BILITERACY AND READING ACQUISITION IN HINDI AND ENGLISH AMONG
NORMALLY PROGRESSING READERS AND DYSLEXICS

*Sonali Chatterjee, **Bhoomika R. Kar, & *Soumi Awasthy

* Defence Institute of Psychological Research (DIPR), DRDO, Delhi, INDIA
** Centre of Behavioural and Cognitive Sciences
University of Allahabad, Allahabad, 211002, Uttar Pradesh, India

ABSTRACT

Reading acquisition in an alphabetic and an alphasyllabic script can pose unique demands on the development of orthographic and phonological representations among normally progressing readers and dyslexics. We examined eighty-six normally progressing readers and 28 dyslexics on word and nonword reading, and phoneme deletion in Hindi and English. Dyslexics performed poor on all the tasks in both the languages. Reading accuracy was compared across tasks within each language and for each task between the two languages. Overall, reading accuracy was better for Hindi as compared to English except for spelling and phoneme deletion among normally progressing readers. Reading accuracy for words and nonwords was equally adequate for Hindi whereas words showed an advantage over nonwords for English among normally progressing readers. However, orthographic transparency in Hindi did not show an advantage among dyslexics, as they were equally deficient with words as well as nonwords in Hindi and English. Normal readers as well as dyslexics may use lexical processing strategies for word recognition, as even dyslexics performed better with words as compared to nonwords in both the languages. Tasks, which primarily rely on phonological awareness (nonwords and phoneme deletion), showed equally deficient performance for both Hindi and English. Phonological deficits not only affect reading acquisition in an alphabetic script but could also show a generalized effect on an alphasyllabary. A sequential rather than simultaneous instruction for two different writing systems could prove to be a better strategy for the fine grained development of the phonological system.

Key words: Biliteracy, reading acquisition, Hindi and English language, dyslexia.
Dyslexia is supposed to be a failure in learning to optimize the coordination of sub processes involved in reading with the consequence of errors in integrating reading related information represented in working memory (Lachman, 2002). Reading involves visual and semantic decoding, temporal processing, phonological processing, orthographic, syntactic and contextual analysis and comprehension. An inefficient synchrony of these underlying mechanisms results in reading disability. Dyslexia is the most common of the learning disorders that interferes with the child’s ability to acquire speech reading despite average intellectual functions. Reading is one of the most complex cognitive processes for humans involving visual and semantic decoding, temporal processing, phonological processing, orthographic, syntactic and contextual analysis and comprehension. Manifestation of dyslexia in bilingual population is not very clear even in western literature with respect to the incidence as well as explanations for the same.

Children having reading difficulty in one language could also have difficulties with another language. However, the nature of influence of L1 on L2 and L2 on L1 would be determined by a number of factors such as orthography, phonological systems, phonemic or syllabic sensitivity etc.

Transparent orthographies may demand different strategies when, as in Hindi, the basic unit is a syllable and not a phoneme. However, if both languages are acquired simultaneously the possibility of cross-linguistic interaction in terms of psycholinguistic strengths of the two languages cannot be ruled out. We assume that a) acquisition of syllabic awareness might be easier and faster irrespective of the fact whether it is an alphabetic language or alphasyllabary; b) even though English relies on phoneme awareness and were found better on phoneme awareness than Hindi but they were also found better on syllabic awareness as compared to Hindi; c) hence there is a possible interaction between the acquisition of phonemic and syllabic awareness in both the languages. The process of acquisition of literacy becomes complicated when there is a need to acquire languages following different writing systems as prevalent in India.

There are many languages which are spoken, written and read in India, but all the four different orthographic families of modern India— Indo-Aryan, Dravidian, Astro-Asiatic (Munda, Santali), and Tibeto-Burman have a common source in Brahmi and therefore share the same salient features. An Indian child’s first language could be one of the Indo-Aryan languages like Hindi, Marathi, Gujarati or Punjabi or Dravidian languages like Kannada, Tamil, Telegu, Malayalam etc., which form the two major groups and the second language is mostly English. English being the second language is acquired once the child starts school at 4 years of age when children have already acquired considerable skill in their first language. Bi/tri/multilingualism is a socio-cultural condition and cannot be ignored in India. Cross-linguistic studies suggest that reading skill develops at a different pace in different orthographies (Karanth, 2003). Less is known about how first language or mother tongue interacts with second language acquisition.

The nature of orthography, its transparency and form of representation should influence the pattern of reading development. English follows an alphabetic script and depends heavily on grapheme-phoneme correspondence whereas languages with transparent orthographies like Italian, Spanish, German and Indian languages are considered as alphasyllabaries. It has been demonstrated that grapheme-phoneme recoding skills take longer to develop in less transparent orthographies like English taking about two years of reading experience as compared to more transparent orthographies like Spanish, Greek, Finnish for which word and nonword reading is acquitted in the middle of first grade (Seymor, Aro, & Erskine, 2003). Phonological awareness is crucial for reading alphabetic scripts. It is neither crucial nor necessary for successful reading acquisition in transparent writing systems. In a study on Indian population with monoliterates, nonliterate and biliterates (Hindi and English or Kannada and English) on tasks like rhyme recognition, syllable deletion, and phoneme deletion it was
observed that only biliterates performed well on phoneme awareness tasks, others performed well on syllable deletion and rhyme recognition tasks (Karanth, 1998; Prakash & Rekha, 1992).

Hindi is an alphasyllabary and has transparent orthography where grapheme to phoneme correspondence is quite consistent. Hindi script has syllabic and alphabetic properties. It may be considered semi-syllabic as the consonants in Hindi do not stand alone as in English rather there is an inherent vowel along with the consonant. Words in Hindi can be segmented at the level of phoneme as well as syllable. The complexity of Hindi orthography is mostly due to the orthographic markings of vowels that vary in length. Hindi instruction in kindergarten begins with phonics program first with vowels and then consonants, which is further followed by maatraas. In India, children start with their formal schooling at 3 years of age in nursery and start learning the letters in English and Hindi.

It has been reported that despite the transparency of Hindi orthography, it involves complex perceptual analysis (Gupta, 2004). In a recent fMRI study on Hindi-English bilinguals it was found that reading in Hindi entails recruitment of more visuospatial regions and putamen as compared to English (Kumar et al., 2009). These findings indicate that reading acquisition in different orthographies may require different strategies and have different cognitive demands dictated by the phonology orthography interface.

There are several studies on biliterates with respect to English and more regular scripts like German, Spanish etc., or English and nonalphabetic scripts like Chinese/Japanese. However, research on reading difficulties with respect to English and semi/alpha-syllabic scripts such as Indic scripts. Alphasyllabaries inform about the interaction between the structural properties of alphabetic scripts and those associated with syllabic scripts. Existing research suggests that semisyllabic scripts depend less on phonological awareness in reading acquisition. However, reading acquisition in biliterates that involves an alphabetic script and an alphasyllabic script, may pose unique demands with respect to the acquisition of phonological skills and visual-phonetic decoding and their relative involvement in reading of two different orthographies. Visual analysis is more demanding due to linear as well as nonlinear arrangements of vowels in Hindi whereas phonological processing is more demanding in English. Alphasyllabaries have been reported to involve different reading strategies with respect to lexical (English) versus sublexical (Hindi) strategies.

Nature of reading strategies for Hindi and English among normally progressing biliterates and the nature of errors in reading and spelling in Hindi and English in children with dyslexia, were examined. The study also aimed to examine if reading skills were similarly affected for both Hindi and English and if these deficits are shared or independent effects of the characteristics of both the scripts. The study also provides normative data for different reading tests in Hindi and English developed by the investigators.

Method
Participants
All the participants were Hindi-English biliterates studying in grades 1 (N=29), 2 (N=27), and 3 (N=30) (age range of 6-8 years) in a coeducation school with English being the medium of instruction. A total of ninety children with thirty good readers from each grade from three schools in Allahabad participated in the study. Good readers were first identified by the teachers on the basis of their academic performance, and reading and writing skills. They were further subjected to a formal assessment including tests of reading skills, and a test of intellectual functions. Children who scored more than 80% in terms of accuracy on reading tests were taken as good readers. Poor readers were also first identified by the class teacher using the problem checklist and were then subjected to a formal assessment of reading skills, working memory and intelligence in order to identify children with reading difficulties. Children who were below average to average on intellectual functions, and who scored two standard deviations below the mean on reading tasks were considered as dyslexics. Both normally progressing and dyslexic readers were matched with respect to chronological age and educational level. None of the participants had a history of any neurological/psychiatric disorder. Thirty
children across all the grades were identified as poor readers. All the participants were right handed and they were screened for visual acuity and auditory acuity using brief screening tests. Both the groups were taken from the same schools and were exposed to both the languages. At home the dominantly spoken language was Hindi for all the participants. Children with normal or corrected to normal vision were included in the study. Written informed consent was obtained by the respective class teachers for each participant.

**Procedure**

First phase of the study focused on the development of tests of reading in Hindi and English language for the identification of dyslexia. The battery comprises of tests of letter identification, reading speed and word reading, non word reading, reading irregular words only in English, spelling (writing words to dictation), and phoneme deletion. All the tests were developed in Hindi and English language. Colored Progressive Matrices was also administered to record the level of intellectual functioning of all the participants.

The verbal responses of the participants were recorded on a record sheet as well as using a voice recorder. The second phase of the study aimed to collect normative data by administering the battery of reading tests in Hindi and English with children initially screened as good readers by the teachers. Children with reading difficulties were then identified during the second phase of the study by comparing their performance on each test with the normal readers.

**Measures**

**Reading Tests**

A battery of six tests of reading skills in Hindi and English language was developed to identify children with reading difficulties. The tests were designed such that the test items were graded in terms of the difficulty level rather than taking grade appropriate items. Grade appropriate curriculum was considered while selecting the passages for reading comprehension and dictation. Word reading and nonword reading tests in English were developed using the MRC psycholinguistic database taking the following criteria into consideration: age of acquisition, length of the words, and frequency/familiarity of words.

**Word reading**

**Rationale**

Words form one of the basic units of written text. The level achieved in word reading can also predict the process of reading acquisition. Decoding in Hindi and English was measured by administering test of reading frequent words taken from the MRC Psycholinguistic database for English and from the textbooks of the grade to which the child belonged for Hindi.

**Description**

Thirty words were taken using the MRC Psycholinguistic database. The words were grouped into different grades according to their age of acquisition index. Selection of words was based on complexity in terms of number of letters, number of syllables, frequency and familiarity. All the words were printed on an A4 size sheet. Words were equally spaced and printed in three columns. The participant was instructed to read each word aloud row wise. Response of the child was recorded on a response sheet. Accuracy of time taken to read all the words on the sheet was noted. Errors like letter-by-letter reading, substitution, deletion or addition of letters were also noted.

**Non-word reading**

**Rationale**

Nonword reading test was designed and administered to assess decoding of letter strings. Non-word reading demands decoding at the sub-lexical level as for nonwords pronunciation has to be assembled.
This test could efficiently test phonological processing, as one may not depend on sight or spoken vocabulary to read a nonword. Hindi being an alphasyllabary, may allow faster and more accurate decoding using a sublexical strategy.

**Description**

Thirty, three and four lettered words monosyllabic words in English and thirty three and four lettered words in Hindi were printed on A4 size paper in three columns. The participants were asked to read each word aloud row wise. All the words in the list were pseudo words and hence could be pronounced. Errors were also recorded and later classified as either phonological or lexical based errors (Defior, Martos & Cary, 2002). Phonological errors involve producing another non-word, which is incorrect in some way as it involves a deletion, substitution or inversion of a letter in the target non-word. Lexical errors involve producing a real word for a non-word. The words were controlled for neighborhood effect and only those non-words, which had fewer neighbors, were taken to ensure that the words are not decoded by analogy strategy rather only on the basis of phonological recoding. The list of non-words remained constant for all the grades. Accuracy as well as the time taken to read the word list was recorded.

**Phoneme deletion**

This task consisted of a list of thirty words in Hindi and thirty words in English. The investigator verbally presented words one at a time. The participants were required to delete a given sound in the word at the initial, middle or terminal level and give the remaining word. After deletion, 50% of the words resulted in a meaningful word and 50% of the words in a pseudo word. There were five words for practice followed by thirty test words. E.g.: English: Delete the sound of ‘n’ in ‘mind’: mid. Phoneme deletion in Hindi involved only vowel-based deletions as consonants in Hindi have an inherent vowel and deletions based on consonants cannot be treated as true phonemic level manipulations.

**Statistical analysis**

One-way analysis of variance (ANOVA) was performed to compare the performance of normal readers studying in grades 1, 2, and 3 to examine if the performance on each of the reading tests was significantly different across the three grade levels. Based on the data obtained from the normal readers norms in terms of scores falling below two standard deviations from the mean were derived for each test. ANOVA was also performed to compare the performance of normal readers and dyslexics. A 2 (group: normally progressing readers and dyslexics) x 2 (language: Hindi and English) x 4 (reading tasks) was performed to examine the effect of biliteracy on reading skills. Paired t test was performed to analyze the differences in performance on reading tests in Hindi and English language among normally progressing readers and those with reading difficulties. Content analysis was performed to extract the frequency and nature of errors on word and nonword reading tests as well as for the phoneme deletion test.

**Identification of normally progressing readers and those with reading difficulties**

Identification of normally progressing children and those with reading difficulties was based on multiple measures including teacher’s report (problem checklist), reading and spelling tests (reading accuracy, speed, and nature of errors) in Hindi as well as English language. Children who showed an accuracy of more than 80% on all the reading tests were taken as normally progressing readers. Children who were reported with reading difficulties by the class teachers were subjected to a detailed assessment of intellectual functions, reading speed and accuracy, phonological awareness, and nature and frequency of errors. Children whose scores were two standard deviations below the mean on most of the tests were taken as having reading difficulties. However, they were found to be average or above average on the test of intellectual functions. All the children identified with reading difficulties showed poor performance for both Hindi and English.
Results
Data obtained was analyzed to examine a) reading acquisition as a function of grade levels among normally progressing readers; b) differences in performance on reading accuracy and speed between normally progressing readers and dyslexics; c) differences in performance on reading tests with respect to the Hindi and English language to study the effect of biliteracy in two different scripts among normally progressing readers as well as those with reading difficulties. Cross-linguistic as well as within language effects were analyzed to understand the differences in reading strategies across different reading stimuli among normal readers and poor readers.

Grade effects among normally progressing readers
Data was first analyzed to examine the differences in performance across the three grade levels among the normally progressing readers. Table 1 and 2 present the means and SDs for all the tests across the three grade levels of normally progressing readers.

Mean comparisons of reading accuracy and speed between normally progressing and dyslexic readers
One-way ANOVA was performed to compare the performance of normally progressing readers and dyslexics on all the tests except the ones that showed grade related differences in performance. Table 1 presents the mean comparisons of the two groups on all the reading measures. Figures 1 and 2 present the mean comparisons of the performance of normally progressing readers and those with reading difficulties with respect to reading accuracy and speed for each of reading tests in Hindi and English language.

Table 1. Mean comparisons between normally progressing readers and dyslexics on reading accuracy

<table>
<thead>
<tr>
<th>Reading tasks</th>
<th>NPR Mean (SD)</th>
<th>Dyslexics Mean (SD)</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIH</td>
<td>96.9 (4.6)</td>
<td>90.92 (10.35)</td>
<td>18.15**</td>
</tr>
<tr>
<td>LIE</td>
<td>99.9 (.43)</td>
<td>96.8 (8.01)</td>
<td>13.17**</td>
</tr>
<tr>
<td>WRH</td>
<td>90.01 (11.58)</td>
<td>64.28 (24.41)</td>
<td>56.92***</td>
</tr>
<tr>
<td>WRE</td>
<td>88.37 (14.14)</td>
<td>58.26 (24.08)</td>
<td>65.64***</td>
</tr>
<tr>
<td>NWRH</td>
<td>87.84 (13.3)</td>
<td>52.17 (23.03)</td>
<td>102.28***</td>
</tr>
<tr>
<td>NWRE</td>
<td>83.01 (17.3)</td>
<td>46.17 (23.05)</td>
<td>80.61***</td>
</tr>
<tr>
<td>Spelling (H)</td>
<td>68.24 (20.48)</td>
<td>40.32 (22.61)</td>
<td>37.28***</td>
</tr>
<tr>
<td>Spelling (E)</td>
<td>80.89 (14.86)</td>
<td>54.37 (21.72)</td>
<td>52.78***</td>
</tr>
<tr>
<td>PDH</td>
<td>71.0 (23.65)</td>
<td>21.82 (28.47)</td>
<td>82.06***</td>
</tr>
<tr>
<td>PDE</td>
<td>82.52 (15.88)</td>
<td>26.17 (27.63)</td>
<td>177.51***</td>
</tr>
</tbody>
</table>

Note: * Indicates p < .05; ** indicates p < .01 and ***indicates p < .001. NPR: Normally progressing readers; LIH and LIE: letter identification Hindi and English; WRH & WRE: word reading Hindi and English; NWRH & NWRE: nonword reading Hindi and English; PDH & PDE: phoneme deletion Hindi and English.

Table 2. Comparing normally progressing readers and dyslexics on reading speed

<table>
<thead>
<tr>
<th>Reading tasks</th>
<th>NPR Mean (SD)</th>
<th>Dyslexics Mean (SD)</th>
<th>F ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIH</td>
<td>118.17 (52.2)</td>
<td>198.71 (87.6)</td>
<td>34.9***</td>
</tr>
<tr>
<td>LIE</td>
<td>36.74 (10.64)</td>
<td>49.1 (19.71)</td>
<td>18.5***</td>
</tr>
<tr>
<td>WRH</td>
<td>104.26 (85.74)</td>
<td>172.57 (69.8)</td>
<td>14.59***</td>
</tr>
<tr>
<td>WRE</td>
<td>102.87 (97.26)</td>
<td>176.64 (143.02)</td>
<td>9.49***</td>
</tr>
<tr>
<td>NWRH</td>
<td>122.96 (100.87)</td>
<td>204.46 (115.24)</td>
<td>12.84***</td>
</tr>
<tr>
<td>NWRE</td>
<td>105.4 (83.34)</td>
<td>196.2 (124.29)</td>
<td>19.65***</td>
</tr>
<tr>
<td>PDH</td>
<td>423 (149.07)</td>
<td>458.54 (219.78)</td>
<td>.494 ns</td>
</tr>
<tr>
<td>PDE</td>
<td>352.42 (143.90)</td>
<td>398.54 (212.31)</td>
<td>.887 ns</td>
</tr>
</tbody>
</table>

Note: * Indicates p < .05; ** indicates p < .01 and ***indicates p < .001. NPR: normally progressing readers; LIH and LIE: letter identification Hindi and English; WRH & WRE: word reading Hindi and English; NWRH & NWRE: Nonword reading Hindi and English; PDH & PDE: phoneme deletion Hindi and English.

Comparisons with respect to language related effects (within each language across tasks and within each task across the two languages) among normally progressing and dyslexic readers
A 2 (group: normally progressing readers and dyslexics) x 2 (language: Hindi and English) x 4 (reading tasks) was computed to study the interaction between biliteracy and reading skills in normally progressing readers and dyslexics. Main effect for group, \( F(1, 112) = 100.63, p < .001 \), language, \( F(1, 112) = 5.46, p < .05 \), as well as reading tasks \( F(1, 112) = 33.86, p < .05 \) was found to be significant. Interaction effect between group and reading tasks, \( F(1, 112) = 8.34, p < .01 \), was significant showing poorer performance of dyslexics on all the reading tasks as compared to the normally progressing readers. However, the three way interaction across group x language x reading tasks approached significance \( F(1, 112) = 3.01, p = .08 \). Hence, planned comparisons using the paired t test were computed to examine the differences in performance on each reading task across the two languages as well as within each language but across reading tasks for each group separately. Paired t test was performed to compare the reading skills (accuracy and speed) in Hindi versus English language among the normally progressing readers and those with reading difficulties separately. Reading skills in Hindi and English language were found to be significantly different for most of the tests including that of letter knowledge (accuracy: \( t = 5.95, p < .05 \); speed: \( t = 15.2, p < .05 \)), nonword reading (accuracy: \( t = 3.63, p < .05 \); speed: \( t = 2.23, p < .05 \)), spelling \( t = 8.31 \) and phoneme deletion (accuracy: \( t = 5.91, p < .05 \)) but were not found to be significant for word reading (accuracy: \( t = 1.35, p > .05 \); speed: \( t = .18, p > .05 \)). However, the language effect was not found to be significant for reading accuracy for words (\( t = 1.28, p > .05 \)) and also for nonwords (\( t = 1.7, p > .05 \)) and phoneme deletion (\( t = 0.94, p > .05 \)) among children with reading difficulties. These results suggest that normally progressing readers may depend on different reading strategies for Hindi versus English language, however deficits in phonological processing may equally affect one’s performance on reading tasks for Hindi language (which depends less on phonemic awareness) as well as for English language (which primarily depends on phonological awareness). Figure 1 presents the comparison of the performance of the normally progressing readers and those with reading difficulties on reading skills in Hindi versus English language.

Figure 1. Reading accuracy on reading tests in Hindi and English among normally progressing readers
Note: LI: letter identification; WR: word reading; NWR: nonword reading; SP: spelling; PD: phoneme deletion.
Figure 2. Reading accuracy on reading tests in Hindi and English among dyslexic readers
Note: LI: letter identification; WR: word reading; NWR: nonword reading; SP: spelling; PD: phoneme deletion.

Paired t test was also performed to analyze the within language effects across different reading tests (accuracy) including word reading, nonword reading, phoneme deletion, reading comprehension and listening comprehension in Hindi and English language within each of the two groups. Among normally progressing readers, difference in the performance on the word and nonword reading in Hindi, (t=1.92, p >.05) was not significant whereas word reading in English was found to be better than nonword reading in English (t=3.91, p < .05) (Figures 3). Word reading in Hindi was found to be better than phoneme deletion in Hindi (t=8.06, p < .05) and the same was observed for English language (t=3.59, p < .05) (Figures 5). Nonword reading in Hindi was found to be better than phoneme deletion in Hindi (t=7.39, p< .05) whereas the difference between nonword reading in English and phoneme deletion in English (t=.34, p >.05) was not found to be significant (Figures 7). Among dyslexics, word reading was found to be better than nonword reading for both Hindi (t= 3.90, p < .05) as well as English (t= 3.17, p < .05) language (Figures 4 & 6). Performance on word reading was better than phoneme deletion for both Hindi (t= 6.27, p < .05) and English (t= 4.86, p < .05) language. Performance of dyslexics on nonword reading was better than phoneme deletion for both Hindi (t= 4.88, p < .05) and English (t=3.48, p < .05) language (Figure 8).

Figure 3. Mean comparisons showing within language effects between word and nonword reading among normally progressing readers
Note: WR: word reading; NWR: nonword reading
Figure 4. Mean comparisons showing within language effects between word and nonword reading among dyslexic readers
Note: WR: word reading; NWR: nonword reading

Figure 5. Mean comparisons showing within language effects between word reading and phoneme deletion among normally progressing readers
Note: WR: word reading; PD: phoneme deletion

Figure 6. Mean comparisons showing within language effects between word reading and phoneme deletion among dyslexic readers
Note: WR: word reading; PD: phoneme deletion
Errors were also analyzed for word and nonword reading for normally progressing readers and those with reading difficulties. Frequencies of each type of error for each of the two tests in Hindi as well as English were calculated. Most frequent errors included letter substitution, word substitution, deleting letters, and insertion (letters). Word substitutions were found to be more frequent for English and nonword substitutions were more for Hindi. Interaction between letter substitution and word substitution was observed on nonword reading in English whereas an interaction between deletion of letters and word substitution was observed on nonword reading in Hindi. Errors in the Phoneme deletion task were more for initial level deletions for Hindi (66.85%) and more for terminal level deletions in English (64.06%). Errors pertaining to middle level deletions were equally frequent for both Hindi and English language.

**Discussion**

We examined reading accuracy and speed on various reading tasks with respect to their ability to identify children with reading difficulties in Hindi-English biliterate for whom exposure to English language is more due to English being the medium of instruction. Norms for reading accuracy and
speed for each of the test scores were based on the criteria of mean minus two standard deviations. Reading accuracy and speed for letter identification, words, nonwords, spelling, and phoneme deletion were found to be sensitive in identifying children with reading difficulties. Hence, performance on these tests needs to be compared with grade appropriate norms. Increase in grade level did not make a difference to the performance (accuracy and speed) of normally progressing readers for most of the reading tasks including word and nonword reading, spelling, and phoneme deletion. Other studies on Indian languages have taken reading accuracy on a standardized word reading test in Hindi along with other measures like teacher’s rating and spelling test as the criteria to identify children with dyslexia (Gupta, 1997). Studies on other Indian languages like Kannada and Telegu have also reported use of reading tests and tests of phonological awareness for the identification of dyslexia (Padakannaya et al., 2002). We also observed that poor reading accuracy correlated with increased latencies on these tests among dyslexics. Similarly, normally progressing readers showed better reading accuracy and faster latencies as compared to dyslexics except on two tests. It is to be noted that Hindi was the first language and English was the medium of instruction for all the participants. Slowing was observed pervasively on all the reading tasks for both the languages among dyslexics as compared to normally progressing readers. Even with regular grapheme to phoneme correspondence, reading speed in Hindi was also found to be slower than normally progressing readers as dyslexics have difficulties with the translation of orthographic representations to phonological representations. In case of English it is the grapheme to phoneme inconsistencies and in case of Hindi it could be the perceptual complexity. Dyslexics tend to assemble phonemes following grapheme to phoneme correspondence rules.

Literature shows that alphasyllabaries as compared to the alphabetic scripts depend less on phonological awareness. However, reading acquisition in biliterates that involves an alphabetic and an alphasyllabic script may pose unique demands on the phonological system as well as the system mediating the interaction between orthographic and phonological representations and their relative involvement in learning to read two different orthographies. Greater demands on phonological awareness towards the acquisition of reading skills in an alphabetic script may influence the development of reading strategies used to learn an alphasyllabic script in biliterates. On the other hand better oral proficiency and word knowledge including familiarity with the phonology of the words known and used in spoken language (being the first language) may influence the mapping of grapheme to sound in an alphabetic script. Hence, one needs to understand the patterns of transfer between the first and the second language or vice versa particularly when the literacy skills for both are being acquired at the same time. However, the experience for the first language as the dominant spoken language is more, but the exposure to the sounds and written forms of the letters and words is more for the second language with formal schooling particularly when English is the medium of instruction. These are important concerns to understand the nature and mechanisms of reading difficulties in biliterates.

We also examined the differences in performance with respect to the two different writing-systems being acquired at the same time by Hindi English biliterates. Overall accuracy was better and latencies were faster for Hindi as compared to English language among normally progressing readers as well as dyslexics. Greater accuracy in Hindi as compared to English has been reported by another study among normal readers as well as dyslexics which is explained on the basis of orthographic transparency in Hindi and orthographic ambiguities of English (Gupta & Jamal, 2007). Dyslexics showed difficulties on reading accuracy and speed for both Hindi and English as compared to normally progressing readers, however, Hindi had an advantage on most of the tests like word and nonword reading. We tested language effects for each type of reading stimuli (for example word reading Hindi versus word reading English) as well as within language effects between different reading stimuli (for example, word reading Hindi versus nonword reading Hindi). We observed different patterns of such interactions and differences between the two languages and within each language across tasks and between the two groups. Within language comparisons across reading stimuli were made for words and nonwords and the performance these was further compared with the phoneme deletion task. Between-language
comparisons were made for letter identification, word and nonword reading, listening and reading comprehension, spelling, and phoneme deletion.

Normally progressing readers were found to be equally good on reading accuracy for words and nonwords in Hindi, which could be due to the dependence on grapheme to phoneme correspondence for both kinds of stimuli. Reading accuracy was better for words than nonwords in English, which could be due to greater dependence on lexical processing involved in word reading in English. Reading accuracy for words was found to be better than phoneme deletion for both Hindi and English. Nonword reading was found to be better than phoneme deletion in Hindi, which could be due to the fact that phonemic level processing is difficult in Hindi as it is a semi-syllabic language and children tend to engage in syllable level processing even when phonemic manipulation is required. Accuracy for nonword reading and phoneme deletion task in English was found to be equally good as both the tasks rely more on phonological decoding and phonemic level manipulations are easier to process in English. Dyslexics generally showed poorer accuracy and slowness on all the tasks including word and nonword reading, comprehension, spelling and phoneme deletion. Dyslexics showed a different pattern with word reading being better than nonword reading for both the languages. Accuracy for word reading as well as nonword reading was found to be better than phoneme deletion in both Hindi and English. Dyslexics are able to perform better when lexical access is possible with familiar meaningful words whereas when they have to rely more on phonological awareness they show greater difficulties indicating the phonological processing deficit reported in dyslexia.

The interaction between the two different writing systems may not be at the level of acquisition of letter knowledge, as it is specific to each writing system and the orthographic symbols have to be individually acquired. These orthographic units need to be mapped onto phonemic/syllabic units. We found that letter knowledge for both Hindi and English was adequate among dyslexics. However, phonological awareness may be affected resulting in reading difficulties in both the languages mediated by a phonological system, which mediates the phonology to orthography interface.

To conclude, the overall reading accuracy was better for all the tests in Hindi as compared to English except that of spelling and phoneme deletion for normally progressing readers. Reading accuracy for word and nonword reading was found to be equally adequate for Hindi whereas words showed an advantage over nonwords for English among normally progressing readers. However, orthographic transparency in Hindi did not show an advantage among dyslexics, as they were equally deficient with words and nonwords in both the languages. Lexical processing strategies for word recognition may be used by normal readers as well as dyslexics as even dyslexics perform better on word reading as compared to nonword reading in both the languages. Tasks, which primarily rely on phonological awareness such as nonword reading and phoneme deletion, showed equally deficient performance for both Hindi and English. Phonological processing deficits appear to be severe enough not only to affect reading acquisition in an alphabetic script like English and also seem to overshadow the effects of a transparent orthography like Hindi. A sequential rather than simultaneous instruction for two different writing systems could prove to be a better strategy for the fine grained development of the phonological system. Further studies are needed with experiments focusing on the differences in the nature of orthographic and phonological representations and their interface as their interaction determines reading acquisition in a shallow as well as a deep orthography.
References


