

## **Difficulties in L2 Hebrew reading in Russian-speaking second graders**

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**Abstract.** The present study examined factors that influence the process of learning to read in a second language. The Hebrew reading comprehension skills of 68 Russian-speaking children (mean age 7 years 6 months) were screened at the start of Grade 2. From this sample, 40 participants were selected: 20 successful learners and 20 unsuccessful learners. These two groups were then tested on a wide range of language skills (e.g., phonological processing, vocabulary, syntactic and morphological awareness) in both languages (Hebrew and Russian) and reading skills in Hebrew (e.g., reading speed and accuracy).

Two factors, level of spoken Hebrew and phonological awareness deficits in both languages, were significant. Phonological awareness difficulties constituted the key factor associated with poor decoding whereas insufficient mastery of spoken Hebrew was important in the case of reading comprehension. An interesting dissociation was also found in our poor readers between impaired phonological awareness and other unimpaired phonological processing abilities such as oral pseudoword repetition and working memory. These findings suggest that, in addition to poor spoken L2 proficiency, poor readers are characterized more by a metalinguistic rather than a linguistic deficit in their native tongue.

**Key words:** Bilingualism, Dyslexia, Hebrew, Literacy, Phonological awareness, Russian

The present study focused on relationships between bilingualism and the process of learning to read in a second language. To date, much of the relevant research literature has focused on English (as the first or second language). This may limit the generalizability of findings because English orthography is highly exceptional and hence unrepresentative of alphabetic orthographies in general (Seymour, Aro & Erskine, 2003). Our study examined factors that influence the processes of learning to read in Hebrew as a second language in bilingual children with Russian as their native language.

Bilingual students constitute a substantial proportion of school-age children in countries with high rates of immigration. For example, in Israel, immigrants from the former USSR make up 20% of school

students. Characteristically most of the younger bilingual children learn to read in their second language (L2) Hebrew before (if at all) they acquire the written register of their native (L1) Russian. Accordingly, these children represent a specific case of mono-literate bilingualism, that is, bilingualism in spoken language and literacy learning in only one language (L2). This case is therefore different from the majority of studies in which bilinguals learn to read in a second language after or in parallel with L1 reading acquisition. Our study, therefore, represents a unique examination of the problems experienced by bilinguals learning to read, uncomplicated by the additional factor of biliteracy.

In general, two broad approaches have been taken to the problems of learning to read among bilinguals: the approach founded on the Linguistic Threshold Hypothesis (Clarke, 1979, 1980; Cummins, 1978) and other one based on the Linguistic Coding Deficit Hypothesis (Sparks & Ganschow, 1993)

According to the Linguistic Threshold Hypothesis (e.g., Carrell, 1991; Clarke, 1979, 1980; Cummins, 1978), reading ability in a second language depends greatly on the level of spoken language mastery. The Linguistic Threshold Hypothesis was developed largely on the basis of the investigation of reading comprehension processes in the bilingual population (Carrell, 1991; Clarke, 1979; Cummins, 1979; Cziko, 1980; Lee & Schallert, 1997). In this context, the transfer of reading comprehension strategies from first language to second language was the primary focus of investigation.

According to the Linguistic Threshold Hypothesis, effective language transfer may occur only after a specific linguistic threshold in the second language has been achieved. However, definition of this specific threshold has remained problematic. For example, Cummins (1979) defined linguistic threshold as a certain level of L2 acquisition from the standpoint of lexical, morphological and syntactic knowledge. Achievement of such a level of linguistic knowledge is considered to be a safeguard against difficulties in the cognitive development of bilingual children and a springboard for the development of metalinguistic awareness. Carrell (1991) suggested designating a threshold level of L2 in accordance with instructional level (i.e., academic requirements). However, neither of these researchers proposed objective criteria for the assessment of L2 proficiency aside from designating the highest level as written composition (Carrell, 1991).

Note that in the framework of the Linguistic Threshold Hypothesis, processes of reading and especially of reading comprehension are considered (explicitly or implicitly) language processing. This view is supported by the close association between spoken and written modalities of language, evident insofar as written text processing demands not only

phonological and orthographic knowledge but also an understanding of the syntactic and semantic relationships among words at the phrase, sentence, and text level (Gee, 2001; Olson, 1991; Perfetti, 1999). Nonetheless, one of the very important and basic components of reading ability – word recognition – is largely neglected (Adams, 1990; Rayner, Foorman, Perfetti, Pesetsky & Seidenberg, 2001; Stanovich, 2000).

Word recognition processes are different from those involved in reading comprehension and they develop on the basis of distinct cognitive skills (Rayner et al., 2001; Stanovich, 2000). In particular, word recognition is thought to be an ‘informationally encapsulated’ process that is largely independent of additional supra-lexical sources of information beyond word-specific information, whereas reading comprehension demands use of strategies based on high-level cognitive and metalinguistic processes such as use of prior knowledge and experience, and self-monitoring during text reading, and so forth (Share & Leikin, 2004; Shatil & Share, 2003; Stanovich, 1992, 2000)). However, because word recognition is a precondition for adequate text comprehension, poor reading comprehension can be caused not only by weaknesses in general language proficiency but also by deficient word recognition (Adams, 1990; Slocum, Street & Gilberts, 1995; Stanovich, 1988).

In accordance with the above observations, the study of factors that influence L2 reading acquisition must deal not only with reading comprehension processes but also with basic processes involved in decoding (e.g., phonological processing and working memory). In the case of beginning readers, the significance of L1 evaluation in both spoken and written registers is especially pressing.

The second approach to literacy learning among bilinguals – the Linguistic Coding Deficit hypothesis – cites evidence of a causal connection between specific language impairment (including specific reading disability) in L1 and difficulties in learning to read in L2 (Sparks & Ganschow, 1993). This link has been confirmed in several crosslinguistic studies (e.g., Dufva & Voeten, 1999; Service, 1992). The findings indicate strong relationships between the acquisition of phonological decoding skills in the first language and L2 reading achievement. These studies point to universal transfer from L1 to L2 of phonemic/phonological skills such as phonemic analysis and auditory working memory (Dufva & Voeten, 1999; Service, 1992).

To date, however, only a few studies have compared the linguistic skills of bilingual children in both languages at the beginning of learning to read (Da Fontoura & Siegel, 1995; Geva & Siegel, 2000; Geva, Wade-Woolley & Shany, 1993). In addition, usually only a limited range of

linguistic skills (i.e., working memory, orthographic knowledge, and phonological awareness) have been examined in these studies.

For example, Da Fontoura and Siegel (1995) who compared reading difficulties in Portuguese (L1) and English (L2) in young readers, confirmed the phonological coding deficit. Children with reading difficulties in English showed weaknesses in phonological and syntactic processing, and in working memory in both languages. Similar results were obtained by Wade-Woolley and Geva (2000) in their study of the 'language transfer' hypothesis among bilingual (English/Hebrew) children learning to read in the two languages. A significant interrelationship between the two phonological systems was found. Additionally, strong correlations between phonological decoding in both languages and such reading variables as word and pseudoword recognition were demonstrated. On the basis of these findings, Wade-Woolley and Geva (2000) suggested that alphabetic languages possess several phonological principles that are independent of specific languages and that pass from language to language. Recently, this assumption was confirmed by findings from a nonalphabetic language in a study of English reading achievement among Chinese-speaking children (Gottardo, Yan, Siegel & Wade-Woolley, 2001). In particular, it was found that phonological skills in both languages were correlated with L2 (English) reading performance (see also Comeau, Cormier, Grandmaison & Lacroix, 1999).

Thus, two possible causes for reading difficulties in a second language have been proposed in the literature: insufficient L2 mastery and a specific linguistic (phonological) coding deficit. The available evidence, however, does not permit a clear-cut adjudication between these two approaches. For example, the importance of well-established spoken language mastery for learning to read has been mostly studied among adult learners (e.g., college students) and mostly by means of tests of reading comprehension and syntactic and morphological awareness (e.g., Carrell, 1991; Clarke, 1979, 1980; Lee & Schallert, 1997). By contrast, the second hypothesis is largely derived from research in young school-aged children tested not only on reading comprehension but also on word recognition (Geva, Wade-Woolley & Shany, 1997; Geva, Yaghoubzadeh & Schuster, 1999).

These alternative approaches also have different practical implications. According to the first hypothesis, evaluation of reading disabilities and potential intervention are not needed at this stage and, if anything, should be delayed until spoken language has been adequately mastered. However, delaying intervention may lead to greater obstacles in reading acquisition among those bilingual children who suffer from intrinsic learning disabilities. This is because later rather than earlier remedial instruction has poorer long-term outcomes (Snow, Burns & Griffin,

1998). In contrast, the Linguistic Coding Deficit Hypothesis proposes that difficulties of immigrant children in learning to read should be evaluated as early as 6 months after starting L2 acquisition (Geva et al., 1997; Wade-Woolley & Geva, 2000). In these cases, testing of cognitive and linguistic abilities (such as working memory, naming rate and accuracy, and phonological awareness) in both languages may reveal signs of specific reading disabilities.

Based on the above observations we embarked on a study of the factors that may influence the process of learning to read in a second language (Hebrew) among young new immigrants who are not literate in their first language (Russian). Because Hebrew and Russian belong to different families of languages (Semitic and Slavic), the influence of structural differences on the process of learning to read must be considered. We suggest, however, that such influences (if indeed they exist) may be minimized by using reading comprehension as the selection measure for defining our two groups of children: good readers (successful learners) and poor readers (unsuccessful learners).

Hebrew, and to an even greater degree, Russian languages in general are closer to languages with pragmatic word order than to those with the constant syntactic order of the sentence components (Berman, 1985; Gvozdev, 1961). Even so, SVO (subject–predicate-object) syntactic order is frequent in these languages (Gvozdev, 1961; Sokolov, 1984), especially in texts used for early reading. The most characteristically Semitic feature of Hebrew is its derivational morphology (Ephratt, 1985). Most content words are comprised of two basic components: *root* and *pattern*. The root, being the semantic core of a word, is an ordered sequence of consonants (usually three), while the pattern is a sequence of vowels, or vowels and consonants (e.g., GiBoR, “hero”). In turn, Russian is characterized by rich inflectional morphology (Akhmanova, 1971), which is also highly developed, though to a lesser degree than Hebrew. At the same time, the texts for beginning readers in Hebrew (Grades 1 and 2) rarely include specific and complicated morphological constructions that may cause difficulties in children who know spoken Hebrew only on a basic level.

Finally, compared with Hebrew, Russian seems to be more phonologically complicated (Akhmanova, 1971; Shimron, 1993). For example, Hebrew syllables mostly have a CV (consonant-vowel) or (occasionally) CCV composition (Cohen-Gross, 2003), whereas Russian includes many CCV and even CCCV syllables. This phonological complexity has a positive influence on the development of phonological awareness at the phoneme level in Russian-speaking children (Zaretsky, 2002). Apparently, Russian-speaking preschoolers can perform more complex phonological segmentation tasks than English- or Hebrew-speaking

children (Bentin & Leshem, 1993; Zaretsky, 2002). Thus, considering that orthographic differences are not relevant in the case of *monoliterate* bilingualism, it may be suggested that, on the level of easy texts for beginning readers, structural differences between the two languages are unlikely to be critical.

In view of the above-mentioned considerations, we propose that comparison of two groups of bilingual children (successful and unsuccessful learners) in their performance on linguistic and reading tasks may contribute to a better understanding of the factors influencing the process of learning to read in a second language. We hypothesized that the reading difficulties evident among young immigrant learners are the result of both insufficient L2 proficiency and specific reading disability (phonological decoding deficit). We expected a phonological awareness deficit to be the dominant factor in the overall pattern of reading difficulties at this young age.

## Method

### *Participants*

Participants were an unselected sample of 68 second-grade bilingual Russian/Hebrew children. The sample comprised 37 males and 31 females with a mean age of 7.6 years from three regular schools situated in districts with a predominantly middle socio-economic level of population in the city of Haifa (Israel). The classes in which the participants learned were regular ones with mostly Hebrew-speaking students. All participants had immigrated to Israel at least 1 year and 6 months ( $M = 3.7$ ,  $SD = 1.8$ ) earlier, that is, before the start of formal school learning. Russian was the dominant language in all the children's homes. Although all children had exposure to Russian script, no formal or informal reading instruction in Russian had been conducted with them. Almost all participants were familiar with a few initial letters of the Russian alphabet. At the same time, no child was able to name more than 4–5 letters and to read any simple, and highly frequent Russian words. Hebrew was the only language in which these children had learned to read.

### *Measures*

#### *I. Reading*

1. *A text reading task* (Grinboim & Likhter, 1996). This test measured reading comprehension, accuracy, and speed in context. Participants

read aloud a text at the Grade 1 difficulty level comprised of 61 words. Following the text, children were also required to answer five questions. Participants' scores were the number of questions answered correctly. This measure was used for selecting groups of participants (poor readers and good readers) because comprehension scores are generally employed in Israeli schools for reading achievement evaluation. Also each child received an overall reading *rate* score and an *accuracy* score.

2. Two measures of Hebrew reading abilities (decoding) were used: *Isolated word reading* (after Shatil, 1995). This test includes 30 frequent words on the difficulty level of 1st grade. The participants were asked to read these words aloud. Internal consistency (coefficient alpha) was 0.89.

*Pseudoword reading* (after Deutsch, 1994). This task provides information about the participant's ability to apply phonic and structural analysis skills for the decoding of printed pseudowords, which were structured to comply with Hebrew's morpho-phonemic conventions. A list of 16 pseudowords was presented to children for reading aloud. Internal consistency (alpha) was 0.90.

Reading rate (in seconds) and the number of errors (accuracy) were recorded in these last two tasks.

## II. Language

Several measures of language ability in both Hebrew and Russian were used. Note that all Hebrew language tests (except Fluency and Syntactic Awareness tests) are standardized and all Russian language tests are non-standardized tests.

1. *Peabody Picture Vocabulary Test* (Nevo, 1979; after Dunn, 1965). This test required the child to indicate which of four pictures matched a spoken word.
2. *Fluency test*. In this semantic fluency task, children were required to name as many category members as possible in 1 min. The semantic categories were animals, and fruits-and-vegetables. The letter fluency task, required children to generate words beginning with a given letter (in Hebrew: ג – *Gimel*, 'G' and ש – *Shin*, 'Sh'; in Russian: М, 'M' and П, 'P').
3. *Syntactic awareness*. In this task, participants listened to 10 sentences six of which were ungrammatical (e.g., in Hebrew, *Sara lovesh simla hadasha lemasiba* – violation of gender agreement, 'Sarah is putting on a new dress for the party'; in Russian, *Malchik vyshel v dom* – violation of agreement between verb prefix and noun case with preposition, 'The boy went out in the house'). Children were instructed to identify the

incorrect sentences and to correct them. Internal consistencies were very similar for Hebrew and Russian versions of this task (alpha = 0.84. and alpha = 0.81, respectively).

4. *Morphological awareness* (Hebrew version. Share & Shatil, 1991). A list of 20 pairs of pseudowords that represent different morphological categories (e.g., singular/plural; masculine/feminine; tenses), was orally presented to the children. The children were required to decide which word in the pair indicated specific morphological content. For example, in Hebrew: which word, *gasham* or *gashma*, indicated that a girl performed the action (*gashma*); in Russian: which word, *tor* or *torik*, indicated that this thing is small (*torik*). Internal consistency of the Hebrew and Russian versions of the task were 0.87 and 0.85, respectively.
5. *Working Memory* (Hebrew version. Shany & Ben Dror, 1998 adapted from Siegel & Ryan, 1989). The children were required to complete 18 incomplete sentences (e.g., 'We write on the board with...' ('chalk')). The stimuli were presented orally in two trials (2, 3, 4 and 5 sentences in each). Then children had to repeat all added words in the order of sentence presentation. That is, in the first trial the child had to repeat two words, in the second trial three, and so on. To minimize word-finding problems, the sentences were chosen so that the missing word was highly predictable. Internal consistency of the Hebrew and Russian versions of this task were 0.81 and 0.73, respectively. The task was discontinued when the child failed to repeat all the required words in two attempts at the same level of difficulty.
6. *Pseudoword Repetition* (Hebrew version. Shatil & Share, 1997): A list of 40 pseudowords (e.g., in Hebrew, *mekarelet* and *matzlishim*, and in Russian, *mole* and *karmina*) of different levels of difficulty was presented auditorily to the children. Participants were required to listen to these made-up words and to repeat them. Each stimulus word was presented only once. Alpha Cronbach for the Hebrew and Russian versions of the test were 0.71 and 0.64, respectively.
7. *Phonological awareness* (Hebrew version: Shany & Ben Dror, 1998). This test included two tasks (syllable and phoneme deletion) in which participants were required to delete syllables or phonemes from a spoken word. For example, in Hebrew, "Say *mispar* ('number'). Now, say *mispar* without *mis*"; "Say *shir* ('song'). Now say *shir* without the *r*" (In Russian: *pirog*, 'pie' without *pi*; *miach*, 'ball' without *ch*). In both languages, the test list included 20 words. Test items included the deletion of initial, medial, and final syllables and phonemes. In most cases, deletion resulted in the formation of nonwords. Internal consistency for the Hebrew and Russian versions of this test (alpha) were 0.90 and 0.92, respectively.



### Procedure

At the first stage of the study, from the total pool of 68 children, two groups were selected, poor readers ( $n = 20$ ) and good readers ( $n = 20$ ), on the basis of reading comprehension scores (text reading task). The comprehension test was administered at the beginning of grade two because the mastery of Hebrew decoding is normally achieved by the end of grade one (Share & Levin, 1999). The poor reader group comprised the lower third of the total sample, while the good readers comprised the upper third of the sample.

At the second stage of the study, the two groups of poor and good readers were evaluated on a wide range of reading tasks (only in Hebrew) and spoken language tasks (in both Hebrew and Russian). The Hebrew tasks were administered by a native Hebrew speaker, while a native Russian speaker administered the Russian language tasks.

### Results

Table 1 presents demographic data and mean performance in the text reading task for the whole sample and separately for three groups of participants: good readers, poor readers, and the excluded group. One-way ANOVAs were performed for the three groups of participants. In

Table 1. Performance of three groups of Russia/Hebrew bilingual readers on Hebrew reading tasks.

Variables	General sample		General sample ( $n = 68$ )	Poor readers ( $n = 20$ )	Good readers ( $n = 20$ )	Excluded group ( $n = 28$ )	$F^a$
	Min.	Max.					
Age	7.3	7.9	7.6 (0.2)	7.6 (0.1)	7.6 (0.2)	7.6 (0.2)	0.819
Gender	–	–	37/31 <sup>b</sup>	9/11 <sup>b</sup>	12/8 <sup>b</sup>	16/12 <sup>b</sup>	0.481
Years in Israel	1.5	6.9	3.7 (1.9)	3.7 (1.3)	3.9 (2.3)	3.5 (1.9)	0.482
<i>Text reading</i>							
Rate (in sec)	37	221	136.2 (80.6)	181.1 (96.4)	94.3 (37.8)	144.4 (82.5)	154.35*
Errors	0	64	11.7 (18.2)	25.8 (26.8)	3.25 (5.2)	7.8 (8.8)	5.95*
Comprehension	0	5	2.6 (2.1)	0.4 (.6)	5.0 (.0)	2.6 (1.4)	11.70*

<sup>a</sup>For three groups (poor and good readers, and excluded group).

<sup>b</sup>Males/females.

\*Significant with  $p < 0.01$ .

order to control the Type I error rate, alpha was set at 0.01. It can be seen that the three groups did not differ significantly in age, gender, and years of residence in Israel but were significantly different on all measures of text reading (comprehension, accuracy, and rate).

Background characteristics for the two key groups – poor and good readers and mean performance on the three reading tasks (i.e., text, isolated word and pseudoword reading) are depicted in Table 2. *T*-tests were used to carry out pairwise comparisons with alpha set at 0.01. The results show that the two groups did not differ significantly in age, gender, or duration (in years) of residence in Israel but did differ significantly on the reading tasks. Poor readers were inferior to good readers on all measures of reading with the exception of pseudoword reading rate. These findings show that these poor readers suffered from significant difficulties not only in reading comprehension (text reading) but also in decoding (word and pseudoword reading).

Table 3 presents the performance of the two groups on the linguistic tasks in spoken Hebrew and Russian. These tasks examined phonological

Table 2. Performance of Russia/Hebrew bilingual good and poor readers on Hebrew reading tasks.

Variables	General sample		Poor readers ( <i>n</i> = 20)	Good readers ( <i>n</i> = 20)	<i>p</i>	<i>Eta</i> <sup>2</sup>
	<i>Min.</i>	<i>Max.</i>				
Age	7.3	7.9	7.6 (0.1)	7.6 (0.2)	0.474	0.001
Gender	–	–	11/9 <sup>1</sup>	8/12 <sup>a</sup>	0.355	0.003
Years in Israel	1.5	6.9	3.7 (1.3)	3.9 (2.4)	0.738	0.003
<i>Text reading</i>						
Rate (in sec)	48	213	181.1 (96.4)	94.3 (37.8)	0.001*	0.302
Errors	0	64	25.8 (26.8)	3.25 (5.2)	0.001*	0.264
Comprehension	0	5	0.4 (0.6)	5.0 (0.0)	0.001*	0.969
<i>Isolated word reading</i>						
Rate (in sec)	28	196	106.9 (59.2)	65.1 (24.4)	0.006*	0.198
Accuracy	0	30	16.1 (11.9)	28.5 (2.2)	0.001*	0.357
<i>Pseudoword reading</i>						
Rate (in sec)	19	135	61.9 (31.9)	53.1 (19.0)	0.304	0.091
Accuracy	0	16	7.4 (6.6)	13.7 (3.3)	0.007*	0.276

<sup>a</sup>Males/females.

\*Significant with *p* < 0.01.

Table 3. Performance of bilingual good and poor readers on spoken language tasks in Russian and Hebrew.

Variables	Poor readers ( <i>n</i> = 20)		Good readers ( <i>n</i> = 20)		Good vs. Poor <i>p</i>		<i>Eta</i> <sup>2</sup>	
	Hebrew	Russian	Hebrew	Russian	Hebrew	Russian	Hebrew	Russian
Vocabulary	7.3 (4.1)	24.0 (11.3)	17.9 (9.9)	23.5 (10.9)	0.001*	0.887	0.340	0.001
Phonological awareness (syllables)	11.6 (5.5)	12.5 (5.5)	17.6 (2.3)	17.9 (2.1)	0.60	0.001*	0.351	0.314
Phonological awareness (phonemes)	7.5 (5.2)	11.9 (5.9)	12.3 (4.7)	16.5 (2.9)	0.017	0.004*	0.200	0.204
Phonological awareness (combined)	-0.5 (0.9)	-0.5 (1.0)	0.5 (0.6)	0.5 (0.4)	0.925	0.001*	0.338	0.295
Pseudoword repetition	36.1 (4.1)	37.6 (2.8)	39.1 (1.1)	37.1 (6.3)	0.18	0.003*	0.212	0.003
Working memory	8.5 (3.5)	8.7 (5.4)	13.2 (4.1)	11.4 (6.1)	0.862	0.001*	0.288	0.053
Morphological awareness	11.6 (5.4)	6.5 (1.9)	16.3 (1.8)	7.5 (1.3)	- <sup>a</sup>	0.001*	0.264	0.076
Syntactic awareness	7.4 (1.9)	8.4 (1.9)	8.9 (1.1)	8.8 (1.4)	0.85	0.004*	0.195	0.012
Semantic fluency	2.7 (1.3)	2.3 (1.8)	4.0 (1.7)	2.1 (1.6)	0.426	0.001*	0.466	0.001
Letter fluency	6.1 (2.1)	7.5 (2.9)	10.5 (2.7)	7.4 (3.3)	0.102	0.005*	0.170	0.005

<sup>a</sup>Due to differences between Hebrew and Russian versions of the morphological awareness tasks, statistical comparison was not performed.

\*Significant with *p* < 0.01.

awareness, pseudoword repetition, working memory, morphological and syntactic awareness, and semantic and letter fluency.

The data presented in Table 3 show that, on linguistic tasks in Hebrew, poor readers performed significantly more poorly than good readers, but the two groups were very similar in their Russian language performance; the only exception was phonological awareness (both syllable deletion and phoneme deletion tasks). These results indicate that poor readers suffered from a specific metalinguistic (i.e., phonological awareness) deficit that was apparent in both languages.

As regards the *within*-group comparisons, both poor readers and good readers demonstrated a similar pattern of relationships in their performance in the two languages. There were, however, certain differences between the two groups: Good readers performed significantly better on the fluency test in Hebrew than in Russian, while the poor readers demonstrated significantly lower performance on the Hebrew than on the Russian version of the vocabulary measure (PPVT).

In order to examine the significance of the difference between phonological awareness (a metalinguistic ability) and the other linguistic variables in Russian, a repeated measures analysis of variance was carried out in which the *difference* between a given pair of variables (for example, phonological awareness versus pseudoword repetition) was tested using a planned (difference) contrast. To this end, a new composite measure of phonological awareness in Russian was created by averaging standardized scores on the syllable deletion and phoneme deletion tasks. Table 4 displays the results for the pairwise comparisons between the composite measure of phonological awareness and each of the seven language measures.

These data show that there were significant differences between phonological awareness and most of the linguistic measures. Phonological awareness skills were significantly lower than most other Russian oral language skills. Even in the case of working memory and morphological awareness, the differences were almost significant. These findings confirm the previous suggestion that the deficit in phonological awareness among poor readers is relatively independent of linguistic abilities. That is, poor readers are characterized by a marked phonological awareness deficit in both languages but not by L1 language impairment. More generally, poor readers compared to good readers demonstrated substantial linguistic weaknesses in their second language of Hebrew.

## Discussion

The aim of the present study was to investigate factors expected to influence the acquisition of reading in L2 Hebrew by native Russian-speaking

Table 4. Differences between phonological awareness and linguistic performance in Russian.

	Vocabulary	Pseudoword repetition	Working memory	Morphological awareness	Syntactic awareness	Semantic fluency	Letter fluency
Phonological awareness (combined)	$F(1,38) = 6.74$ $p = 0.006$	$F(1,38) = 8.47$ $p = 0.003$	$F(1,38) = 2.53$ $p = 0.06$	$F(1,38) = 2.12$ $p = 0.07$	$F(1,38) = 5.44$ $p = 0.01$	$F(1,38) = 8.30$ $p = 0.003$	$F(1,38) = 16.38$ $p = 0.001$

\* 1-tailed.

children. Three hypotheses regarding difficulties in learning to read in L2 were proposed: (1) insufficient mastery of spoken Hebrew; (2) specific reading impairments; (3) a combination of the above factors.

There was clear-cut support for the Linguistic Threshold Hypothesis (Cummins, 1979), according to which L2 reading ability depends heavily on the level of linguistic proficiency in this language. In other words, in order to read and to comprehend written text, one must first acquire the language in its spoken modality. In our study, poor readers demonstrated significantly lower proficiency in a wide range of Hebrew (L2) linguistic skills compared to good readers. These differences, furthermore, were not attributable to differences in the number of years in the country. Poor readers, however, were characterized by low scores not only in linguistic tasks but also in phonological awareness in *both* languages.

Most of the studies that have examined the Linguistic Threshold Hypothesis (e.g., Carrell, 1991; Clarke, 1979) focused on assessment of the reading comprehension of bilingual readers; word recognition skills and more basic cognitive and metalinguistic skills required for automatic text decoding were not studied. By contrast, the present study dealt with decoding and phonological skills as well as with reading comprehension. The data obtained indicated that poor readers evinced marked weaknesses in both reading comprehension and word decoding. Furthermore, as compared with good readers, poor readers' performance on the phonological awareness measures was significantly weaker in both Hebrew and Russian. In other words, poor readers showed not only poor knowledge of spoken Hebrew, but also a low level of phonological awareness in both languages – a skill tied more closely to written than to spoken language acquisition. Our findings match those of Gottardo et al. (2001) and Comeau et al. (1999), who recently reported strong correlations between second language reading achievement and phonological awareness in both languages (L1 and L2) of bilingual students.

Accordingly, L2 reading difficulties in our sample are only partly explained by the 'Linguistic Threshold Hypothesis' (Cummins, 1979). Deficient reading comprehension seems to be caused not only by a low level of Hebrew language proficiency but also by deficient phonological awareness in poor readers. This last finding confirms the (mono-lingual) relationship between phonological awareness and early reading comprehension (Rayner et al., 2001; Shankweiler et al., 1999; Share & Leikin, 2004; Shatil & Share, 2003; Stanovich, 1988, 2000)). This hypothesis has also been supported by the results of several studies of L2 reading acquisition (Carlisle, Beeman, Hull-Davis & Sphraim, 1999; Dufva &

Voeten, 1999; Geva & Siegel, 2000; Service, 1992). For example, Carlisle et al. (1999) found that Spanish L1 phonological awareness predicted English reading comprehension in first-, second- and third-grade speakers who were becoming bilingual and biliterate in English.

As to the second possibility, namely, specific reading impairment, our data revealed no reliable language or even phonological deficit in the poor reader group. No statistically significant deficits emerged on either the pseudoword repetition task or the working memory task (in L1), although differences on the morphological task approached significance. Although it must be conceded that our sample size was not very large a similar pattern of findings was also recently reported by LaFrance and Gottardo (2003). These researchers also observed significantly impaired phonological awareness across L1 and L2 among French–English bilingual Canadians but also did not find significant deficits in other tasks of phonological processing such as rapid automatized naming and working memory. Like the poor readers in LaFrance and Gottardo, the poor readers in our study demonstrated substantially and significantly depressed scores in phonological awareness tasks in both languages. This pattern of findings highlights the need to distinguish between what might be termed “basic” phonological processing abilities that are intrinsic to spoken language development as opposed to the literacy-related metalinguistic ability required to manipulate meaningless phonological segments of speech – phonological awareness. The former can be regarded as a truly *linguistic* competence – one that is not primarily dependent on literacy acquisition, whereas the latter is best conceived as a *metalinguistic* skill closely tied to alphabetic literacy development. Several lines of empirical evidence (see, for reviews, Share, 1995; Ziegler & Goswami, in press) support this distinction, including differences in age of onset, developmental trajectory, differential effects of schooling and instruction, and the extent to which acquisition is universal both within and across cultures. The apparent dissociation observed in the present data between linguistic (working memory and pseudoword repetition tasks) and metalinguistic (phonological awareness) phonological abilities was confirmed statistically in the analyses reported in Table 4. Our data, therefore, would seem to support a *metalinguistic* (i.e., meta-phonological) deficit model rather than a specific *linguistic* deficit model.

In conclusion, it may be suggested that the difficulties of struggling Russian-speaking readers in learning to read in Hebrew can be accounted for by two interrelated factors: poor L2 Hebrew language proficiency and a highly specific literacy-related metalinguistic (phonological awareness) deficit.

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