

**A FRAMEWORK FOR TESTING KANNADA READING ON THE BASES  
OF AUTOMATICITY, RULES OF ORTHOGRAPHY AND SEQUENTIAL PROCESSING\***

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The purpose of this study was to differentiate the good and poor reading Kannada children on the bases of the factors of automaticity, rule of orthography, and sequential processing. The relationship of the strategies of simultaneous and sequential processing to reading was also looked into.

Kannada is a Dravidian language, written in a phonetically regular script. The script has a 50 letter alphabet and involves a large number of regular and irregular rules in forming syllables.

Two groups of grade 3 children, 10 good achievers and 10 poor achievers, aged eight years, served as subjects. The subjects were tested for automaticity in reading (words and syllables exposed for one half a second) and reading at their own pace. The subjects were also tested for their nonverbal sequential and simultaneous strategies using the tests - Auditory Sequential Memory; Visual Sequential Memory; Raven's Progressive Matrices; and Memory for Designs.

ANOVA and 't' test were used for statistical analysis of the data. The findings are discussed as follows.

The findings of the study supported the proposal that good readers and poor readers in Kannada can be usefully differentiated based on the measures in automaticity and orthography in reading. The idea that the cognitive nonverbal processing strategies will be related to sequential reading and automatic reading of the readers was partially supported.

Automaticity in reading was observed to be well developed among good readers in comparison to poor readers. Good readers could read significantly more syllables as well as words at

brief exposures. The good readers had learned well to read these stimuli automatically without deploying much attention. Though it is held that automaticity develops sooner after beginning reading, only good readers were found to be better automatic readers. Poor readers were probably still attending to the details of print to decode the stimuli and yet to become adept in reading invariant units of print.

The findings that the poor readers could correctly read a large number of syllables when allowed to read at their own pace supports the idea that inadequate development of automaticity was a factor contributing to their reading difficulties. Speed of stimuli recognition in reading has been found to be a factor contributing to reading achievement. It was found that orthography highly contributed to reading ability. It is plausible that the poor readers could have read correctly and automatically if they had acquired the invariants of orthography. Accepting that the knowledge of orthography plays a significant role in the establishment of reading, it can be stated that behaviourally the poor readers are slow in the decoding of the reading stimuli.

It was expected that the subjects who had two years of formal learning experience in the classroom will become automatic decoders. The subjects could have normally learned the details of print and been fluent in decoding. The observations are supportive of the idea that good readers are fluent decoders and the converse that the poor readers are slow in decoding the reading material.

It is possible to speculate that it is the knowledge of the rules of writing/invariants of print that may be primarily responsible for the development of automaticity. It was seen

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that it was poor readers' knowledge of syllables that had contributed to their automatic reading of words, which is comparable to that of good readers. But, on reading following long exposures, only good readers showed a high relation between reading syllables and words. It can be surmised that it is the knowledge of the rules of orthography, apart from other possible factors like practice, that permits the development of automaticity among good readers. Similarly, it is the lack of good knowledge of orthography that affects the performance of poor readers both in reading following long exposures and in the development of automaticity.

As children develop automaticity in reading i.e., learn to process the stimuli parallelly, with deploying least attention to the details, they become good readers. It was expected that children's automaticity in reading relates to the nonverbal strategy simultaneous processing. Particularly on the measure Progressive Matrices, a trend of relationship between their reading achievement and simultaneous processing, was seen for both groups. Whereas good readers showed a relationship between reading complex material and simultaneous strategy, the poor readers showed a relationship between reading simpler stimuli and the simultaneous processing. For example, whereas good readers seem to be processing complex words, simple words, and complex syllables simultaneously, for the poor readers such processing seems to be restricted to alphabet letters, simple words and complex syllables. There was also a trend observed that for poor reader, reading syllables was related to simultaneous processing. But it was noted that the relations were not strong ones.

Before the children become fluent readers, they need to learn about the details of print and the invariants therein. Kannada children need to learn the alphabet, allographs of all the letters, and forming syllables by using them. The observation was

that the good readers had learned to read using those details very well, compared to poor readers. Good readers were not only able to read significantly more number of stimuli, but were also able to make use of lower level abilities (required in reading simple stimuli) for reading complex stimuli.

Good readers read significantly more number of letters of the alphabet at brief exposures. However, poor readers did correct a large number of the misread letters at long exposures. But still it was the poor readers who had a large number of letters left misread after the long exposures. Kannada letters have round envelopes and many of them can be confused to each other based on their forms. It was observed during the interactions that whereas good readers rarely had confusions, poor readers had more confusions among letters. Poor readers were not able to make out the salient features of the letters not only at brief exposures but also following long exposures. It has been found in English that letter recognition ability determines the ability of word recognition and reading speed.

Syllabic scripts are thought to be easier scripts for reading acquisition. This is not true of all languages. It was found that poor readers of this study had considerable difficulties in decoding the syllables and in constructing the syllables. It could be that though Kannada script is syllabic, apart from having similar looking/confusable letters, it follows many ligaturing rules which are often irregular and complex which pose difficulties in reading acquisition.

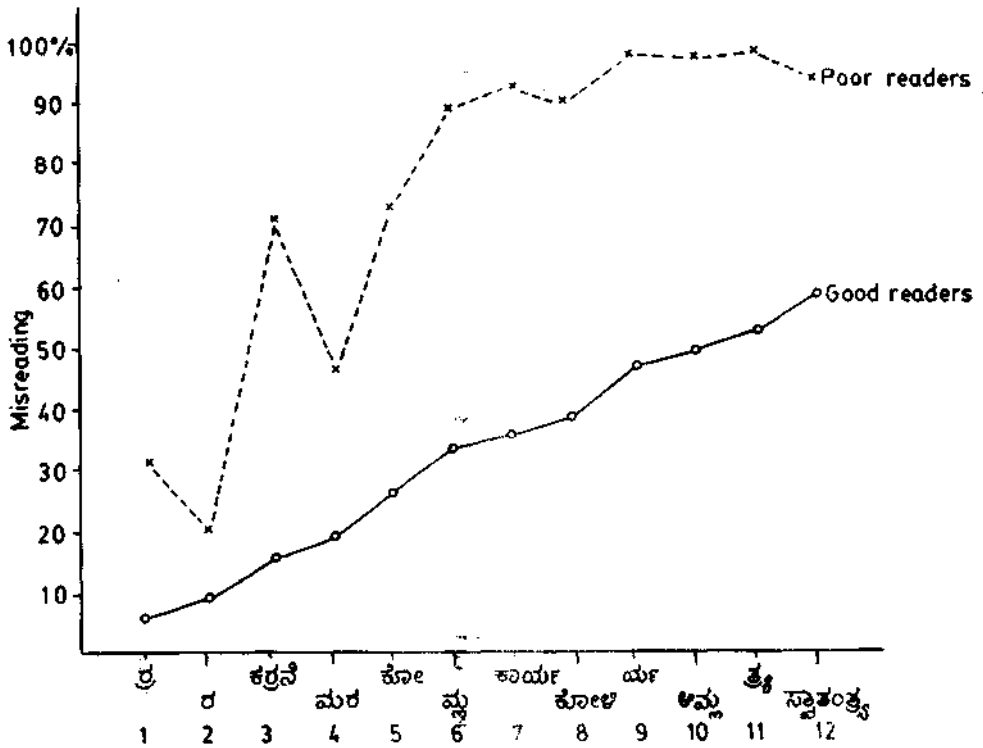
Knowledge of the rules of orthography was observed to be an important factor differentiating the good readers from the poor readers. There were significant differences between good and poor readers in their achievements. Good readers scored better in reading the syllables composed of different rules of orthography than the poor readers (Figure 1). Good readers were

able to correct most of their misreadings following long exposures of the reading materials, whereas the poor readers could not owing to their paucity in the knowledge of the rules of orthography. Good readers' ability in using their knowledge of orthography in reading words was also found to be higher than that of poor readers. Generally poor readers misread more than the good readers in all measures of reading.

Gibson (1969) and Massaro, et.al.

(1980) found that the skilled readers in English are more apt to perceive the letter strings of English orthography. It was found true among Kannada skilled readers that they perceived the complex syllables better than poor readers. Poor readers' difficulties in learning orthography have been noted in English. It was found true of Kannada readers too.

It is necessary to learn the various rules of adding vowel ligatures and



Stimuli

1. Geminated CCV syllables.
2. Alphabet letters.
3. Words with CCV syllables.
4. Words with alphabet letters.
5. Syllables with various vowels.
6. Blend CCV syllables.
7. Words with syllables of alternate spelling.
8. Words of syllables with various vowels.
9. Syllables with alternate spellings.
10. Words with syllables of CCV blends.
11. CCCV blends.
12. Words with CCCV syllables.

Figure 1. Misreadings of various reading stimuli by the poor and good readers.

consonant ligatures to Kannada letters if one has to read Kannada syllables. These ligaturing rules often are inconsistent. It will not be possible to read a large number of words if the orthographic rules are not known. It is known that it is the orthographic learning than the association learning that makes the reading efficient. Unlike in English, Kannada children are explicitly taught of orthographic rules in forming the syllables. According to this study the good readers had learned the orthographic rules, whereas with the same teaching exposure the poor readers had not learned those rules. Morrison (1984) had observed that disabled readers experienced difficulty in learning associations that are governed by rules, particularly if those rules contained exceptions or inconsistencies. It was the inability of poor readers in acquiring rules that had affected their reading. According to Baron, even when the rules are not taught, the orthographic rules are learned by observing similarities in words. Probably, in addition, such a learning might also not be happening among the poor readers.

It is possible that when not all the instances of forming syllables are taught in the classroom, the readers may find it difficult to construct certain complex syllables. According to Gagne (1970), even when the lower order rules are learned, the higher order rules may not also be immediately known the complex rules may have to be taught. It was observed that even good reader had certain difficulties in reading complex blend syllables. However, it is the poor readers who had scored consistently less in all the measures of orthography including the identification of letters.

These findings support the idea that poor readers have difficulties in learning the rule-based graphophonic associations. Also, as the complexity of syllables increases the difficulties in reading increase proportionately. In this regard the poor readers are worse affected. Except the simple

reading material like letters of the alphabet and words made of them, they find most of the orthographic rules difficult to handle (Figure 1).

It has been noted since a long time that reading difficulties in English are associated with sequential difficulties. Reading Kannada syllables (except the letters of the alphabet) and words need processing of more units than one. It is imperative that the units are followed in the right sequence for correct reading. The sequencing difficulties and reversals observed in reading Kannada were meager in number. The good reading group had such difficulties only in reading 0.05% of the stimuli and also the poor readers had such difficulties only in 0.01% of the stimuli

Transposition of Kannada syllables are possible only when the words are of simple syllables like alphabet letters. The English alphabet being phonemic, sequencing difficulties have been found higher in number compared to Kannada. Shankweiler and Liberman (1972) reported 15% of the total errors as sequencing errors. Kannada letters, which generally occur with various ligatures, rarely form words without ligatures thus reducing chances for transposition of syllables. Transposing the ligatured syllables in words may render the words nonpronounceable. Thus the number of transpositions seen are very less among Kannada readers compared to English poor readers. Kannada orthography thus provides immunity for transpositions of syllables within the words. When the reversals do occur the words thus formed may be meaningful or at the least will be pronounceable. Transpositions of syllables seem to be visual in nature. The transposed syllables were not related linguistically.

Kannada script being syllabic transpositions within syllables need separate discussion. In syllables of consonants and vowels there can be no transpositions as always the syllables end in vowels. There can be transpositions in syllables with two consonants

and a vowel. The consonants can be reversed. These are unlike the palindromes in English. The reversed syllables may bring about a change in meaning of the word and sometimes produce nonsense but pronounceable sequences. Similar to the observation of Shankweiler and Liberman (1972), it was found that the reversals were quite inconsistent. In Kannada, generally the allograph of a consonant is infixed in a CV syllable to form a blend. For example, 'ರ' [ r ] allograph with 'ಕ' [ ka ] is pronounced 'ಕ್ರ' [ kra ]. As an exception, an other allograph 'ರ' [ r ] with 'ಯ' [ ya ] i.e., 'ಯರ' is pronounced [ rya ] which is not infixed but prefixed auditorily and suffixed visually. In both these instances the transpositions have been observed which rule out the consistency in misreading.

Few orientation reversals were observed in the reading of both the good and poor readers. Reversals of only two letters were observed, 'ತ' [ ta ] and 'ನಾ' [ na ]. They were confused for each other. The basis for their misreading can be visual as well as auditory. The letters are not only visually reversible but also their sounds are related phonemically.

In one instance the problem was not only of the reversal but also was associated with the verbal retrieval. The sign 'ಮ' written below the level of letters presents the allograph of [ m ] and the same next to letters represents the allograph of [ r ]. In decoding the syllable 'ರ್ಮ' [ rma ] the response was 'ಮತ' [ mata ]. The allograph 'ಮ' [ m ] should have been infixed to 'ರ' [ ra ]. But the subject who had failed to recall the syllable 'ರ' [ ra ] had recalled 'ಮ' [ m ] correctly and also reversed its visual form to decode again 'ಮ' as 'ತ' [ ta ]. It could have been 'ರತ' [ rata ] if there was only the misreading of 'ಮ' [ ma ] as has happened in a latter instance.

These examples support the finding that the reversals are very inconsistent.

It was suggested from the findings by Shankweiler and Liberman (1972) that visual reversibility is not a sufficient condition for the misreadings and that there may be a linguistic basis. From these few examples seen it may be noted that the bases for the reversals could be both. Whereas the reversals can be dependent on the basis of related sounds ( 'ನಾ' [ na ] and 'ತಾ' [ ta ] ) they can also be based on visual characteristics ( 'ಮಾ' [ ma ] and 'ತಾ' [ ta ] ).

The sequencing difficulties observed were not only inconsistent but were also not significant enough to disrupt reading primarily. The findings of Doehring, Trites, Patel, and Fiedorowicz (1981) are also similar. They had classified one of the poor reading groups as sequential reading disability type. They stated that the sequencing problem could result from a difficulty in learning to recognize orthographic regularity, a purely phonological difficulty in segmenting spoken syllables and words. They also recognized that the sequencing difficulty had less severe practical consequences.

It was observed that good readers and poor readers equally performed on the tests Auditory Sequential Memory and Visual Sequential Memory. However, when the performances were correlated with various reading measures certain patterns of relations were observed. For poor readers the sequential strategy was related to their performance on reading simple words. For good readers the strategy was related to reading complex syllables. It could be interpreted that poor readers were processing the words they could read, sequentially (and processing syllables simultaneously). Good readers who scored equally on sequential strategy, seemed to process the complex syllables which have more units in them sequentially (and were generally able to process the reading stimuli simultaneously).

The findings of this study are in consonance with the findings that

Cummins and Das (1977) have reported. Unlike in their study the Kannada subjects were classified into good and poor reading groups. In their study the subjects were grouped based on the scores on the processing strategy markers. Cummins and Das observed that reading and spelling tests were well correlated with sequential processing. They cite Das, Manos, and Kanungo (1975) that poor readers' reading achievement was found to be significantly related to sequential processing. Such pattern was also observed in this study. Cummins and Das also stated that for advanced skills in reading simultaneous processing is necessary. Similar findings are reported by Das, Kirby, and Jarman (1979) and Leong (1980). Similar is the finding in this study too.

In a later study Das and Cummins (1982) did not find any significant deficiency in the cognitive strategies of processing of poor readers. They found that "the RD children experienced difficulty in processing language in cognitively demanding situations but were equivalent to normal readers both in nonlinguistic tasks and in cognitively undemanding manifestations of language" (p.20). They explained that even when the poor readers have processing capacities they may not be able in making use of them optimally when the situation calls for. In other words, poor readers may not plan adequately to use the strategies in solving the task and thus perform poorly. It was observed that the poor readers had performed comparably to good readers on nonlinguistic tasks, but not on reading.

The idea that the sequential and simultaneous strategies of processing should be used in a balanced way for normal reading has been emphasized (Aaron, 1982). There is also a view that the development of simultaneous abilities is important for better reading. However, though the strategies are thought to be independent they are thought to be contributing indirectly to reading. The findings are of a changing

trend that it may be the planning and language awareness which may be contributing more directly to reading than the cognitive strategies.

The different strategies of processing also reflect the functioning of nervous system. While it is necessary to process language in a sequential manner, it also becomes necessary that such activity becomes automatic so that the information is processed for its content in relation to other meaningfully. Whereas for the former processing, the functioning of left hemisphere is essential, for the latter that of right hemisphere is necessary (Elliot, Halliday, and Callaway, 1978).

From the findings of this study it can be said that the Kannada poor readers have difficulties primarily in processing the elements of print. This is the reason that they process the reading material inappropriately and misread. It is possible to speculate that they fail to process the stimuli appropriately in the left hemisphere, for having not learnt the invariants of the stimuli.

Analysis of the component parts in reading is the function of the left hemisphere. In the right hemisphere the stimuli are processed simultaneously and automatically. The stimuli are processed in both hemispheres at the same time. Even when the stimuli are processed in the right hemisphere automatically, still the reading may be incorrect because the subjects are not processing the details precisely. Leong (1980) discussing the laterality and reading states that "the right hemisphere superiority is more apparent in identity matching while the left hemisphere superiority occurs in the analysis of component parts" (p.189). Pirozollo and Raynor (1977) found that both hemispheres function independently in reading tasks. Whereas good readers not only learn the basic invariant features of reading using left hemisphere but also process them correctly and automatically when they process the same using right hemisphere. When

called for, good readers can process the stimuli predominantly either sequentially or simultaneously, i.e., they not only can read processing all the elements precisely but also read automatically. Poor readers are at a loss in both these capacities. Not only do they not read the stimuli processing the details precisely but also they do not read the stimuli automatically correctly.

The speculation is based on the belief that the left hemisphere that processes phonemes, the units of language, is also the base for processing the highly phonetically based script. For a Kannada reader spelling problems can not occur independent of spoken words, either in writing or in reciting. Whereas in English dissociation of spelling and reading are possible, in Kannada it is not possible. Teaching method in Kannada invariably being synthetic children do not learn by word method and always learn by sounding/spelling the units. It is known that decoding the naming are processed by left hemisphere. Synthetic approach not only requires the children to hear (left hemisphere) but also needs them to learn by sequencing of those sounds increasing the dependence on the left hemisphere, particularly in the beginning. When the appropriate processing for decoding Kannada script in the left hemisphere does not occur, the same is reflected in the right hemisphere's processing.

The findings in this study are in consonance with the findings of others that poor readers are slow decoders. The contribution of orthographic knowledge seems to be paramount in Kannada reading. This supports the findings of Gibson (1969), Brooks (1977), Massaro, et.al, (1980), and Singer (1982) that orthographic knowledge is very important for fluent reading. Kannada poor readers' main difficulty lies in their knowledge of orthographic rules. Morrison (1984), Schwartz and Doehring (1977) and many others have reported the poor-readers' difficulties or orthography

in English reading. The misreadings in Kannada due to (difficulties in sequencing and of reversals are not considerable. The syllabic Kannada script provides inherent resistance for such misreadings. Considering the reversals in English reading (15%), such difficulties are insignificant in their occurrence in Kannada (less than 1%).

The patterns or relationships observed between the cognitive strategies of information processing and reading are supportive of the findings of other studies. Good readers showed better relationship between simultaneous processing and reading. Poor readers' Performance on reading was related to their sequential processing. However, in this study the relationships did not reach any statistical significance.

It is speculated that poor readers' processing for decoding in left hemisphere may not be as efficient as that of good readers. The speculation is based on the demands of Kannada script for reading and the method of teaching Kannada reading. Left hemisphere specializes in analytical and naming tasks whose processing is necessary for decoding graphophonetic details. There is a one to one relationship between the script and the sound and reading is learnt by sounding each detail of the reading material. Also there is no dissociation of spelling and reading, and reading can hardly be wholistic, atleast in the beginning. Poor readers were found to read the material precisely as well as fast. They could process the material not only analytically but also wholistically.

Summarily the following can be stated. Behaviourally, automaticity in reading can differentiate poor readers from good readers. Knowledge of the rules of orthography is an important factor which can differentiate poor readers from good readers. The patterns of relations between reading and the cognitive processing strategies may be revealing the difficulties in the processing of reading.

## Implications

Automaticity is an important factor in learning to read fluently. Though practice may be a contributing factor for automaticity, learning of the details of print is very important.

Knowledge of the rules of orthography is a very important factor in learning to read Kannada. Knowledge of the rules of orthography, particularly in reading phonetically regular scripts, will be highly contributing to fluency and precision.

Good readers are able to acquire the rules of orthography and automaticity in reading better than poor readers.

Poor readers of Kannada fail to read correctly whenever the syllables incorporate more than three ligatures in print. Poor readers also find the syllables with two or more consonants difficult to read.

Poor readers of Kannada also show poor graphophonemic associations and exhibit confusions among the letters of the alphabet.

Poor readers also do not make use of the cues provided in the immediate past in reading, exhibiting their difficulty in learning from cues.

Poor readers' difficulty in reading is a generalized one than specific to any level of script unlike among good readers who find only complex syllables difficult to read.

Specific kinds of misreadings, for example reversals, are not the characteristic of either poor or good readers of Kannada.

## Suggestions:

In Indian education system, formal special education does not yet exist. When special education becomes a reality for Kannada reading children there need to be guidelines to implement

reading correction procedures. There need to be diagnostic tests apart from other materials. A norm oriented and more extensive study is needed before constructing a test for diagnostic purposes. Such a study should include students as subjects from different socio-economic status and from various schools.

In training for the development of reading, the factors automaticity and rules of orthography should be considered paramount. In individual remedial teaching, training in orthographic rules and practice in using those rules should be taken up. A programme for explicitly teaching each type of regular and irregular instances of writing Kannada syllables has to be developed. Lessons for such a purpose can be produced using general rules of orthography and findings of studies like the present one.

Separate studies can be taken up to learn about the effect of various kinds and number of ligatures on reading. It is known that difficulties in reading increase proportionately with the number of ligatures in syllables. It is to be learnt whether different kinds of ligatures have different effects on their reading.

Further studies should incorporate the reading stimuli larger than individual words. The factors of morphology, syntax, and semantics have to be investigated in Kannada reading separately.

## Limitations:

The study included only reading of individual words. Studying syntactic and semantic aspects of reading were not considered.

The subjects were limited in numbers as they were chosen from a single school to keep the homogeneity of the population.