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Dyslexic Children and their Difficulties in Reading Persian Orthography

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Abstract

This research investigated the word reading performance of Persian speaking dyslexic children through the use of a reading test. For this reason, 15 Persian elementary developmental dyslexic student with the mean age of 9.6, (SD= 1.5) and 15 Persian unimpaired elementary student with the mean age of 9.6 (SD= 1.4) were compared. The performance of the two groups was examined according to the effect of transparency variable. Participants were required to read a list of 32 one syllabic word and nonwords in order to compare the reaction times and error rates of reading transparent and opaque words and nonwords. Overall, the finding showed that dyslexic children encountered more problems in reading both transparent and opaque words than did unimpaired children. The finding also showed that reading the opaque words was harder than reading the transparent words for both groups. The results of this research show that specific charactristics of writing systems affect the word processing ability of individuals in the reading task.

Keywords: Dyslexic, Orthography, Opaque, Transparent, Persian

1. Introduction

According to the dual route model (Colthaert, 1978) and the recent cascade model (Colthaert, Curtis, Atkins, & Haller, 1993) words in English are classified in two categories; regular and irregular. In order to read the regular words aloud, graphemes are converted to phonemes. This route is also called nonlexical or sublexical route. However, to read the irregular words aloud, there is a direct route which is called lexical route in which there is an orthographic access to their lexical entry. Therefore, according to this model writing systems can be placed on a continuum. This continuum can show the ease and reliability of converting graphemes directly to phonemes (Frost, Katz & Bentin, 1987).

Examining the routes in reading words in Hebrew, English and Serbo-Crotian according to the differences in the reaction time latencies to words and nonwords, high and low frequency words and semantic context, Frost et l. (1987) suggested an orthographic depth hypothesis according to which spelling transparency influencess the choice of routes in reading. However, Baluch & Benser (1991) proposed some universality in the reading process which is independent of transparency or script. They (1991) found that Persian which is both transparent and opaque is read with greater use of lexical route regardless of the transparency of words.

Phonology plays a vital role in the development of reading (Rack, Hulm, Snowling & Wightman, 1994; Ehri, 1999; Frith, 1980) and developmental dyslexia (Snowling, 1980; Goswami, & Bryant, 1990). In the developmental models of reading and spelling there are distinct stages. Reading and spelling develop from the logographic stage (or pre-alphabetic stage) and end in the alphabetic stage which finally results in the establishment of an orthographic lexicon. In alphabetic stage as an important stage in the development of reading and writing, beginning readers learn to connect letters (graphemes) with their corresponding phonemes.This enables them to use the grapheme-phoneme correspondence as a process in word reading and word recognition (Ehri, 1999). This results in the correct pronounciation of the words. Further evidence in support of the role of phonological processing in reading development comes from readers who show a good phonological awareness and show greater reading skills than those who show a poorer phonological awareness. Further Evidence comes from the reading perfomance of a group of poor readers namely developmental dyslexic children (Snowling, 1980, Goswami & Bryant, 1990). Dyslexic children in compare to unimpaired children spend more time and make more errors in reading words and nonwords aloud (Jackson & Colthaert, 2001). They also have difficulty in taskks which involve phonological awareness (Goswami & Bryant, 1990; Wagner & Torgesen, 1987). Although childrens' reading ability is affected by their phonological processing ability, it can be alo affected by orthographic characteristics.

Many researchers examined the effects of spelling transparency on the development of reading skills. Therefore, if the development of reading skills relies on the efficiency of phonological generation from print, it would be easier to read a transparent orthography and this lowers the rate of reading impairment (snowling, 2004). Cross-linguistic researches show that children reading transparent orthography like French acquire phonological awareness earlier than the children who read an opaque orthography (Goswami et al., 2003). Bruck, Genesee and Caravolas (1997) compared a group of begging readers of English (with an opaque orthography) with a group of begging readers of French on reading words and nonwords. They found that the group reading a transparent orthography performed more accurately in reading words and nonwords. Moreover, Baluch & Danaye Tousi (2006) studied the effect of spelling transparency on reading in Persian which is transcribed by two types of spelling; words spelled with long vowels (letters) (a, i, u) and are called transparent words and those spelled with short vowels (a, e, o) which are generally represented by diacratic marks (omitted) and are called opaque. The results of their study showed that dyslexic children performed worse (had a slower reading and more error) than did unimpaired reading control. Their results also suggested that dyslexic children had greater difficulty with phonological processing and the effect was true even for transparent words. Regarding the dual route model of reading in Persian, it can be suggested that transparent words can be read via grapheme-phoneme conversion rule and opaque words can be read via lexical route. Baluch (1992) believed that beginning reader of Persian specially impared readers may encounter difficulty when reading an opaque word. However, skilled readers who established an orthographic lexicon may use a lexical route for reading both transparent and opaque words. Baluch & Benser (1991) found that adult Persian readers make extensive use of the lexical route when reading opaque and transparent words while the sublexical route was more prominent in beginning readers.

The present study aims to investigate the effect of spelling transparency on the word reading performance of dyslexic and unimpaired reading control, using OpenSesame (PsychologySoftwareTools) software. In line with the aim of the study, the following questions arise:

1. How does the reading performance of dyslexic children differ from that of unimpaired children?

In line with the findings of the previous studies, it was hypothesized that dyslexic children perform worse in reading words than unimpaired children.

2. Are the reaction times of reading transparent words shorter than those of opaque words?

It is hypothesized that participants read the transparent words faster than the opaque words.

2. Method

2.1 Participants

Fifteen monolingual Persian children, namely developmental dyslexics with the mean age of 9.6 (SD=1.5) and fifteen unimpaired children matched on age (mean age=9.6, SD=1.4) were compared. Impaired children were diagnosed by educational psychologists. Performance of IQ was measured using WISC-III (WECHSLER, 1974). In order to determine any emotional or neurological deficits Bender-Gestalt Test (Koppitz, 1975) was used. The criteria for selection of dyslexic children were that they had an IQ of 90 or above and showed no emotional or neurological deficits. However, their reading performance was about two years behind their peers. All the dyslexic participants were female and they attended a special needs school and unimpaired children were from a public school within the same socio-economic statue. All the students followed a phonic approach in which children first learned the sounds of individual letters followed by learning to sound the combination of phonemes, and then words as a whole. In this stage, children also learn to notice to the spelling of words without the short vowels.

2.2 Materials

2.2.1 Stimuli

Thirty two Persian words were selected. The words were selected according to the following criteria: (1) all the words were frequent words; (2) all the words were concrete and (3) they were divided into two categories based on their transparency. The first category consists of 16 one syllable transparent words and the second category consists of 16 one syllable opaque words. Thirty two nonwords were also devised by changing the intial phoneme in words. Therefore, there were 16 one syllable transparent nonword and 16 one syllable opaque nonwords. The stimuli were presented to participants using DELL monitors operating at 1366x768 resolutions, with a refresh frequency of 100 Hz. The dimensions were 47 cm horizontal and 30cm vertical. The viewing distance was 60 cm. The computers were DELL (2.4 GHz processor, 4GBRAM, 320 Gb disk drive). The experiment was designed using OpenSesame software (PsychologySoftwareTools).

2.2.2 Experimental procedures

The participants were tested individually in a sound proof labaratory. They were placed in front of a Dell computer at a viewing distance of 60 cm. They were requested to perform an oral reading test. They had to read the transparent and opaque words and nonwords. They received oral and written instruction. Oral instructions were recited before participants started the test and written instructions were delivered throughout the test on the screen. The test started with four trial question training session which was performed with completely different words and nonwords than those in the real test. The test started initially when a fixed point appeared on the screen for 500 ms. Then the word appeared on the screen and after 240 ms the next fixation point appeard. Reading latencies were measured from the onset of the word. The response time was also set 250 ms. The participants were moved to the next trial as soon as they responded to the stimuli. However, if they failed to respond within 2,500ms, the trial disappeared and they were moved on to the next

trial.

3. Results

In this section the result of the word reading task is presented. Dyslexic and unimpaired children are compared. Independent samples T-test was performed and mean and standard deviation of groups were compared to give a reliable source for the data analysis and interpretation.

3.1 Reaction times

The participants mean reaction time of reading the lists of transparent and opaque words and nonwords (in second), with their corresponding standard deviations are depicted in table 1.

Table 1. The mean response latencies (in seconds) and their corresponding standard deviations of reading transparent and opaque words and non words

	Participants			
	Dyslexic		Unimpaired	
	Transparent	Opaque	Transparent	Opaque
words	40.31 (15.43)	43.50 (12.43)	7.32 (0.83)	10.54 (0.76)
nonwords	56.87 (30.03)	84.21 (42.12)	10.74 (2.12)	18.45 (4.21)

As the results in table 1 shows the dyslexic children had a statistically significant better performance in reading transparent words than opaque ones. They read the transparent words faster (40.31) than the opaque word (43.50). The results of t-test showed that there was a statistically significant difference between reading latencies of these two types of words in dyslexic children ($t= 4.324$, $df=16$, $p<0.05$). They also read the transparent nonwords faster (56.87) than the opaque nonwords (84.21). They showed statistically significant differences in reading latencies of transparent and opaque nonwords ($t= 3.432$, $df=14$, $p<0.05$).

The results also showed that unimpaired children performed better in reading transparent words than the opaque ones. Unimpaired children read the transparent words faster (7.32) than the opaque ones (10.54). T-test showed a statistically significant differences between reading latencies of these two types of words in unimpaired children ($t=3.562$, $df=16$, $p<0.05$). They also read the transparent nonwords faster (10.74) than the opaque nonwords (18.45). This differences was statistically significant ($t= 9.431$, $df= 16$, $p<0.05$).

3.2 Error Analysis

Table 2. The participants' errors in reading transparent and opaque words and nonwords

	Participants			
	Dyslexic		Unimpaired	
	Transparent	Opaque	Transparent	Opaque
Word	2.25 (1.32)	3.65 (1.36)	0.16 (0.34)	0.30 (0.58)

Participants' errors in reading transparent and opaque words are shown in table 2. As the data shows dyslexic children made more errors in reading opaque words than in transparent words. The data obtained from t-test showed a statistical significant difference in errors of reading opaque and transparent words ($t= 2.561$, $df= 9$, $p<0,05$).

These data also showed that unimpaired children made more errors reading the opaque words than the transparent words. T-test confirmed a statistical significant difference in error rates of reading opaque and transparent words ($t=1.321$, $df= 9$, $p<0.05$).

A comprehensive look at the data shows that there is a significant effect of transparency both in latencies and in error rates of reading words and nonwords. In both dyslexic and unimpaired children there was a statistical significant difference in the reading latencies of transparent and opaque words. They read the transparent word faster (25.7) than the opaque ones (34.54). This implies that there was not a statistically significant main effect in the analysis by participants ($t= 6.543$, $df= 28$, $p>0.05$). Likewise, both groups read the transparent nonwords faster (32.99) than the opaque nonwords (50.87). In the same way, both groups made fewer errors reading transparent words than the opaque ones. The data obtained from t-test showed a statistical significant difference in the error rates of these types of words ($t=7.453$, $df= 28$, $p<0.05$).

Generally, the data showed that unimpaired children read the words faster than the dyslexic children. T-test analysis showed that this difference was statistically significant ($t=0.942$, $df=28$, $p<0.05$). The data also showed that unimpaired

children read nonwords faster than the dyslexic children and the difference was statistically significant (t= 10.961, df=28, p<0.05). Unimpaired children also made fewer errors in reading words than did dyslexic children. T-test showed a statistically significant difference between two groups (t=7.837, df= 28, p<0.05).

Results obtained from Pearson correlation confirmed a negative and significant correlation between transparency and group variables. In other words, in compare to unimpaired children, dyslexic children made more errors in reading the transparent words.

4. Discussion

The aim of this research was to compare the reading performance of dyslexic and unimpaired children in reading Persian orthography. The results showed that dyslexic children were significantly slower than unimpaired children in the time taken to read words. Comparison of dyslexic children with a group of unimpaired children can provide information about the extent to which the reading behavior of developmental dyslexic children was an indication of their delay from the norm (Castles & Colthaert, 1993). In relation to the participants' ability to read words, it was predicted that transparency affects word reading ability of both groups. However, it was predicted that this effect would be greater for dyslexic children than unimpaired readers. This finding is in accordance with the previous researches on unimpaired readers across orthographies which differ in the degree of transparency (Porpodas, et al, 1990) and in relation to Persian orthography which suggest an effect for spelling transparency on reading (Baluch, 1992). Moreover, Snowling (2000) refers to a generally agreed view that dyslexic children have more difficulty than unimpaired children in retriving the phonological information.

Regarding the reading time for opaque and transparent words, for both dyslexic and unimpaired children, it takes more time to read the opaque words. Furthermore, both groups made more errors in reading opaque words than the transparent ones. This comparison between transparent and opaque words in Persian shows that when there is not enough phonological information, the efficiency and speed of reading is affected. However, previous research showed that the degree of differences may differ according to the degree of orthographic transparency (Goswami, Ziegler, Dalton, & Schneider, 2001). There are researches which show that transparent orthographies are read faster and with fewer errors than opaque orthographies (Cossu et al., 1995; Porpodas et al., 1990). However, researches also showed that dyslexic children have a worse performance both in terms of reading time and error rates compared to unimpaired children (Olson, Wise, Conners, Rack, & Fulker, 1989). Furthermore, there are studies which show that the degree of the differences between dyslexic and unimpaired children varies according to the orthographic transparecy (Goswami, Ziegler, Dalton, & Schneider, 2001). Goulandris (2003) showed that the degree of differences between dyslexic and unimpaired children in performance on phonological task in a transparent orthography was less than the difference between dyslexic and unimpaired readers for a deep orthography like English. Based on these researchers, it can be stated that opaqueness aspect of Persian orthography can be a contributing factor for a greater difference between dyslexic and unimpaired children.

5. Conclusion

The findings of the present study showed that developmental dyslexic children showed more difficulty in reading words than the unimpaired children. This can be taken as an indication of a specific impairement in their phonological processing rather than a delay in their ability to read normally. An immediate implication which can follow from the present reasearch is that elementary school children and more specifically dyslexic children receive continious reading instructions in which opaque words are spelled with diacratic marks until they gain a high level of phonological skills and establish a substantial orthographic lexicon.

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