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Relative Contribution of Naming Speed and Phoneme Awareness To Reading Kannada and English in Dyslexic and Nondyslexic Biliterates

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Abstract

Phonological awareness (PA) and naming speed or Rapid automatised Naming (RAN) are the major building blocks of efficient reading. The current study compared the performance of three groups of biliterates with and without dyslexia on PA and RAN. Further, the study examined the unique and shared contributions of the aforementioned building blocks to the reading English and Kannada, an alphabetic and Indian alpha syllabary writing system respectively. Adopting a quasi-experimental research design, the participants were dyslexic children who were remediated to a large extent, children who were typically developing, and children with dyslexia who were not remediated. The overall results confirm the view that while both RAN and PA together contribute to the early development of reading across orthographies, the relative importance of PA, specifically at the phoneme level, may not be so crucial in nonalphabetic systems.

Keywords: Phonological awareness, naming speed, alpha syllabary, biliterates, developmental dyslexia, remediation, English, Kannada.

Introduction

Biology is not destiny (Leopold, 2013). Neuronal plasticity has given opportunities to researchers to successfully remediate children, adolescents and adults with developmental dyslexia (DD) benefit from reading intervention (Shaywitz & Shaywitz, 2005). The inconsistent sound encoding by dyslexics can be 'fixed' by training (Hornickel & Kraus, 2013). DD is a lifelong brain disorder with a genetic disposition, and no spontaneous remission for "catching

up" can be expected. The inconsistencies in performance and learning challenges can be very frustrating and the devastating effects can be seen in the form of low levels of general and academic self esteem, and also peer and teacher related areas of adjustment (Thambirajah, 2010).

Efficient phonological processing such as phonological awareness (PA) and rapid naming are very vital for the mastery of literacy (Araújo, Bramão, Faísca, Petersson, & Reis, 2010; Wagner, Torgesen, & Rashotte, 1999). These deficits are the primary causes for reading problems in DD, and despite being independent sources of breakdown of reading dysfunction, have an additive effect on most reading and spelling measure (Miller et al., 2006; Nicolson & Fawcett, 2005; Norton & Wolf, 2012; Verhagen, Aarnoutse, & Van Leeuwe, 2010; Vukovic & Siegel, 2006).

No orthography is indifferent to DD (Holopainen, Ahonen, & Lyytinen, 2001; Tressoldi, Stella, & Faggella, 2001). The degree of deficits is greatly influenced, and moderated by the characteristics and phonological demands of the linguistic system, which modulates the specific demands on the phonological and orthographic processing skills (Grigerenko, 2001; Guardiola, 2001; Miles, 2000). Kannada is one of the major Dravidian languages of South India. With a boastful recorded history of over 2,300 years and unmatchable literature, obtained classical status granted by the Indian Central Government on the occasion of 52nd Kannada Rajyotsava and highest number of Jnanapeeta awards (Express News Service, 2012). It is necessary to foreground the research on a hybrid class of scripts categorized as an alphasyllabary (Vaid & Padakannaya, 2004). It is the state language of Karnataka, and is spoken by over 60 million people. Kannada has 50 basic letter symbols called akshara which means that the symbol stands for orthographic syllable, which can further be visually analyzed into its constituent phonemes. There is almost one to one graphophonological equivalence expressed in syllable structure, regular signs of vowels being attached to the basic consonant forms. Each of the vowels, in addition to its syllabic (primary) form, has an intrasyllable (secondary) form which is used in writing a CV syllable and each syllable form can be analyzed into its consonant and vowel components. Consonants also have dual graphemic representations- basic form and in conjunct form (see Nag & Snowling, 2012; Padakannaya & Ramachandra, 2011; Prakash & Joshi, 1991,

1995). English is notoriously irregular and follows an alphabetic spelling system (Nag, 2007), and the relationship between letters and their spoken equivalent is far from consistent. It is a deep alphabetic system, as the letter-sound mapping is less consistent with several exceptions (Landerl & Wimmer, 2008; Norton &Wolf, 2012).

India has the largest population of children below the age of 18 (Child Rights and You, 2012). As per population census of India 2011, the literacy rate of our country has gone up to 74.04 from 65.38% in 2001, thus showing an increase of 9% in 10 years. The present study, part of a larger study, is novel and important on two accounts. Firstly, there is dearth for studies comparing children who have undergone remediation with the typically developing (with normal academic achievement) children, and children with dyslexia not exposed to any remedial intervention. Secondly, this study examined the performance of participating groups in two distinct language systems viz., alphabetic (English) and alphasyllabary (Kannada/Hindi) with respect to unique and shared contribution of PA and RAN measures to reading. The schematic representation of the study is presented in Figure 1.

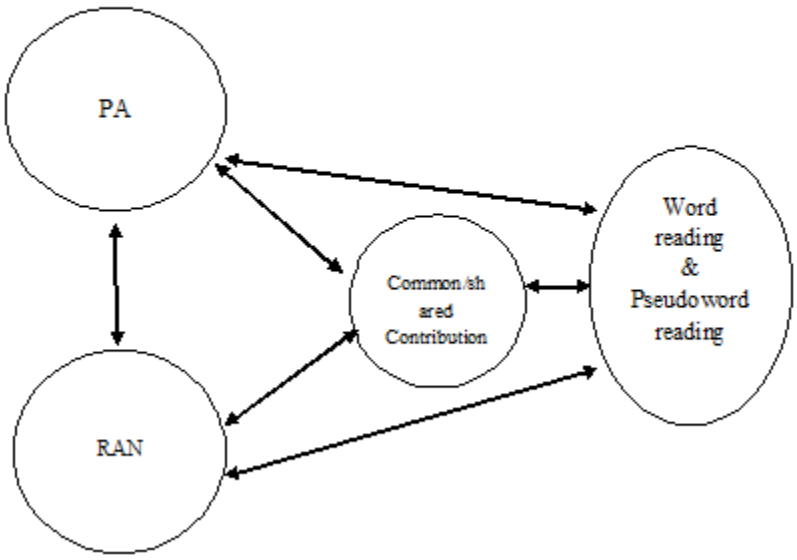

Figure 1. Schematic representation of the study depicting direct and combined effect of PA and RAN on reading.

Method

Participants

One hundred and forty one students (both boys and girls) of 11-17 years of age participated in the study and were studying in English medium schools. There were three groups of participants:

1) Typically Developing children (TD): There were 46 students (33 boys and 13 girls, with a mean age of 12yrs and 9 months, SD=1.02), who were normally developing with normal academic achievement, language developments and intellectual ability.

2) Children with dyslexia remediated (CDR): There were 49 students (37 boys and 12 girls, with a mean age of 14yrs and 2 months, SD=1.6), who were largely compensated at the time of testing.

3) Children with dyslexia with no remediation (CDNR): There were 46 students (36 boys and 10 girls; with a mean age of 12yrs and 9months, SD=1.3), in the group who never had exposure to any special education intervention or remediation prior to the testing.

CDR group children had gone through remediation for a period of minimum 3 years at the time of testing. They had full time remedial teaching in a special school in Kannada and English along with other academic core subjects by trained special educators. All the participants in CDR and CDNR were officially certified having DD by authorized institutions in Karnataka state, India. The research project had the approval of the Human Ethical Committee of the University and informed consent was obtained from the parents of the students.

Measures

A. Reading Measures

1. Word and Pseudo-word reading in Kannada (Saldanha, Siddaiah, Veerappa, Ramachandra & Padakannaya, 2014).

This test developed in the lines of Test of Word Reading Efficiency (TOWRE, Torgesen, Wagner, & Rashotte, 1999), measured word and pseudoword reading efficiency in Kannada. The sight word efficiency (SWE) section and Pseudo-word efficiency (PDE) section comprised of 72 and 62 items respectively.The total number of words/pseudo-words correctly read in 45 seconds and the total number of correctly read items (without time limit) constituted one's scores . The time sampling test-retest reliability coefficient of the four subtests was 0.91 and above. The test details are available elsewhere Saldanha et al., 2014).

2. Test of Word Reading Efficiency (TOWRE; Torgesen et al., 1999). The test for English comprised Sight Word Reading Efficiency (SWE) and Phonological Decoding Efficiency (PDE) measures. The test is widely used as a timed measure of single-word and pseudoword reading efficiency. The number of items read correctly within a 45-second time limit as well as the total number of items read was recorded.

B. PA measure.

Phoneme reversal test from Saldanha & Padakannaya, (2010) and *The Comprehensive Test of Phonological Processing* (CTOPP, Wagner et al.,1999) for Kannada and English respectively were used for this study. They required the participants repeat orally presented short nonwords in the reverse order of the sounds/phonemes.

C. RAN measure.

Color naming part of the RAN test in English developed by Denckla and Rudel (1974) and its Kannada adaptation (Siddaiah, Saldanha, Venkatesh, Ramachandra, & Padakannaya, 2016) were used. The participants were required to name an array of color squares arranged in 5 rows of 10 symbols each on a sheet as rapidly and accurately as possible. The total time was taken as the score.

The above measures are all valid measures used in researches. The particular PA and RAN tests were selected due to their significant correlations with reading measures (Table 1). These tests were administered individually to all the participants in a quiet room provided by the institution authorities.

Table 1. Correlation between PA and RAN measures with word and pseudoword reading across the groups (Kannada).

	Sight Word Reading			Pseudoword Reading		
	CDNR	CDR	TD	CDNR	CDR	TD
Kannada						
PR	0.48**	0.32*	0.22	0.33*	0.35*	0.27
RAN-Color	-0.12	-0.31*	-0.40**	-0.90	-0.36*	-0.47**
English						
PR	0.31*	0.55**	0.26	0.34*	0.40**	0.48**
RAN-Color	-0.40**	-0.34*	-0.41**	-0.30*	-0.26	-0.19

Note. CDNR= Children with Dyslexia with no Remediation; CDR= Children with Dyslexia Remediated; TD=Typically Developing; PR=Phonological Reversal; RAN=Rapid Automatized Naming

*p < 0.05 ** p < 0.01

Results

The descriptive statistics (Table 2) for the reading measures, PA and RAN measures. As expected, the CDNR group showed slowest naming speed and weakest phonological awareness among the three groups. The performance of the TD was the best followed by CDR group in all the tests.

Table 2. Descriptive statistics for word and pseudoword reading, PA and RAN tests (Kannada)

	CDNR		CDR		TD	
	Mean	SD	Mean	SD	Mean	SD
Kannada						
SWE[a]	14.83	8.96	31.04	12.09	53.28	12.99
PDE[a]	11.09	5.96	22.47	7.7	38.72	10.63
PR[b]	2.37	3.14	9.22	2.14	11.04	0.99
RAN-Color[c]	116.83	70.80	77.92	45.18	53.96	16.24
English						
SWE[a]	20	11.23	45.78	17.5	74.76	10.41
PDE[a]	9.48	5.65	24.14	11.62	46.35	10.27
PR[b]	3.89	2.58	11.18	3.28	15.35	2.27
RAN-Color[c]	58.5	30.4	41.16	9.5	35.09	7.63

Note. SWE= Sight Word Reading; PDE= Phonological Decoding Efficiency; PR = Phoneme Reversal; PR=Phonological Reversal; RAN=Rapid Automatized Naming

[a] Measured in terms of number of words/pseudo words read; [b]Correct number of responses; [c]Measured in seconds.

The Regression Commonality Analysis (RCA) was applied to infer the independent and joint contributions of PA and RAN to sight word reading and pseudoword reading. RCA helps partitioning of variance to quantify proportions of variance in the dependent variable, which can be attributed uniquely to the different independent variables, and also the proportion of variance that are attributed to the different combinations of the independent variables (Pedhazur, 1982). We opted to go for a representative measure each from among the PA and RAN measures based on their correlation pattern with sight word reading and pseudoword reading measures (Table 1). The SPSS script was based on the R code (Nimon, Lewis, Kane, & Haynes, 2008) for performing the analysis. The results of the unique and shared contribution of PR and RAN color naming to the reading measures for the three groups are shown in Table 3A for Kannada and Table 3B for English.

Table 3A. The unique and common contributions of PR and RAN color naming to Single word and pseudoword reading of the three groups of readers in Kannada (%variance accounted for is given in the parenthesis).

	Sight Word Reading			Pseudoword Reading		
	CDNR	CDR	TD	CDNR	CDR	TD
Unique contributions						
PR	0.2321	0.0754	0.0431	0.1087	0.1014	0.067
	(94.12)	(43.83)	(21.51)	(93.12)	(78.30)	(23.19)
RAN -Color	0.14	0.0678	0.1510	0.008	0.0021	0.2126
	(5.88)	(39.42)	(75.34)	(6.87)	(1.64)	(73.58)
Common contributions						
PR & RAN –	0.000	0.0288	0.0063	0.0000	0.026	0.0093
Color	(0.005)	(16.74)	(3.14)	(0.005)	(20.05)	(3.22)
Sum	0.2466	0.1720	0.2005	0.1168	0.1295	0.2889

Note .CDNR= Children with Dyslexia with no Remediation; CDR= Children with Dyslexia Remediated; TD=Typically Developing; PR=Phonological Reversal; RAN =Rapid Automatized Naming

The results for Kannada (Table 3A) showed that the unique contribution of PR accounted for a major proportion of variance - 94.12% (100*(0.2321/0.2466)) and 93.12% to word and pseudoword reading of CDNR group respectively. The proportion of unique contribution of PA to reading decreased, as the level of reading expertise increased. Whereas, the proportion of unique contribution of RAN color to word and pseudoword reading, 75.34% and 73.58 % respectively, is highest for the TD group. The proportion of unique contribution of RAN to word reading decreased as the reading expertise decreased. The results showed that combined contribution to sight word reading and pseudoword reading by PA and RAN decreased as the reading expertise of the groups increased.

Table 3B. Unique and common contributions of PR and RAN color naming to Single word and pseudoword reading across the different subsets of readers in English (%variance accounted for is given in the parenthesis).

	Sight Word Reading			Pseudoword Reading		
	CDNR	CDR	TD	CDNR	CDR	TD
Unique contributions						
PR	0.0642	0.2505	0.0427	0.0915	0.1311	0.2068
	(29.12)	(68.74)	(20.32)	(50.58)	(66.21)	(84.75)
RAN -Color	0.1256	0.0666	0.1440	0.0633	0.0404	0.0178
	(56.96)	(18.28)	(0.023)	(34.99)	(20.40)	(7.30)
Common contributions						
PR & RAN – Color	0.0308	0.0473	0.0234	0.0260	0.0265	0.0194
	(13.97)	(12.98)	(10.95)	(14.37)	(13.38)	(7.95)
Sum	0.2205	0.3645	0.2101	0.1809	0.1980	0.2440

Note: CDNR= Children with Dyslexia with no Remediation; CDR= Children with Dyslexia Remediated; TD=Typically Developing; PR-Phonological Reversal; RAN=Rapid Automatized Naming

The results for English (Table 3B), showed that the unique contribution of PA to reading was greater than RAN except for the CDNR group. Further, the unique contribution of PA to pseudoword reading was directly proportional to the reading proficiency of the groups. On the other hand, the unique contribution of RAN decreased as a function of increase in reading ability of the groups.

Discussion

The results suggest that the CDR group were compensated largely as they performed significantly better than the CDNR group. In fact, their performance on RAN was almost on par with the TD group though they still showed marked deficiency in PA. Despite intensive

remediation at the phonemic level, children with dyslexia can never acquire complete mastery at the phonemic level due to the lack of consistency in grapheme-phoneme relations in a non-transparent orthography like English (Goswami, 2000).

In both the languages the CDNR group showed DD typical profile with the weakest PA and slowest naming speed. Remediation seemed to have helped the CDR group as the mean scores on reading and PA of the group are one standard deviation above the mean scores of the CDNR. However, the results support the view that the poor PA is the principal marker associated with DD.

Further, the RCA analysis for Kannada showed that PA plays a major role during the early reading acquisition phase, but as reader scales to higher level in decoding ability, the contribution of naming speed increases. However, the unique contribution of RAN decreases as the reading ability in English, a deep orthography, improves. The combined contribution of PA and naming speed decreases as the reading proficiency increases.

Conclusion

For English, the strength of shared contributions of RAN and PA to reading word and pseudoword decrease as the level of reading proficiency increases; whereas for Kannada, an alphasyllabary, the unique contribution of both PA and the shared contributions of PA and RAN decrease as the level of reading proficiency increases.

The overall results confirm the view that while both RAN and PA together contribute to the early development of reading across orthographies, the relative importance of PA, specifically at the phoneme level, may not be so crucial in nonalphabetic systems.

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