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Dyslexia From a Cross-Linguistic and Cross-Cultural Perspective: The Case of Russian and Russia

Aleksandr N. Kornev
St. Petersburg University, Russia

Natalia Rakhlin
Yale University, USA

Elena L. Grigorenko*
Yale University, USA
Moscow State University, Russia

An important goal of research on specific learning disorders (such as dyslexia, or specific reading disability, or dysgraphia, or specific writing disorder) is to elucidate the universal characteristics and cross-linguistic and cross-cultural differences of literacy acquisition and disability. However, despite the acknowledged necessity of broadening the scope of reading research to include typologically diverse languages, the bulk of reading research has focused on a small group of closely related languages. This paper reviews the characteristics of the Russian language and orthographic system that are relevant to literacy acquisition, approaches to literacy instruction, and dyslexia in Russia, historically and at present, and discusses the potential contributions of Russian language research to the field of reading acquisition and reading disability.

Although the last two decades have produced impressive advances in the field of reading acquisition and specific reading disability (SRD or dyslexia), many important key questions remain unresolved. Despite a consensus recognizing the neurobiological nature and genetic origin of SRD, the precise core neurological and cognitive deficits remain a subject of controversy. Identification of susceptibility genes have been complicated by the heterogeneity of the phenotype and its multifactorial etiology. Among debated issues are the role of the discrepancy between reading ability and IQ in defining SRD, the relationship between reading and spelling deficits in SRD and between written and spoken language difficulties in children with SRD, as well as the effect of differing orthographies and approaches to reading instruction that exist in different cultures on the different rates of SRD reported across cultures.

Amidst the continuing debate on many issues of theoretical importance, however, a number of points have been established. Thus, it is now widely accepted that SRD involves a deficit in the representation and/or processing of speech sounds (Paulesu et al., 2001; Snowling, 1998). The on-going debate concerns whether the phonological deficit alone can account for the heterogeneous phenotype or whether additional deficits underlie difficulties in SRD, such as visual (Livingstone, Rosen, Drislane, & Galaburda, 1991; Spinelli, De Luca, Judica, & Zoccolotti, 2002); automaticity, as posited by the cerebellar theory (Nicolson, Fawcett, & Dean, 2001); or broader deficits, as posited by the magnocellular theory (Stein, Talcott, & Witton, 2001).

*Please send correspondence to: Elena L. Grigorenko, Yale University, Child Study Center, 230 South Frontage Road, New Haven, CT 06519

Second, the componential approach to reading recognizes that reading involves multiple psychological processes and skills, such as phonemic awareness, letter knowledge, phonological coding, orthographic skills, automaticity in processing letter sequences, lexical access, memory—all of which exhibit individual differences and may potentially be a source of differences between those who master literacy skills successfully and those who do not. Third, for languages with alphabetic scripts, it has been determined that the degree to which the orthography approaches or deviates from a 1-to-1 grapheme-phoneme correspondence affects the development of word reading accuracy (Goswami, 2002). Finally, recent studies addressing reading disability in languages other than English have shown that despite the differences in the orthographic systems across languages, reading acquisition follows a certain universal developmental trajectory and that language disability shows certain common characteristics, namely a deficit in the representation and processing of speech sounds and the lack of the ability to automatize orthographic sequencing (Grigorenko, 2001; Ziegler, Perry, Ma-Wyatt, Ladner, & Schulte-Korne, 2003).

An important goal remains not only to elucidate more fully the universal characteristics of literacy acquisition and disability, but also to understand how language-specific properties found in typologically different languages (along with different approaches used by different cultures to address literacy acquisition and reading disability) affect the differences in prevalence and manifestation of reading disability found across cultures. Despite the acknowledged necessity to broaden the scope of reading research to include typologically diverse languages, the bulk of reading research has focused on a small group of closely related European languages (Germanic and Romance, with a few exceptions). One language that has not been widely studied with respect to SRD is Russian. This paper summarizes the characteristics of the Russian language and orthographic system that are relevant to literacy acquisition (including approaches to literacy instruction and SRD in Russia) and reviews the potential contributions of Russian language research to the field of reading acquisition and reading disability.

Russian Language and Alphabet: Demographic and Historical Background

The Russian Federation (hereafter, Russia), with a territory of 17,075,400 square kilometers (6,592,800 sq mi) covering 1/9 of the Earth's land mass, and a population of 142 million people is the largest and the ninth most populous nation in the world. Russia's landmass spreads across 11 time zones and stretches almost half way around the world connecting two continents, Europe and Asia. Partly because of the large land mass and the size of the population of Russia, and partly because of the country's history and its past expansion policies, Russian is one of the world's most commonly spoken languages.

Ethnologue (http://www.ethnologue.com) lists Russian as the 8th most widely spoken language in the world. It is one of the 6 official languages (along with Arabic, Chinese, English, French, and Spanish) of the United Nations (UN). Russian is also considered the most geographically dispersed language of Eurasia. Outside of the Russian Federation, it is spoken primarily in the former Soviet republics, but is also used by communities of Russian expatriates throughout the world. It is estimated that an additional 120,000,000 Russian speakers reside outside of Russia.

The population of Russia is highly diverse, encompassing Russia's 160 ethnic groups, whose people speak some 100 languages belonging to diverse language families, some with long traditions of literacy and some with no writing systems of their own. The Russian Constitution gives its 21 autonomous republics the right to institute their native language co-officially next to Russian, even though as of November 2002, all official languages within the Russian Federation are required by law to use the Cyrillic alphabet. For example, in the Republic of Dagestan, children are taught using 9 local languages, newspapers are published in 13 languages, and TV channels broadcast in 11 languages. Given this high degree of linguistic diversity, it is important to maintain a common language, and this role is fulfilled by Russian, the official state language of the Russian Federation. The 2002 Census data indicated that the overwhelming majority of the population of Russia (98.2%) spoke and read Russian (although only 79.8% of the population were recorded as ethnically Russian). Thus, Russian is the language of cross-cultural communication and literacy in Russia.

Russian belongs to the Indo-European language family and is one of the members of the East Slavic languages (along with Belarusian, Ukrainian, and Rusyn). Russian is an example of a fairly young language (the predecessor of Russian and other related Slavic languages was in common use by the 5th century AD, when the Common Slavonic speaking people separated into Western, Eastern and Southern groups with the Eastern Slavs settling in the territory of the present-day Ukraine). However, first reliable historical information concerning the East Slavs dates from the 9th century because of the lack of earlier written records (Kiparsky, 1979).

The first Slavic writing system is credited to two Slavic-speaking missionaries from Salonica (now Thessaloniki), brothers St. Cyril and St. Methodius, who in the year 863 were sent by the Byzantine emperor Michael III to Moravia (now part of the Czech republic) to translate the Gospels into Slavic and develop a writing system for it. The written language that developed as the result became known as Old Church Slavonic because it was different from any of the Slavic vernacular languages used at the time and was used exclusively for translating liturgical texts and conducting sermons. The alphabet was based on the Greek alphabet, but new letters were invented for those vowels that did not exist in Greek. The original alphabet became later known among Slavic scholars as the Glagolitic script. Cyrillic alphabet was the second Slavic alphabet most likely developed by the disciples of Cyril and Methodius in the 10th century. It was also based on the Greek alphabet and most likely adopted the letters for the Slavic-specific sounds from the Glagolitic script (Schenker, 1996).

The Old Cyrillic alphabet contained 44 letters, many of which were also used as numerals in the Greek tradition. The alphabet was inherited by the Eastern Slavs and became the script used by Russian. However, since it was developed for a different language, it contained multiple redundant letters and had to be reformed, first by Peter the Great in 1708-1710, and then again in 1918, when redundant letters were eliminated bringing the number of letters to 33 (including 2 auxiliary signs) (Cubberley, 2002). The orthographic reform of 1918 coincided with the time of a great social upheaval in Russian history following the Bolshevik revolution of 1917 and the subsequent civil war; consequently, the orthography reform arguably was not complete. Debate about the necessity of further reform has continued to the present time, with proponents arguing that Russian orthography needs to be further sim-

plified and regularized to make it more accessible for the masses, while opponents predictably call the attempts to reform the orthography an "assault on the Russian language." Many educators acknowledge that the time allocated to the study of Russian in secondary schools is spent disproportionately on learning the rules of spelling and memorizing "all the exceptions, justified illogical details, variants and intricate traps, which strongly smell of 'medieval scholastics'" (Klein, 1964, p.54).

Despite the intricacies of Russian spelling rules, the country has one of the highest adult literacy rates in the world, estimated by the 2009 UN Human Development Report at 99.4%, which places Russia behind the UK (99.9%), but ahead of the US (97%). The high literacy rate reflects the universal access to free public education and literacy instruction. A substantial portion of children in Russia, however, experience difficulties in literacy acquisition. Thus, among school-aged children, the rate of SRD is estimated at 5-10% (Kornev, 2007; Zavadenko & Rumjantseva, 2008) depending on how it is defined. One striking observation that has been made is the marked difference in the ease of acquisition between reading and spelling. It has been reported that difficulties in spelling occur twice as much as syllable blending problems in reading (Kornev, 1995, 2003). To understand the reasons for this discrepancy, we will review the pedagogical approach to teaching reading and spelling in Russian schools and the properties of the Russian orthography and spoken language that affect the acquisition of the two processes.

Russian Orthography and Literacy Acquisition in the Context of Typical Development

Stages of Reading Acquisition in Russian

In Russian secondary schools, spelling skills are part of the curriculum for 9 years out of the total 11 years of schooling, whereas it is assumed that the basic skills of reading are mastered within the first 4-5 years of formal schooling. One major reason that reading acquisition is accomplished in a much shorter period than spelling is the relative (although not absolute) transparency of Russian orthography in the direction from letters to sounds, but not in the inverse direction: sound to letters.

The majority of letter-sound correspondence rules are governed by the phonological principle: each letter consistently and uniquely corresponds to one sound regardless of its context (its position in the word with regard to other letters, sounds or morphemes) with only some deviations from this principle discussed below. However, unlike languages with the most transparent orthographies, in Russian there are certain context-dependent letter-sound correspondence rules.

One group of words that involves such rules are the words with the 2 auxiliary signs, the "soft" and "hard" signs, and words that contain the so-called "jotated vowels" е (je), я (ja), ю (ju), and ё (jo) (see Appendix). These vowels, when they occur word-initially or after another vowel, correspond to a syllable containing a glide [j] plus a vowel quality ([e], [a], [u] and [o] respectively). For example, letter я in the word <яблоко> (я+bloko, «apple») corresponds to the sound [ja]. However, when these vowels occur word-medially after consonants, they mark palatalization of the preceding consonant plus the vowel quality. For example, in the word <мята>, the

syllable containing the letter я (<мя>) is pronounced [m^{y}a] (without the glide, but with a palatalized or «soft» consonant).

Furthermore, if there is a morphological boundary between the consonant and the jotated vowel (i.e. between a prefix and the root), a «soft» or a «hard» sign is inserted between them and the vowel is pronounced as jotated (e.g. as [ja] rather than [a]), while the consonant is still palatalized. For example, <пью> [p^{y}ju], <платье> [plat^{y}je], <съезд> [s^{y}je:zd]. Violating this rule can lead to mistaking one word for another. For example, <сел> [s^{y}el] («sat down») и <съел> [s^{y}jel] («ate») differ only in the presence of the glide indicated by the «hard sign» ъ in the second word.

In addition to the orthographic rules involving the jotated vowels and the auxiliary signs, there are a small number of other context-dependent grapheme-phoneme correspondence rules, which are lexically-based, and each affects only a small set of typically high frequency lexical items (see the Appendix). The fact that Russian letter-sound correspondences involve only a small number of context-dependent rules, most of which are regular (do not allow many exceptions) facilitates reading acquisition. Furthermore, the Russian approach to reading pedagogy helps accommodate for these complexities by using a syllable-based approach to reading typically taught during the first two years of schooling (Egorov, 2006; Kornev, 1995, 2003).

Fundamentally, teaching reading in Russian is based on the analytic-synthetic method. This means that along with teaching letter names, children are taught (1) to parse spoken words into syllables and sounds (carry out phonetic segmentation of spoken words and develop phoneme awareness), then (2) to learn the letter-sound correspondences, and only after that (3) to learn how to blend letter-sounds into syllables (use letters to synthesize syllables) and words (based on their sound representation). According to this approach, a typical Russian child, while acquiring the skills of reading and spelling, needs to master the following steps.

First, children need to master the so-called syllable reading; i.e., skills of blending sounds into a syllable. Then they are taught syllable-based construction and deconstruction of words. Only after this skill is mastered, whole-word reading is taught. It has been stated (Zinder, 1987, 2007) that letter knowledge and mastering the syllable-based principle of reading in Russian are sufficient enough for decoding the majority of Russian words. Some children have difficulties with this, although most children master these skills in their first (commonly) and second (rarely) years of formal schooling.

One factor that complicates this phase of reading mastery is the syllabic complexity of Russian words. Syllables in Russian often contain complex onsets and codas creating consonant clusters (see Appendix). As has been argued by Goswami (2002), for children learning to read consistent alphabetic orthographies with an open (consonant-vowel or CV) syllable structure, the letter-sound mapping problem is the most straightforward. In such languages, onset-rime segmentation, which children possess prior to literacy (Bradley & Bryant, 1983; Wimmer, Mayringer, & Landerl, 2000) is equivalent to phonemic segmentation for many words. Developing phoneme awareness for a typically developing child at an early stage of learning an orthography, where one letter consistently maps to one phoneme, is quite simple because many of the phonemes are represented in his or her spoken lexicon since they are onsets and rimes (e.g., for a word like "casa," the onset-rimes are [c] [A] [s] [A]

and so are the phonemes) (Goswami, 2002). In contrast, for children learning to read alphabetic orthographies with more complex syllable structures such as Russian, the mapping problem is more difficult because onset-rime segmentation is not equivalent to phonemic segmentation for most words, as many words either have codas, often complex (e.g., <мост>, *most* - «bridge»), or complex onsets (e.g. <брат>, *brat* - «brother»; <взгляд>, *vzglyad* – «look»).

Furthermore, Russian consonant clusters may violate the Sonority Sequencing Principle (SSP), which requires segments within a syllable to increase in sonority, reaching its peak at the nucleus (the vowel) and then to decrease it so that the first segment of the onset and the last segment of the coda are the least sonorant. In Russian, clusters like those in the words <встретить> ([fstr^{y}et^{y}it^{y}] – «to meet») or <толстый> ([tolstyj] – «thick»), in which this principle is violated by more sonorant segments preceding less sonorant ones in the onset (fricatives preceding stops as in the cluster [fst] or a liquid preceding a fricative and stop as in [lst]) are quite common. The SSP has its roots in the human perceptual system and its violations may be a complicating factor for the acquisition of skills related to phoneme awareness and syllable construction and deconstruction in Russian. The existence of context-dependent letter-sound correspondence rules further complicates the task. In syllables with onsets (or monosyllabic words) children have to recognize the letter of the vowel first and then the letter of the preceding consonant, taking into account the positional influence of the vowels on the preceding consonant (as discussed above).

After mastering syllable reading and having developed a sufficient degree of phonemic awareness, at the second stage of literacy development, the child needs to master the skills of recoding (assembling phonological forms of whole words from the orthographic pieces) and word recognition (linking the assembled phonological forms with their lexical meaning). Given that the overwhelming majority of Russian words have multiple syllables, accurate whole-word recognition is possible only when syllable-based reading becomes fluent and automatized. Thus, assuming that the principles of phonological coding and sound structure modeling are mastered during one or (at most) the first two years of formal schooling, the major emphasis in subsequent 2-3 grades is placed on the development of fluency in reading (i.e., the skill that allows the seamless, accurate, and quick blending of syllables into words). Acquisition of fluency is closely monitored by educators by checking reading speed. But this indicator sometimes is not informative enough. It is relevant to recoding processes (sounding out the word), but not to word recognition processes. While the speed of reading becomes the main indicator of the degree of reading mastery in Russia after the first year of formal schooling, it misses the problem that some children may read fast, but mechanically, without comprehension.

Research has shown that while phonemic awareness is important during the initial stages of reading acquisition when decoding skills are acquired, morphological awareness (MA) is an important predictor of reading comprehension (Müller & Brady, 2001) (for a review of the literature on the role of morphological awareness (MA) in literacy see Kuo & Andersen, 2006). Russian is a highly morphologically complex language, characterized by complex patterns of derivational and inflectional morphology, with conjugation and declension patterns that involve morphemic fusion, morphological syncretism and shifting stress patterns (Wade, 1992), as well as

phonological alternations and deletions (Halle, 1959). The complex multidimensional nature of Russian morphology with its multiple sources of irregularity and inconsistency, may complicate the development of morphological awareness and make word recognition more challenging (see Appendix). In Russian schools, children have to be taught to segment word stems from inflections, as well as word roots from suffixes and prefixes. How this irregularity and inconsistency affects the development of MA, whether morphological fusion and the various morpho-phonological and phonological processes that come with it hamper children's ability to develop conscious awareness of morphological structure of words and what effect it has on the reading ability and disability are an important empirical question that has not been sufficiently addressed.

The third (and most complex) task of a literacy learner of Russian is to learn the rules of spelling. As mentioned in the previous section, among Russian-speaking children, difficulties in writing occur twice as much as syllable blending problems in reading (Kornev, 1995, 2003). Such disproportionate distribution of difficulties in mastering reading vs. spelling is a phenomenon observed cross-linguistically (Caravolas & Volın, 2001). It is an important theoretical question whether this incongruence stems from the distinct linguistic/orthographic or psychological mechanisms involved in each respective skill.

Why is Spelling More Difficult?

As was discussed above, context-dependent letter-sound correspondence rules for reading in Russian are few and easy to master. The majority of letter-sound correspondence rules are governed by the phonological principle: each corresponds to 1 and only 1 sound regardless of its context (orthographic, phonological or morphological), with the exception of the rules indicating palatalization of consonants with the following vowel and glide-insertion, as discussed in the previous section. Yet, in the inverse direction from sound to letters, the orthographic rules for a great many words in Russian are driven by a multiplicity of orthographic, morphological and syllabic rules, which are both complex and inconsistent (have many exceptions). It is the acquisition of these rules that takes time and generates the tremendous amount of individual differences in writing acquisition among Russian-speakers.

A full analysis of the sources of this complexity is beyond the scope of this paper. However, three main principles leading to the complexity of spelling acquisition are worth noting; namely, (1) the complexity of the phonological analysis necessary for correctly mapping underlying (phonological) rather than surface (phonetic) forms with the corresponding orthographic forms; (2) a related principle of morphological constancy, which keeps spellings of morphologically related albeit phonetically distinct forms constant; and (3) a grammatical principle, which codifies grammatical differences between phonologically similar but grammatically distinct words with distinct spellings.

One major source of considerable difficulty in mastering spelling across languages, and in Russian in particular, is that in order to develop good phonology-to-orthography mapping skills (but not vice versa – from orthography to phonology), one must develop a good conscious understanding of the sound pattern of the spoken language in which one is learning to read, a highly complex domain for any natural

language. In any language, there are context-dependent phonological processes that alter underlying phonemic representations of words by creating allophones, context-dependent variants of phonemes. Often these processes neutralize contrasts between minimally distinct phonemes leading to segments that are phonemically distinct in the underlying representation of the word becoming non-distinct in its surface form (e.g. writer and rider in colloquial American English). Spelling in such cases reflects the underlying phonemic form, and not the way the word is pronounced.

In Russian, there are multiple such processes (see Appendix). One major phonological process that complicates spelling acquisition involves the process of vowel reduction in unstressed positions neutralizing contrasts between vowels. This process is complicated by the fact that vowel reduction follows a different pattern after palatalized versus non-palatalized consonants and that the degree of reduction depends on the proximity of the unstressed vowel to the stressed syllable and whether it follows or precedes it. Thus, after palatalized consonants, vowels /a/, /e/, /o/, /i/ all surface as [i].[1] For example, the word <леса> /lʸesá/ ("woods") is pronounced as [lʸisá] – homophonous to the word <лиса> /lʸisá/ ("fox"), which has an invariant underlying/surface form. Since the spelling in such cases reflects the underlying phonological form of each word rather than their surface form, the child must learn that the former is spelled with the vowel letter <e> (<леса>), while the latter with the letter <i> (<лиса>) despite the fact that both are pronounced with the same vowel sound [i]. Other phonological processes that have the same effect of neutralizing phonemic contrasts and creating surface forms distinct from the underlying forms and with spelling discrepant from pronunciation in Russian are final devoicing of voiced obstruents and regressive voicing assimilation in obstruent clusters (see Appendix for examples).

Although at the age of literacy acquisition (6 and above), all typically developing children have a tacit knowledge of the phonological processes operating in their native language, in order to learn to spell, they must develop conscious knowledge of some of these processes relevant to the rules of orthography (e.g., to be able to represent orthographically the underlying phonological form of words and not the surface phonetic form). This skill is a much more complex form of phonemic awareness compared to what is typically discussed in the literature on reading acquisition, where the child simply needs to become consciously aware of the surface (phonetic) composition of words.

In order to appreciate the complexity of this task, it is enough to realize that a whole subfield of linguistics is dedicated to discovering and characterizing phonological processes operating in languages and that this task is far from trivial. Thus, in the field of Russian phonology, a consensus has not been reached among linguists even on the exact number of phonemes in the phonological inventory of Russian. There are at least two opposing views represented by the Moscow and St. Petersburg schools of phonology on what sounds in Russian should be considered phonemi-

1 < > indicates the spelled form, [ ] indicates the phonetic form (the way the word is pronounced), / / indicates the phonological form (the underlying form before the changes induced by phonological processes, such as final consonant devoicing, etc., and italics indicate Russian spelling transliterated into English

cally distinct as opposed to being context-determined allophonic variants. This phenomenon explains why development of orthographic skills is not an effortless or spontaneous process and why children have to be extensively coached to master it. In Russian schools, for example, children are taught various techniques to probe the underlying representations of words to determine their correct spelling. Thus, with respect to figuring out the correct spelling for unstressed vowels, children are taught to find a cognate word in which the vowel corresponding to the reduced vowel in question would be stressed (i.e. where it occurs in the so-called "strong position"), which would indicate its correct spelling For example, for the word *lʸesa* ("woods", pronounced as [lʸisá]) from the example above, the child would be able to use the singular form of the word *lʸes* ("forest"), in which the vowel is clearly pronounced as [e]. This indicates that the correct spelling for the word in question is <e> and not <i>. In contrast, the spelling of the word *lʸisa* ("fox", pronounced the same way) can be checked by using the word *lʸísij* (the adjectival form of "fox", where the vowel in question is stressed and can be determined to be [i]).

The phenomenon of invariant spelling of phonetically distinct but morphologically related words is due to the principle of morphological constancy, which many languages adhere to in their orthography. According to this principle, each morpheme has one and only one written representation even if its pronunciation changes as a result of derivation or inflection, which often create morpho-phonemic variation (e.g. in English electric, electricity, electrician). Homophones, on the other hand, are represented by different spellings (e.g. English two and too). This principle, however, is not applied consistently. Thus, in Russian, in contrast to the cases in which the spelling preserves the underlying phonological form of two morphologically related words with two distinct surface forms, (e.g., for the singular and plural forms of the word "wood"), as discussed above, as discussed above, there are cases in which morphologically-conditioned changes in the sound form of a word are recorded in spelling: e.g. *pisátʸ* ("to write", inf.) vs. *pishu* ("write"-1st person sing), *drug* ("friend") – *druzʸja* ("friends"). Here we see that there is an alternation in the shape of the root between the infinitival (<pis->) and 1st person singular (<pish->) forms, a change recorded in spelling.

It is easy to see that the phonetic and morphological principles of spelling are in conflict with each other, with the phonetically organized parts of the orthography serving the interests of the child at the beginning stages of literacy acquisition by aiding decoding, while the morphologically organized parts facilitate the process of word recognition at more advanced stages of literacy. Maximizing the adherence to the phonetic principle would make word recognition harder by eliminating spelling differences between homophones (e.g. in Russian the words "fox" and "woods" would have identical spelling) creating widespread ambiguity. Relying on the morphological principle and codifying morphological units in spelling, on the other hand, creates a very challenging problem for mastering spelling especially if the morphological analysis itself is complex, as it is in Russian (see Appendix).

In addition to the morphological constancy principle, another source of spelling complexity in Russian orthography is the so-called grammatical principle, a tendency to use distinct spellings to mark grammatical distinctions between similar sounding words. Thus, phonetically similar adjectives and cognate past participles

would differ in their spelling to reflect their grammatical difference; likewise, nouns that end in a sibilant (sounds like [ch], [shch], [zh], etc.) are spelled with a "soft" sign if they are feminine and without the soft sign of they are masculine; e.g. <дочь> (*doch*, "daughter, fem."), <меч> (*mech*, "sword, masc."), etc. Some of these rules are historical, some are based on very subtle, and not necessarily universal, distinctions in pronunciation, and some appear arbitrary.

The modern Russian spelling system was developed in 1880s by J. Grot, a philologist at the University of Helsinki, who "with German accuracy and refined precision collected and systematized a great number of deviations, variants and exceptions to the spelling norms..." (Klein, 1964, p. 54). His work *Русское Правописание* (Russian Orthography; Grot, 1878, 1885) was considered the standard for Russian spelling and punctuation until the reform of 1918, although his theoretical justifications for Russian orthography rules remain mostly unchanged to this day. The fact that spelling systems are not just outcomes of spontaneous historical developments in spoken and written language, but result from efforts of individual scholars and in some cases government decrees, is another source of difficulty of spelling acquisition because it brings a certain degree of arbitrariness, individual biases or perceptions.

To summarize, there are significant differences between the complexity involved in acquiring reading vs. spelling skills in Russian. They stem primarily from the differences in complexity of the linguistic and consequently psychological processes involved in the development of reading and spelling skills. Russian elementary education has developed an effective methodology of teaching reading skills. The evidence of an effective approach to teaching reading in primary grades is that according to the results of the Progress in International Reading Literacy Study in Primary School Countries (PIRLS-2006) that compared 4th grade students in 40 countries, Russia finished in the top three, sharing the first place with Hong Kong and Singapore.

Learning to Comprehend in Russian

In contrast to the successful approach to teaching reading skills at the level of elementary education, reading competence of Russian high school students is lagging behind compared to their international peers. Thus, according to the results from the Program for International Student Assessment (PISA), a worldwide evaluation of 15-year-old school children's scholastic performance, performed first in 2000, on the measures of reading competence, Russia ranked 29th among 32 countries; in 2006 it ranked 40th among 57 participating countries. Particularly challenging were the assignments that required the students to use reading comprehension in order to find a solution to a practical problem. Especially difficult were such texts as newspaper reports or analytical articles with graphs, etc.

One reason for such poor performance may be the approach to teaching reading comprehension skills adopted in Russian schools. The main medium used for teaching reading comprehension and text analysis is fiction. The criteria used to assess comprehension are the ability of a student to retell the content of the text, answer questions related to the text, to compose a synopsis of the text or an essay based on it. Students are not taught to read with a goal of problem solving.

However, there may be another, broader reason for the poor reading performance among teenagers related to the societal changes that took place in Russia dur-

ing the post-Soviet period. The social perturbations of the 1990s brought with them major changes in the educational system. First, what previously was a tightly controlled, centrally monitored and homogeneous system of education with the whole country using the same set of textbooks and, quite literally, going through the same page of these textbooks on the same day, has diversified into a great many programs that are both less controlled and supervised and more heterogeneous. An unintended consequence of this democratization of the educational system was a deterioration of the overall quality control of the Russian educational system—old control mechanisms had been dismissed and new ones are still just being developed.

Second, many new experimental textbooks have appeared. Previously, any textbook that was to be used country-wide needed to go through multiple expert control steps; now there are literally dozens and, perhaps, hundreds of textbooks for different subjects. What is used in any particular classroom is only loosely controlled and the decision-making process for adapting textbooks is not well regulated. As a result, tools of known and tested quality have been substituted with tools of unknown quality and effectiveness. Whether the new modes of education and new textbooks are better or worse than those of the old Russian education system is yet to be determined.

Unfortunately, there have not been many empirical studies investigating the impact of these innovations on the levels of literacy in Russia. What became obvious, however, is the lowered general level of engagement with reading and the quality of writing and written expression reflected by the indicators of the recently instituted Unified State Exam (analogous to the SAT) and the comments of educators on the levels of functioning of their students (Grigorenko, Jarvin, Niu, & Preiss, 2008). Sociological studies also showed that compared to the 70s, the percent of the population who report reading regularly has markedly decreased. This phenomenon is observed both among children and adults. In addition, among school-aged children, there exists a gap between the adequately formed reading skills and low interest in reading. Population studies undertaken in 2007 have shown that among second to sixth graders, reading comprehension has measurably worsened, and writing literacy has deteriorated. Thus, cultural and societal changes have a direct effect on literacy, particularly on the level of reading and writing competence among teenagers and adults.

Scientific Study of SRD in Russia: Historical Context

Although the scientific study of reading in Russia has a long history, contemporary research, especially empirical quantitative data and experimental work involving new technology, such as fMRI or ERP, is scarce. Since the 1930s, when the first case studies of reading disability were described, only a few dozen articles addressing writing disorder and no more than 30 papers on reading disability have been published in Russia (Kornev & Chirkina, 2005). Interestingly, because of the country's isolation from the West during the Soviet period, the field of reading disability developed in isolation from the Western schools and consequently produced certain distinct conclusions and insights regarding the nature of SRD and its cognitive underpinnings.

The first descriptions of serious deficiencies in the acquisition of reading and writing in the USSR appeared in the literature in the 1930s. Tkachev (1933) described 9 cases of what he referred to as "inherited alexia and agraphia" in children with normal intelligence. Five of these children had relatives with similar deficiencies.

Three of these children could not acquire letter knowledge; the other 6 read letter-by-letter. Syllable construction was not mastered by any of these children. Mnukhin (1934) presented three boys with similar symptoms; they all read letter-by-letter. Describing the psychological texture of the deficits in these three boys, the author pointed out that all three of them had difficulty with serial ordering processes (i.e., successive processing—the ability to name letters, digits, seasons, and week days in a proper sequence) and demonstrated considerable weaknesses when asked to count numbers of syllables, construct a word of letters, or insert missing letters. Mnukhin interpreted these cases as manifestations of developmental selective partial cognitive impairment resulting from minimal brain damage or minimal brain dysfunction. Both authors referred to these cases as cases of alexia and agraphia, connecting the observed presentations to what was known in adults as deterioration in reading and writing related to cerebral stroke, but stressing the absence of the known trauma. They emphasized the developmental character of these syndromes.

Due to various societal forces that operated in the USSR from the 1930s to the 1970s, there was a gap in research on developmental dyslexia. The next publications, carried out in the clinical tradition, appeared only forty years after. In the 1970s and 1980s, there were studies of reading and writing disability in children with mental retardation (MR) and with what in the Soviet literature was called "delayed psychological development" (задержки психического развития) hereafter, DPD. According to the view maintained in this literature, dyslexia as a concomitant diagnosis can be legitimately applied to children with certain clinical manifestations of MR. In these cases, there is evidence of selective, rather than generalized, cognitive impairments. Along with certain spared cognitive functions, such children have clear delays in certain other areas. Such children frequently exhibit good adaptive skills, but have academic difficulties (Isaev, 1982; Isaev, Efremov, & Pukshanskaia, 1974; Isaev, Karpova, & Karpov, 1976).

The second group of children studied at that period, namely children with DPD, was characterized by certain partially impaired cognitive functions (e.g. sequencing, speech, or visuo-spatial deficits), but without the symptoms of MR. It was revealed that in addition to the symptoms of partial cognitive impairments, children with DPD exhibit delays in emotional-volitional development and deficits in executive functioning (Lebedinskaia, 1982; Pevzner, 1966; Sukhareva, 1965). According to the ICD-9, used in Russia until 1992, within the DPD group, a subgroup of children classified as Specific Developmental Disorder (SDD) was identified. Children with SRD were included in this category. These children have IQ in the 80-94 range on the WISC (Zaidel, 1978). Up to 1973, the evaluation of mental development was based on psychiatric or psychological evaluation, not on psychometric measures (there are historical reasons for this, such as the prohibition of psychological testing in Russia; for more detail, see Grigorenko & Kornilova, 1997).

The diagnosis of DPD is still widely used in today's Russia, and difficulties in reading acquisition are typically referred to as a syndrome within the manifestation of DPD, but in a specific form. Criteria of such diagnosis resemble the demands of the ICD-10, which include an IQ-based discrepancy criterion. Of note is that such a diagnosis is established in Russia by psychologists or speech pathologists regardless of

the level of IQ (i.e., the discrepancy criterion has not been used/is not used in Russia, with rare exceptions such as Kornev, 1995, 2003), as long as it falls within the range of DPD (i.e., the standard score of 80-95). However, after 1973 and especially in the last 20 years with the development of the psychological testing industry in Russia, more attention has been paid to the inclusion of psychometric information into diagnostic procedures (e.g., the usage of the data from the Russian adaptation of the WISC, Panasiuk, 1973). Thus, in Russia, the descriptors of difficulties in reading acquisition are used with regard to children with DPD or children with mild MR. Of note also is the lack of correspondence between Russian and US standards in interpreting a threshold for MR using the WISC-generated IQ. As a result of the most recent standardization (in 1973), the range of IQ for DPD is established as 80-95 and for MR as 50-79.

Even during the years when the psychometric study of SRD was largely interrupted for ideological and historical reasons, studying typical and atypical reading acquisition continued in the fields of education and related fields, primarily within what in Russia are called defectology and logopedia, two fields whose closest analogues in the West are studies of speech and language pathology and learning disabilities. Traditionally, logopedia is a domain of science and practice concerned with the physiology and pathology of the organs of speech and with the correction of speech deficiencies (e.g., stuttering and pronunciation). In Russia, however, logopedia covers both spoken and written language disorders (i.e., practitioners of logopedia, or logopeds, correct deficiencies not only in spoken, but also in written language). Defectology, on the other hand, is correctional or remedial pedagogy.

The development of this line of work was initiated by Levina, one of the students of Vygotsky. Her dissertation, titled *Нарушение чтения и письма у детей: алексия и аграфия* (Difficulties in Reading and Writing in Children: Alexia and Agraphia) formed the foundation for subsequent research and clinical practice in the USSR. The premise of this position is that difficulties in written language acquisition (i.e., reading and writing) are direct consequences of developmental speech and language disorder, in particular its phonological aspect. This view was formulated, to a certain degree, to oppose the treatment of difficulties in reading and writing through references to visual-spatial deficiencies—a position that was prevalent, at that time, in Western psychology and pedagogy (Orton, 1925; Stein & Fowler, 1981; Zangwill & Blakemore, 1972). Of note, however, is that Levina's position was not absolute—discrepant cases were noted, in which a severe deficiency in spoken language might not be associated with a severe deficiency in written language and vice versa (Levina, 1940; Spirova, 1965). Thus, in the USSR, research and practices involving difficulties in written language were directly connected to research and practice in spoken language, and both unfolded in the context of logopedia and defectology. Of note is that this work was quite productive in the 1960s–1980s, and resulted in a number of articles, books and manuals. However, the amount of research focused on reading and writing was uneven: in teaching literacy in Russian, primarily because of reasons discussed in the previous section, the major remediational accent has been placed on spelling and writing rather than on reading itself.

Reading/Writing Acquisition of Russian in the Context of Atypical Development

Typical Presentation

Educators, researchers, and clinicians in the related field of clinical psychology and speech and language pathology, distinguish the following difficulties of reading mastery in Russian children.

1. Immature reading, indicating that the child has difficulty transitioning from letter- to syllable- to word reading. In context of this difficulty, a word is read first letter-by-letter, then syllable-by-syllable, and finally, as a single word (e.g.; the word <рука> (*ruka*—"hand") is read first as р..у..к..а, then as ру..ка, and only finally as рука, as a word). This is usually accompanied by a lack of proper stress and prosody.
2. Low speed of reading, which is the consequence of immature reading.
3. Lack of accuracy during reading aloud is manifested in a variety of ways, mostly in vowel and consonant substitution and letter replacement or omission. Typically these errors are not consistent, and while reading the same sentence, the child may make different errors. For example, while reading the word <хотела> (*khotela*—"wanted" feminine), a child can generate a number of words that might or might not have meaning (e.g., ходела, хотила, ходила); similarly, while reading the word <щука> (*schuka*—"pike"), a child can read чтука or щтука, not noticing that both words are pseudo-words. Among such mistakes, vowel substitutions are more common than consonant substitutions; the replacement and omission of letters is relatively infrequent. Of interest is that a comparison of such errors in groups of children with dyslexia with their typically developing peers matched on overall level of reading mastery (i.e., 9-10 year olds vs. 7–8 year olds) did not reveal differences in the percentages of specific types of errors (Kornev, 1995). In other words, children in both groups made similar errors, but children with dyslexia made more of them.
4. Double reading and guessing is also quite common in children with dyslexia. In double reading, the child reads a word twice—first silently and then aloud. The silent reading is typically done letter-by-letter and the reading aloud, syllable-by-syllable or in whole words. Guessing is applied when the child does not recognize the word or recognizes it partially, and rather than trying to decode it (or having difficulties decoding it), just guesses, based on the context or randomly, what the word in question might be.
5. Lack of comprehension, both at the word and sentence levels, is also a sign of difficulties in reading acquisition.

Conceptualization

There are differences in both defining and explaining the etiology of atypical acquisition of reading and spelling in Russian that exist between the so-called Moscow and St. Petersburg scientific schools. As discussed above, the Moscow "logo-

pedia school" is based on interpreting reading and spelling difficulties as "two sides of one coin," recognizing them as the manifestations of the same disability, which is directly linked to the phonological impairment of spoken language (Levina, 1940; Nikashina, 1965; Spirova, 1965). According to this viewpoint, developmental speech and language disorder is the direct cause of writing and reading disorders. This theoretical position influenced the terminology used to signify such difficulties. Even today, the terminology recommended by the Russian Ministry of Education is directly related to the Moscow school position so that disorders in the West typically labeled as dyslexia and dysgraphia, are referred to as "disorders of reading and writing caused by phonetic-phonological speech impairment" ("нарушение чтения и письма, обусловленное фонетико-фонематическим недоразвитием речи"). Yet, in parallel with this official terminology, as early as in the 1960s, many authors started using the term "dyslexia." However, the usage of this term has been rather broad, with a reference to all and any difficulties in reading and reading acquisition (Liapidevskii, 1969). The current definition of dyslexia, as used in the leading Russian textbook on speech and language disorders, states that dyslexia is "a partial specific impairment of the process of reading, which is caused by the immaturity of higher mental functions and is manifested in repeated consistent errors" (Volkova, 2007). The current definition of dysgraphia refers to "a partial specific impairment of the process of writing" (Volkova, 2007).

The position of the Leningrad-St. Petersburg clinical-psychological school (Isaev, 1982; Isaev et al., 1974; Kornev, 2003) is different. This approach differentiates specific difficulties in reading from nonspecific difficulties (i.e., difficulties caused by intellectual or sensory deficiencies from those that stem from severe speech and language disability). Here, dyslexia is viewed as a manifestation of challenged cognitive development or specific delay of mental development (mental dys-ontogenesis). Thus, under this view, dyslexia is only "the tip of the iceberg," and its basis is in the atypical schedule of cognitive or mental maturation or persistent cognitive deficiency. Sometimes it is coupled with emotional immaturity and a deficit in executive functioning (Kornev, 1995, 2003). Notably, from this point of view, the issue of comorbidity is interpreted as an expected, systematic manifestation of dys-ontogenesis (Sukhareva, 1965). Followers of this scientific school view dyslexia as "a condition, manifested in the consistent, specific inability to master the skills of reading, in spite of adequate intellectual and speech and language functioning and optimal schooling, in the absence of auditory and visual deficit. The core deficit in dyslexia is seen as the inability to master sound blending and syllable decomposition and to automatize recognition of complex syllables and whole words. The source of this condition, which manifests itself in deficient reading comprehension, is the challenged neurocognitive processes that form the functional basis of reading" (Kornev, 1995, p. 31-32). Based on the research carried out within this approach, 5–6% of the Russian school-aged population of children suffer from this condition (Kornev, 1995).

Dysgraphia (the term is used in Russia to refer to the inability to spell regular words with transparent orthography) in this approach is defined as a consistent difficulty in mastering the skill of writing based on the phonological principles of spelling in spite of adequate intellectual and speech and language functioning and

optimal schooling, in the absence of auditory and visual deficit (Kornev, 1995, 2003). Dysgraphia is characterized by repeated consistent specific errors, the most frequent among which are consonant substitution, accented vowel substitution, and letter omission. The most prevalent errors are voiced–voiceless or soft-hard consonants substitutions or letters deletions.

Thus, Russian researchers working in clinical and theoretical contexts, have identified difficulties in literacy acquisition as a specific neurocognitive disorder distinct from general cognitive impairment; however, researchers working in different traditions (logopedia versus clinical-psychological traditions) developed distinct theories of the underlying cognitive mechanisms of the disorder. Typical behavioral manifestations of dyslexia and dysgraphia in Russian are well described and include difficulties with reading speed, accuracy and comprehension.

Individuals With SRD in Russia

In order to understand how well the interests of individuals with SRD and other learning disabilities are met in Russia, one has to consider the historical progression of special education in Russia. In tsarist Russia, the first specialized schools for children with special needs were established in the early 19th century. Thus, in St. Petersburg, a school for deaf children was opened in 1806, and a school for blind children in 1807. A school for children with mental retardation (intellectual disabilities) was opened in 1884 in St. Petersburg and in 1908 in Moscow. The first country-wide document legalizing the right to education for all children was issued in 1930 (Закон о Всеобуче, Education for All Act). However, this document did not take into account the special needs of disabled children. Specifically, there was no mention of any special educational resources for such children. According to this law, all children, with no regard for their ability to learn, had to be placed in regular classrooms and educated according to the standard curriculum. It was believed that anyone could be educated. This belief was manifested in popular slogans of the period, such as "There are no bad students – only bad teachers."

Paradoxically, children with intellectual and learning disabilities who couldn't cope with the regular curriculum were labeled as "uneducatable" (Malofeev, 2000). Subsequently, in 1936 a special category of schools appeared—schools for mentally retarded; these schools were referred to as auxiliary schools (вспомогательные школы). In 1956 the first school for children with speech and language disorders was opened in Leningrad. Similar schools were opened in a number of cities throughout the country (e.g., Moscow and Sverdlovsk); simultaneously, a chain of specialized kindergartens was established. Finally, in the 1970, a network of schools for children with DPD was developed. Thus, by the late 1970s, the USSR had a system of preschool- and school-aged institutions that admitted children with (1) deafness; (2) hearing impairments; (3) blindness; (4) visual problems; (5) severe speech and language disabilities; (6) severe motor development problems (e.g., cerebral palsy and scoliosis); (7) DPD; and (8) mental retardation.

In the 1990s, the system of general education was modified to introduce specialized classes for children with DPD and for children with mental retardation (MR) in regular schools. In general, the dynamics are such that a portion of the children with special needs are relocated from specialized schools into specialized classrooms

in regular schools. Comparatively speaking, the largest group of children without sensory and motor difficulties who are served in specialized schools consists of children with mental retardation (severe intellectual disabilities). Children with DPD are served primarily in regular schools, through specialized classrooms. The ratio of children with MR to children with DPD educated in specialized schools and classrooms is 1.16:1. At the same time, according to epidemiological studies, the prevalences of MR and DPD have a ratio of 1:5 (2% and 10% of children respectively for each diagnosis). Thus, in 2005, children with MR attending specialized classrooms and schools represented 1.4% of the population of Russian school children (approximately 14.5 million); in contrast, children with DPD represented only 1.2%. Thus, special education services were available to 70% of children with MR, but only to 12% for children with DPD. In other words, special education services were much more accessible to children with MR than to children with DPD.

Children with speech and language impairments are served primarily in specialized schools, but their numbers are substantially lower than either those of children with MR or children with DPD. This group represented 0.7% of the population of school children in 2005, while the epidemiological estimate for the percent of children with speech and language disorders is 7–10%. In other words, the vast majority of such children attend regular schools and do not receive special services.

In parallel with the special education system, professional help for children with special needs is available through a network of remediational institutions such as specialized centers in children's outpatient clinics (hospitals) and psychiatric clinics. These centers are typically staffed with speech and language pathologists (or as they are called in Russia, logopeds) and psychologists. During the last 20 years, there has been growth in the development of regional school-district-based centers for medical-psychological-educational and psycho-social support. At present, such centers employ a variety of personnel (e.g., social workers, psychologists, educators, physicians) who address a wide range of problems (e.g., from family functioning to gifted and talented programming) while serving children with special needs.

Typically, a child with difficulties in speech and language acquisition has access to free remediational support from the age of 2 (at entry to a nursery school or through a referral by a pediatrician). Children in all kindergartens are screened for signs of speech and language impairments, and when identified, the child and his/her family are offered an opportunity to be placed in a specialized kindergarten (free of charge).

Specialized kindergartens and specialized classes in inclusive regular kindergartens serve children with a variety of speech and language disabilities—dysarthria, developmental aphasia, dyspraxia, stuttering, and various forms of developmental language impairment. According to the regulations, if and when a child with impairments is identified, a so-called medical-psychological-pedagogical committee (MPPC) is established to formally evaluate the child, provide recommendation or comment on his/her placement, and monitor his/her progress. Such a committee typically includes a psychiatrist, a psychologist, a special educator, and a speech-language pathologist. The charge of the MPPC is to diagnose the child's clinical condition, to measure his/her aptitude, and to develop a plan for remedial treatment of the deficit. Of note here is that, traditionally, the diagnoses are made by a psychiatrist or neurol-

ogist based on a clinical evaluation coupled with (substantiated by) a psychological evaluation and observations from other professionals on the committee. For the cases of dyslexia and dysgraphia – the key person is the logoped. These observations might also include data from standardized tests. Unlike the diagnoses, the remediational plan is typically developed in collaboration with a special education professional, a psychologist and a logoped on the committee. If remediation is not accomplished during kindergarten, this committee might recommend continuing the education of the child in question in a specialized school. If the child is remediated (or remediated enough), he/she is transferred to a regular school. In this case, depending on the profile of strengths and weaknesses of the child, the committee might give a recommendation for the child to continue working with an appropriate professional (e.g., a speech-language pathologist) while in a regular school. These recommendations are often made not only in conjunction with the remediation of the existing speech and language problem, but also preventatively, to avoid the manifestation of dyslexia or dysgraphia. Yet, although there are effective models for both screening and preventive activities with regard to dyslexia and dysgraphia in Russia (Kornev, 1995, 2003), they are not systematically used or promoted. In fact, a survey of primary teachers in 2005 in Moscow indicated that only 30% of them are aware of such conditions as dyslexia.

When the child is in school, his/her progress is monitored by the teachers, school psychologists and speech-language pathologist, and school administrators. If any of these professionals has concerns about the child's development, the parents are notified, and with their permission, an evaluative process unfolds whose aim is to identify the typology and source of the difficulties and issue remediational recommendations. This process is governed by an MPPC (see above) and follows the same steps; that is, diagnosis and remediation, as outlined above. Traditionally, school referrals are made from the second grade up, to allow for school adaptation, but it is possible to make a referral of the deficit to an MPPC at any point of the child's schooling.

Due to the fact that there are no explicit federal or local regulations differentiating dyslexia and dysgraphia as separate categories, children with reading and writing difficulties are typically remediated through schools and classrooms for children with DPD or for children with speech and language disorders. There is evidence that among children educated in these schools and classrooms, approximately 50% have difficulties with reading and writing. If, however, children with dyslexia and/or dysgraphia do not have cognitive, intellectual, or speech and language difficulties, they do not get served in the framework of special education. Yet, they often receive support from their school-based or school district-based speech pathologists. In such cases, they are most often identified based on their dysgraphia, not dyslexia. Both conditions are highly comorbid in Russian children, but only half of all children with dysgraphia suffer from dyslexia.

Whether in a specialized school, in a specialized classroom, or in an out-of-school setting (i.e., in a research or community center or in private practice), the main professionals who remediate children with dyslexia and dysgraphia are speech pathologists (logopeds). The positions of logopeds in public schools and centers are supported by the government, and thus, their help is delivered to children for free.

To evaluate what accommodations are available for individuals with SRD (dyslexia) and specific writing disorder (SWR or dysgraphia) in Russia, we used common international practices as they are presented in the literature as a reference point. Specifically, when the educational experiences of children with dyslexia from 19 European countries, Brazil, and the USA were compared (Bogdanowicz & Sayle, 2004), a number of alterations to classroom practices and the examination/evaluation processes emerged as critical to prevent discrimination between students with and without dyslexia. Unfortunately, only a few of these accommodations are even considered possible in Russia. Specifically, they are the rights to (1) not have to read aloud in front of the class; (2) not be penalized for poor handwriting or spelling; (3) use a dictionary in a classroom; (4) more time to complete written assignments; and (5) substitute written assignments with oral assignments. These are granted at the discretion of the teacher (but not protected by any regulations or laws). Additional rights, such as the right to (1) use a keyboard/computer for written assignments; (2) use a recorder to capture the content of oral presentations in place of taking notes; (3) be allowed to start a foreign language later or not at all; (4) hear questions read aloud by the examiner before preparing a written response; and (5) answer certain questions orally, for example, in foreign language classes, is not granted (or even considered).

What is granted free of charge and guaranteed by the recently adopted Education Law of the Russian Federation from 2009 (Закон Российской Федерации "Об образовании" [The Education Law of the Russian Federation], 2009) is the professional rehabilitation and remediation support of speech-language pathologists. However, there is a caveat. This support is guaranteed to children with impairments in speech, language, reading, and writing, but only in grades 1–4, that is, in primary school. A chance to obtain such support in middle school (grades 5–9) or in high school (grades 10–11 or 12, in some schools) is limited and is highly linked to family advocacy and various circumstances (e.g., the availability of professionals in the child's district). The Russian Federation does not have any laws about special education, and thus, educational provisions for children with special needs (including those with dyslexia and dysgraphia) are not guaranteed. Moreover, there is no clear guidance at the federal level with regard to the process of identification and subsequent services for children with special needs.

Because children with dyslexia do not receive help in the amount and duration necessary for achieving adequate levels of literacy, the vast majority of such children do not have access to free higher education because of their inability to pass the Russian composition college entrance exam.

Conclusion

Studying literacy acquisition in Russian-speaking children presents an important new avenue for the study of SRD. The Russian language, its orthography, and the didactic approach used in teaching reading in Russia has certain unique properties that allow one to address important theoretical issues currently being debated in the field. For example, it provides a window into the respective roles of phonological processing versus automaticity in reading ability and disability.

In English, the language in which the majority of SRD research has been conducted, the mapping from orthography to phonology has a high degree of opacity and irregularity. This results in both a high rate of accuracy errors and at the same time reduced fluency in beginning readers and children with reading difficulties, making it difficult to dissociate the roles of phonological processing from automaticity (as well as memory and visual processing of orthographic sequences) in reading ability and disability. When dealing with an orthography that has a high degree of irregularity, both phonological deficits or deficits in automaticity would result in decreased fluency and high error rate because the child has to make use of both phonological and orthographic coding to read (and spell) words. In Russian, on the other hand, because of the high degree of orthographic transparency in the letter-to-sound mapping, deficits in automaticity are easier to isolate from deficits in phonological processing.

As discussed earlier in the article, letter knowledge and phonological coding are sufficient for word reading in Russian, and the child doesn't have to learn complex orthographic rules to be able to decode words or non-words. Furthermore, reading instruction in Russian schools follows several successive steps: the first, when the skill of blending sounds into syllables is developed and phonemic awareness is built, and second, when the skill of combining syllables into words is learned and automaticity is achieved, making fluid reading of whole words possible. This approach allows one to pinpoint with greater accuracy the stages of reading development when phonemic awareness and automaticity respectively act as better predictors of reading ability. As research in other countries with transparent orthographies have shown, children learning to read in such orthographies develop word reading skills and PA relatively quickly, and tests of PA become uninformative in predicting reading ability for such children (Wimmer et al., 2000). In the context of Russian schools, one may target stages of reading development more precisely and compare children's performance at the "syllable-reading" stage with their performance at the whole-word reading stage, etc. Testing whether a deficit in phonological processing (isolated at the first stage) or one in automaticity (at the later stage) is a better indicator of subsequent reading difficulties would make an important contribution to a contentious area of research.

Also, in English the mapping from both letters to sounds and sounds to letters is notoriously opaque. In Russian, on the other hand, only the latter has a high degree of irregularity. Furthermore, as we have discussed, certain complications of spelling in Russian stem from the phonological complexity of the language and/or from complex morphological analysis, while others from arbitrary rules and exceptions to the rules codified as norms by several generations of orthography reformers. For example, some spelling errors stem from having to represent in writing the underlying instead of the surface representation of vowels, which requires a high level of sophistication in phonological awareness. On the other hand, spelling of some words simply has to be memorized. This makes Russian an interesting testing case for theories of SRD because various theories make distinct predictions as to what pattern of spelling errors we should expect in such children.

In addition, because of the complexity of Russian inflectional and derivational morphology, and the important role morphological awareness plays in word recognition and spelling, Russian would provide an important test case for testing theories of the relationship between spoken and written language impairment. For

example, if the deficits in SRD are not related to language processing, we should not expect to find an effect of morphological complexity on reading if controlled for phonological complexity.

Another reason why conducting SRD research in Russia at present may be advantageous is that ironically, as a result of the relaxed state control over education and the negative consequences of these changes with regard to reading competence discussed earlier in the paper, it has become easier to identify children with reading difficulties than it was with the old system because reading difficulties are more manifest in the population.

Finally, the present may be especially fruitful for reading research in Russia because on the one hand, Russian researchers have a long tradition of studying the problems of language and reading and have developed important insights not widely known in the West. On the other hand, they have worked in isolation from the rest of the field for a very long time, and bringing the two traditions together would be of great benefit to furthering our knowledge on the universal and language-specific properties of literacy development.

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Author Note

Aleksandr N. Kornev, St. Petersburg University, Russia; Natalia Rakhlin, Yale University, USA; Elena L. Grigorenko, Yale University, USA, and Moscow State University, Russia.

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Correspondence concerning this article should be addressed to Elena L. Grigorenko, Yale University, Child Study Center, 230 South Frontage Road, New Haven, CT 06519

APPENDIX

Language Characteristics	English	Russian	Potential Effects on Literacy Acquisition
Deviations from the 1-to-1 sound-letter correspondence	Phonemes: 44 (20V+24C) Letters: 26 (6V+20C)	Phonemes: 42 (6V+36C) Letters: 33 (10V+21C+2 auxiliary signs)	A smaller sound-letter ratio in Russian allowing for a greater orthographic transparency;
Context-dependent grapheme-phoneme correspondence rules	Graphemes: ~210 (106V+104C) (Carney 1994) Graph-phone correspondence rules: a large number of rules, positionally, morphologically or lexically-based, often hard to define and with many exceptions, often affecting groups of words of a certain origin (e.g. Latin, Greek or French) (see Carney 1996 for a detailed description); e.g. <a> may correspond to the following sounds: /ei/ as in f***a***ke /a:/ as in ***a***rm /i:/ as in e***a***t /e/ as in m***a***ny /ai/ as in ***a***isle /u:/ as in be***a***uty, /ø/ as in critic***a***lly, etc.	Graphemes: 33 (10V+21C+2 aux. signs) Graph-phone correspondence rules: A. few regular positionally-based rules, e.g. • Vowels: so-called jotated vowels indicate consonant palatalization if preceded by a consonant, j-insertion elsewhere: <мять> - [m^{j}***a***t^{j}]-«to crumple» **<я**ма> – [***ja***ma] – «a ditch», B. a number of lexically-based rules affecting small sets, typically of high frequency lexical items, e.g. • consonant cluster dissimilation in *cht*/*chn* clusters: **<чт**о> (<**ch**to>)– [**ʃ**to] – “what” <коне**чн**о> (<kone**chn**o>) –[kan^{j}e**ʃn**o] – “certainly” , <наро**чн**о> (<naro**chn**o>) – [naro**ʃn**o] “on purpose”, but по***чт***а (<po**cht**a>)– [po**čt**a] –«post office», <нару**чн**ик> (<naru**chn**ik>) – [naru**čn**ik] “handcuff”; • consonant cluster simplification in certain 4- and 3-consnant clusters:<чу***вств***о> (<chuvstvo>) – [chu***st***vo] “feeling”, but <воро***вств***о> (<vorovstvo>) – [varavstvo] “theft” по**здн**о – [po***zn***a] “late”, but бе**здн**а – [be**zdn**a] «void» • morpheme internal coalescence: /s/, /z/, /ʃ/ **+** /***t***ʃ/ /ʃʃ^{j}/ му***жч***ина – [mu**ʃ**^{j}ina] “man” ***сч***итать – [**ʃ**^{j}***itat***^{j}***]*** • In stressed syllables, <e> can correspond to the sound [o]: <**е**лка> (<**e**lka>) – [**jo**lka] «Christmas tree», <**е**жик> (<**e**zhik>) – [**jo**ʒik], but <ель> (<el^{j}>) – [jel^{j}] «pine tree»	High degree of grapheme-phoneme inconsistency and irregularity in English complicates the development of phonological coding. Russian has a much smaller gap between the number of graphemes and sounds, few inconsistent grapheme-phoneme correspondences, and no graphemes larger than a single letter (with the exception of those combined with the aux. signs). However, its orthography is not fully transparent because of the existence of the lexically-bases rules each affecting a small set of lexical items. Given these differences, we can expect that reading disability in Russian would manifest itself differently than in English; e.g. not in word reading accuracy but in lowered fluency;

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Context-dependent surface neutralization of underlying phonemic contrasts creating homophones;	Few e.g. /writer/- [raiDər] /rider/ - [raiDər]	Many • Final devoicing: e.g. /porog/-[parok] - <porog> (<порог>, “a threshhold”), / porok/-[parok] - <porok> (<порок>,“a vice”); • Regressive voice assimilation in obstruent clusters: e.g. /**vs**^{y}e/)-[**fs**^{y}e]-<vse> («all»), /ra**sd**^{y}et^{y}/-[ra**z**^{y}**d**^{y}et^{y}]-<razdet^{y}> • Vowel reduction in unstressed positions neutralizing contrasts between vowel qualities a) after palatalized consonants, vowels /a/, /e/, /o/, /i/ surface as /i/; e.g. /l^{y}**e**sá/-[l^{y}**i**sá] – <l^{y}-**e**sá> (<леса>, “woods”) homophonous to / l^{y}**i**sá/ [l^{y}**i**sá] < l^{y}**i**sá> (<лиса>,“fox”). b) after non-palatalized consonants, unstressed mid-vowels /o//e/ surface as either [a] or [**ʌ**] depending on their position with respect to the stressed syllable; e.g. /g**o**dá/-[g**a**dá]-<g**o**da> (<года>,“years”), /g**a**dát^{y}/-[g**a**dát^{y}]-<g**a**dat^{y}> (<гадать>, «to tell fofrtune”) /m**o**l**o**kó/ - [m**ʌ**l**a**kó]-<m**o**l**o**ko>; /p**aro**xód/ - [p**ara**xót]- <p**aro**xod> (<пароход>), «steamboat»);	Due to the various phonological processes neutralizing contrasts between consonantal segments and vowel qualities in Russian, the mapping from sound to letter is complicated; contributing to the difficulty of mastering spelling.
Word Stress	Stress pattern is complex, but predictable. Syllable weight determines the primary stress and rhythmic pattern a secondary stress	Stress is free and can fall on any syllable in a word. It is not predictable from the phonological features of the word. It is mobile; i.e. it shifts within inflectional and derivational paradigm of a given word. There is no rhythmic (secondary) stress.	Given the process of neutralization of vowel qualities in unstressed positions in Russian, the unpredictability of Russian stress is a complicating factor for phonological coding. English consistent rhythmic organization may serve as a cue used for in phonological coding.
Stress used to encode lexical or grammatical information (i.e. words can be distinguished solely on the basis of their distinct stress).	In cognate words that differ in their grammatical class: prógress/ progréss, tórment/torménт, etc.”, stress differentiates the grammatical category.	Words can be distinguished solely on the basis of stress, leading to a large number of homographs; e.g. *zámok* (“castle”) – zamók (“lock”), *stóit* (“cost-3rd-sing.”) – *stoít* (“stand-3rd-sing”), *úzhe* (narrow-comparative) – *uzhé* (“already”). In many cases, stress is the only feature that distinguishes between different grammatical forms; e.g. *rúki* (“hand-plural-nom”) – *rukí* (“hand-sing-gen”), *srézat^{j}* (“to cut off – perfective”) – *srezát^{j}* (“to cut off – imperfective”).	Give the existence of such homographs and the complex pattern of stress, the reader must rely on the context to discern the intended meaning, which would present an additional demand on a beginning reader.

Syllable structure	Complex, but respecting Sonority Sequencing Principle: i.e. clusters in which the sonority of the segments preceding the nucleus fall instead of rising (e.g. “lda”, “fba”, etc.) are forbidden.	Complex, and allows consonant clusters that violate the Sonority Sequencing Principle; e.g. ко**сть** [kosʲtʲ] “bone”, ртуть [**rt**utʲ] (mercury), **ств**ол [stvol] “trunk of a tree”, ве**рбл**юд [vʲ**ɪr**ʲblʲ**j**ut] “camel”, тол**ст**ый [ˈtolst̪j] “thick”, **встр**етить [ˈ**fstr**ʲetʲɪtʲ] (“to encounter”), ***вскр***ы***т***ь [**fskr**ytʲ] (“dissect”).	Complexity of the syllable structure complicates the phonology-orthography mapping, particularly in languages with deep orthographies (Goswami, 2009).
Historical sound change and words of foreign origin.	Orthography frequently preserves historical phonological forms.	Orthography typically reflects modern pronunciation.	Since English spelling does not reflect the result of historical sound change and instead preserves pronunciation no longer used or the pronunciation of the language of origin, this creates a high degree of inconsistency between graphemes and sounds in English.
Morphemic variation (allomorphy)	Orthography preserves morphological unity; i.e. phonemically distinct morphemic variants have common spelling. E.g. • The past tense morpheme –ed has the allomorphs: /-t/ (missed, locked, etc.), /-d/ (tied, logged, etc.) /-id/ (rotted, wedded, etc.). All variants are spelled as <-ed>. • Medi**c**al/medi**c**ine n**a**tural/n**a**ture, electric/electricity/electrician etc.	Orthography is strongly phonemically-based; i.e. morphologically-related forms with alternative phonological forms have distinct spelling: e.g. дру**г** (dru**g,** “friend”) – дру**ж-**ба (dru**zh**-ba, “friendship”), бе**г**ать (beg**a**tʲ)– бе**ж**ать (be**zh**atʲ).	The **morphemic principle** of English orthography complicates the task of developing the skill of phonological coding in the beginning readers, but aids the development of morphological awareness in the more advanced readers. The **phonemic principle** of Russian orthography aids the beginning reader in developing phonological awareness and phonological coding, but complicates the development of morphological awareness.

Morphological system	Analytical (a low morpheme-to-word ratio), a clear boundary between roots and affixes, stems and inflections.	• Synthetic (a high morpheme-to-word ratio). Nouns, verbs, pronouns and adjectives are inflected and cannot be used as bare stems even in the dictionary form. A case system with 6 cases to mark grammatical roles of nouns in a sentence, the category of gender with 3 genders, agreement in the nominal domain (all elements of the noun phrase, such as adjectives or demonstrative pronouns must agree with the head noun in gender, number and case). The verbs show agreement with the subject (in gender and number in the past tense and person and number in the present and future tense), in addition to tense and aspect. A word may have several derivational prefixes and suffixes in addition to the inflection. • Fusional: i.e. grammatical categories, (e.g. case and number of nouns), are realized as inflections fused to stems (i.e. segmentation of stems and inflections is not trivial because of the morpho-phonological blending with morphemic and syllabic boundaries that often do not coincide. Syllabic division in the word may not coincide with morphemic division: *пред|вку|ша|ю|щий̆* пред/в/куш/аю/щ/ий pred/vku/sha/ju/*shchi*j), pred/v/kush/aju/shch/ij, “anticipating” “pred”, “v” – prefixes, “kush” – root, “aju”, “shch” – suffixes, ij- inflection) • The relation between form and function is non-unique in both directions: the same morphological exponent may appear in more than one paradigmatic positions; e.g. *-i* appears as a nominative plural marker for masculine and feminine nouns in the 1st, 2nd, and 3rd declensions, a genitive singular ending in the 2nd and 3rd declension, as well as dative and prepositional singular in the 3rd declension. At the same time, as the existence of multiple declension classes demonstrates, the same grammatical function is performed my multiple exponents. Thus, dative singular is marked by -u in the first declension, –e in the second, and –i in the third declension. • A single morphological exponent combines multiple grammatical categories; e.g. for nouns, the categories of case, number, gender and animacy are compressed into a single morphological exponent[1]; e.g. *–a* can signify “*accusative singular masculine animate*” or “nominative, singular, feminine”	The complex multidimensional nature of Russian morphology with its multiple sources of irregularity and inconsistency, may complicate the development of morphological awareness. Thus, children have to be explicitly taught to segment word stems from inflections, as well as word roots from suffixes and prefixes. How this irregularity and inconsistency affects the development of MA, whether morphological fusion and the various morpho-phonological and phonological processes that come with it hamper children’s ability to develop conscious awareness of morphological structure of words and what effect it has on the reading ability and disability is an important empirical question that needs to be addressed.

1 This “fusional” character of Russian inflection stands in contrast to agglutinative languages, such as Turkish, in which not only there is a 1-to-1 correspondence between form and function, but each grammatical function, such as gender, number or case is expressed as a separate morpheme, which results in words containing long strings of inflections and paradigms being highly regular and consistent.

Word Order	Fixed SVO	Any order between subject, verb, object and indirect object is possible. However, although all of the possible permutations of the subject, verb and direct object have the same grammatical and thematic relations, they are not completely equivalent. Various permutations of word order in Russian serve a pragmatic purpose to convey subtle information about discourse situation; i.e. what is known as "information structure", namely "old" and "new" information or topic and focus: the "old" or the topic typically comes in the beginning and "new" or focus at the end of the sentence. Thus, Russian word order encodes the division of information into what the speaker can assume as taken for granted by the hearer as part of the speaker/hearer common ground and that, which constitutes the assertion contributing new information to the discourse.	The flexibility of the Russian word order makes it not an effective clue for reading comprehension, as it is in English, and the reader has to figure out the grammatical relationships between constituents using morphological clues (e.g. case of nouns). Also, since constituents in Russian can be moved from their canonical positions, e.g. a modifier can be moved away from the noun it modifies and with which it agrees in case, gender and number, the reader has to maintain such discontinuous dependencies in memory until the parse is completed. Furthermore, given the pragmatic division into a topic/focus structure in a Russian sentence, reading comprehension would require the reader to have sensitivity for subtle pragmatic information.