown in Table 6.

Table 6
Ranked significant measures (SRD gp.)

Measure	O	A	S
4 Elt. Phr.	1	2	3
4 Elt. Cla.	1	2	3
Subordinate	1	2	3
Verb Phr.	1	2	3
Adv. Phr. Length	1	2.5	2.5

This was the first reasonably reliable evidence that the 3 reading disabled groups could be separated by

experimental measures. A further analysis of variance between each of the SRD groups and the combined 5 and 6 controls was performed, in an attempt to determine the reliability of the differences in performance indicated by the rank ordering. The 'F' values are shown in Table 7.

Table 7

Analysis of variance on 5 measures between each SRD group and combined grades 5 and 6 controls.

Measure.	O	A	S
4 elt. phr.	.005	1.420	2.978
4 elt. cla.	.009	2.805	13.444***
subord.	1.537	.188	3.697*
verb phr.	2.519	.183	2.279
adv. phr. length	.991	6.625**	9.013
*: $p < .10$ **: $p < .05$ ***: $p < .01$			

Though not all these disparities are significant, the S group is clearly further removed from the controls than the A's, who, not so clearly, seem to be further removed than the O group. This picture was clarified somewhat by conversion of the group means to Z scores, using the combined 5 and 6 group mean and standard deviation as base, followed by summing the Z's across measures for each SRD group. The summed

Z scores are listed in Table 8.

Table 8
Summed Z scores

Group	Z
O	.88
A	-2.26
S.	-4.93

At this point, it is possible to state that, at the least, quantitative evidence has been found of differences in the speech of SRD children. Further, the rank ordering, and to a lesser extent the analysis of variance (Table 7), allow grouping of these children as they were distinguished by independently administered tests of reading achievement (Table 1).

The above result is, in itself, interesting, but it has been pointed out³ that these 5 measures may not accurately reflect the bases of variance between the groups. Therefore, a factor analysis was performed, using the SPSS system PAI (Principle factoring without

³ At a research seminar in the Psychology Department, University of Waterloo, in which these results were presented, in October 1979.

Iteration), with a varimax rotation, on scores on all measures, for each child in grades 5 and 6, and groups O, A, and S. Out of the 15 measures, 5 factors were found with eigenvalues greater than 1. Since 2 of these were borderline, however, only the first three were used in further analysis. The rotated factor matrix for these factors is presented in Table 9.

These results are much clearer than had been expected, considering the small samples. The first factor loads primarily on number of phrases and subordinate-clauses. Not surprisingly, counts of noun, verb and adverb phrases are related to two, three, and four element phrase totals. Also, in the absence of conjoined sentences (for reasons stated above), use of subordinate clauses is an important way of lengthening a protocol. Therefore, it is reasonable to consider this first factor as based on protocol length. It is, in other words, a verbosity factor.

The second factor clearly involves 3 and 4 element clauses and adverb phrase length. Particularly interesting is the negative weighting of 3 element clauses. Returning to the table of group means for all measures (Table 4), we see that for 2 element clauses,

Table 9
Rotated Factor Matrix

Measure	Factor 1	Factor 2	Factor 3
2 elt. phr.	-0.046	0.521	0.362
3 elt. phr.	0.747	-0.136	0.115
4 elt. phr.	0.614	0.116	0.359
noun phr.	0.872	-0.147	-0.039
verb phr.	0.828	0.016	0.249
adv. phr.	0.056	0.327	-0.062
noun phr. length	0.338	-0.147	0.031
verb phr. length	-0.067	0.262	0.917
adv. phr. length	0.057	0.568	0.021
2 elt. cla.	0.129	-0.060	0.037
3 elt. cla.	0.232	-0.832	-0.124
4 elt. cla.	0.533	0.698	0.280
subord.	0.902	0.141	-0.052
morph.	0.522	-0.006	0.758
pron-DN	0.337	-0.389	-0.047

there is a good linear decrease in incidence over grades 1 to 5, which is exactly and negatively matched for 4 element clauses. This is clear evidence of development, and 4 element clauses was the only measure which discriminated both the control and SRD groups (see Table 5, ANOVA). Parenthetically, it should be noted that all the results were somewhat blurred by the fact that the grade 6 subjects performed noticeably worse than the grade 5's. Reasons for this will be advanced in the Discussion section. Still, the developmental trend in the use of clauses is neatly captured by the following model.



Fig. 2

As 2 element clauses begin to decrease in frequency, 3 element clauses increase. When 4 element

clauses enter the picture, the 3 element structures begin to decrease. This no doubt reflects development of skills at various levels: the older children have a larger vocabulary, are more familiar with grammatical strings, and are adept at planning the larger strings. Since there is a roughly linear increase in adverb phrase length, this second factor may be considered a measure of sentence complexity. As shown above, in Table 4, the rank ordering of the SRD groups on these items is O:1, A:2, S:3.

The third factor loads heavily on only two measures, morphological composite score, and verb phrase length. This, again, is not surprising, because 6 of the 7 components of the composite score add to the length of verb phrases. Thus, the inflection of verbs is the most important influence on the morphological usage basic to this factor. This is particularly interesting because it suggests that a more comprehensive morphological score used on more varied samples of speech might support the idea of ability in morphological analysis being critical for reading development.

What does the factor analysis tell us? That our

data on the 35 children involved reflect 3 qualities of their spontaneous speech: talkativeness, sentence complexity, and facility with verb inflection. The next question of interest is, can we differentiate reading disabled from control subjects in terms of these factors? To answer this question, and in an attempt to mitigate the effect of small sample size, the SRD and control subgroups were amalgamated, yielding two overall groups, of 21 and 14 children respectively. The factor score coefficients already generated by the SPSS PAI programme were used to weight scores on each measure, for each child and each factor. The weighted scores were then summed across measures, and T-tests were performed to test the group differences for significance. The test results are reported in Table 9.

Table 9

Factor 1	Mean	Var	SD	T
Group 1	.180	1.194	1.093	.907
Group 2	-.134	.882	.939	
Factor 2				
Group 1	.479	1.254	1.120	2.482***
Group 2	-.319	.617	.786	
Factor 3				
Group 1	-.186	.909	.953	-.896
Group 2	.124	1.069	1.034	

***: $p < .01$

That completes the statistical analysis carried out on the experimentally obtained data. We can be confident in saying that a measure of sentence complexity (Factor 2) in the naturally occurring speech of reading disabled children serves to distinguish these children from normal readers of the same age. It is important to note that SRD cannot be considered a cause of simplicity of sentence since not all the SRD subjects showed the effect. Indeed, sentence complexity was reflected in 2 of the 5 measures which differentiated the SRD subgroups from each other.

5.0 DISCUSSION

The hypothesis stated above referred to several kinds of linguistic dysfunction, evidence of which was sought in the natural speech of reading disabled children. Since the linguistic dysfunction was hypothesized to obtain in only a subset of all cases of SRD, such evidence was not expected to be found in all subjects' protocols.

As it turned out, the experimental measure of morphological usage permitted no division of subjects into performance groups. This is interesting, because

Doehring, Trites, & Patel (forthcoming), administered the Berko test of morphological usage to the children involved in the research reported above, and found that the test discriminated the O, A, and S groups. There are two possible explanations for the discrepancy in these results. First, and perhaps most likely, the present research has not given the hypothesis of difference in morphological analysis ability a fair test. Small sample size, possible confounds of age with respect to the O group, and a limited amount of speech available for analysis may all have militated against a fair test. Alternatively, the Berko test may not reflect everyday usage adequately, as Crystal, et al. suggested of lab tests in general (1976, 13). This failing might be a function of the test material, or of a child's shyness and slowness as a consequence of previous failure on such tests. The first possibility could be tested by a replication of this experiment with improvements in the design, as outlined below. The second is a much larger issue, beyond the scope of this paper.

In an earlier part of this report, the concept of originality in the selection of independent variable was referred to several times. It is hoped that the cause of originality has been served by the application of the experimental measures to natural child speech. It is appropriate at this point to review some of the benefits accruing from this study in experience, before summarizing the rather more modest, substantive gains.

If this experiment were to be performed again, it would be with several changes. First, it would be wise to concentrate all control subjects in the range of ages of the SRD children. Much of the linguistic capacity under review has developed by age 7 or so, and the focus is not so much on development of language as on gaps in a developed capacity. Secondly, it would, by the same token, be desirable to increase the number of SRD children, if possible, to reduce the possibility of Type II error, and make results more reliable. Since we have evidence of several syndromes of dyslexia existing, it is as well to attempt some pre-experimental categorization of SRD subjects, to which any experimental discrimination of

subjects can be compared. Third, and perhaps most important, a greater variety of material should be used to stimulate the natural speech used as raw data. Boredom with subject matter is likely to plague a study involving only one stimulus and a considerable range of ages in subjects.

All the above considerations deal with experimental design and methodology. Another potential problem area is the quantification of speech for analysis, a concern of the discipline of linguistics. A major problem, as stated above, is definition of the sentence, so crucial to accurate judgements of protocol length. Attempting to get around this problem by counting everything said is obviously unsatisfactory, since it would allow for testing only of the influence of verbosity on reading ability. It is felt that since children with more complicated speech are more likely to use conjunction as a logical operator (rather than a filled-pause-type 'and'), the conservative approach of eliminating conjunction is likely to have reduced the differences between the linguistic high- and low-achievers on all measures.

The schema provided by Crystal, et al. has the

advantage of a firm foundation in recent linguistic theory - as opposed to say, Fry, Johnson, & Muehl (1970), who use theoretical references dating back to 1930. At the same time, the functional approach prevents the authors from worrying about fine points of theory when doing so is not strictly necessary. As Chomsky (1957) pointed out many years ago, the object is not to perfect theory before applying it, but to generate a reasonably sound theoretical framework, and then modify it insofar as it proves unsuitable to practical use.

In spite of this firm foundation in recent theory, however, of the 15 measures derived from, or added to the LARSP for which enough subjects had any scores at all, 10 were found to reflect only 3 factors. These were protocol length, sentence complexity, and morphological usage. Further, two borderline-significant factors, which together accounted for 14.8% of the variance among SRD subjects, involved another 3 measures. Therefore, without intending any derogation of a most interesting approach to disordered language, the LARSP cannot be recommended for this sort of study. Exploratory work, such as the present paper, in co-operation with mainstream linguistics, may be able to develop a more appropriate set of measures, working

not just with elements of a syntactic profile, but with the inherent correlations of those elements.

In this respect, a speculative look at the correlates of phrase length is instructive. Since this is entirely post hoc and speculative, we can include here the fourth factor generated by the PAI programme, apparently a stylistic factor. It accounted for 7.8% of the variance and loaded on number of 2 element phrases, noun phrase length, and the pronoun - determiner/noun score. With this factor, we can derive the following relationships:

Adv. phr. length	reflects	sentence complexity
Verb phr. length	"	morphological ability
Noun, phr. length	"	stylistic skill

Use of a pronoun instead of the determiner noun group would, of course, reduce the average length of noun phrases. Therefore, use of pronouns without concern for an interlocutor's comprehension should be reflected in shorter noun phrases. If this could be demonstrated experimentally, we might have grounds for reducing thirteen of our fifteen measures to four: the three phrase length measures and protocol length.

Since it is too soon to make suggestions for

teaching on the basis of analysis of natural speech in disabled readers, the final topic of discussion is comparison of the above results with Doebling & Hoshko's classification of similar groups of reading disabled children.

On the three scores related to complexity, which have become the most important of all, there is very definite cleavage between the SRD groups. (See Table 4) The O group performs best, the S group worst, with the A's in between. Doebling & Hoshko's O and A groups, however, performed below the intermediate level of the S's on oral reading of words. More in tune with our findings are the S group's scores on auditory-visual matching of words and syllables, which were depressed compared to the A's and especially compared to the O's. It was suggested above that word-ness, by stimulating deeper processing, could be a substrate of the response delay in Doebling & Hoshko's tests. Presumably any difficulty in processing words would exacerbate the delay⁴ on such tests. If access to the

⁴ Unfortunately, a difficulty in processing words (i.e., getting into the lexicon) is likely to be hard to distinguish from a difficulty in actually extracting the words from the print.

lexicon is, as Morton suggests, via morphemes, the S group's performance on auditory-visual matching could be explained as a slowness in extracting morphemes from print, i.e., in segmenting the words.

Equally interesting is the relationship between our sentence complexity measure and the earlier tests. Doehring & Hoshko posited a problem with "rapid perception of sequences of graphemes and phonemes." (1977, 285; emphasis added.) However, if we again invoke a more profound, less sensory word-processing problem, we might consider a lack of complex sentences to reflect an inability efficiently to derive and manipulate semantic information, which Vogel (1975) showed to obtain in some SRD children. All such possibilities require, and deserve, a better test than that reported above, a test profiting from the experience gained in this research.

6.0 SUMMARY AND CONCLUSIONS

This study has demonstrated a non-trivial connection between sentence complexity in natural speech, and reading ability, at least in the small groups observed. Since the effect was so strong, it

encourages further research on the same subject, and to some extent justifies the use of natural speech rather than more easily manipulated, laboratory-derived data. In addition to the substantive progress, valuable experience has been gained (by the writer) in the areas of experiment design, assessment of the quantitative aspects of language, and dealing with some of the problems encountered in studying spontaneous speech.

63 children in 9 groups, comprising grades 1 to 6 and 3 reading disabled groups were involved in this study. A quantification of samples of their natural speech, using the Language Assessment and Remediation Screening Procedure (Crystal, et al., 1976), was found to reflect substantial differences in the degree of sentence complexity, with the S and A groups of disabled readers being significantly lower on this factor than all others. Though significant differences were not found for any other factors, this failure is quite possibly a result of the experiment design inadequacies. The matter is still open. Finally, an attempt was made to relate findings to Doehring & Hoshko's classification of similar children (1976).

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