

CROSS-LINGUISTIC STUDY OF SPELLING IN ENGLISH AS A FOREIGN
LANGUAGE: THE ROLE OF FIRST LANGUAGE ORTHOGRAPHY IN EFL
SPELLING

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CROSS-LINGUISTIC STUDY OF SPELLING IN ENGLISH AS A FOREIGN LANGUAGE: THE ROLE OF FIRST LANGUAGE ORTHOGRAPHY IN EFL SPELLING

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The study investigated the effects of learning literacy in different first languages (L1s) on the acquisition of spelling in English as a foreign language (EFL). The hypothesis of the study was that given the same amount of practice, English learners from different first language backgrounds would differ on their English spelling proficiency because different orthographies “train” spelling skills differently and therefore the opportunities for positive cross-linguistic transfer that benefits English spelling would differ across L1s. The study also predicted that cross-linguistic differences in English spelling would not be the same across different components of spelling proficiency because cross-linguistic transfer would affect some skills involved in spelling competence, but not others.

The study tested native speakers of Danish, Italian, and Russian with intermediate to advanced EFL proficiency. The three languages were chosen for this study based on the differences in native language spelling skills required to learn the three orthographies. One hundred Danish, 98 Italian, and 104 Russian university students, as well as a control group of 95 American students were recruited to participate in the web-based study, which was composed of four tasks testing four skills previously identified as components of English spelling proficiency: irregular word spelling, sensitivity to morphological spelling cues, sensitivity to context-driven probabilistic orthographic patterns, and phonological awareness.

The study confirmed the existence of cross-linguistic differences in English spelling and found that the differences were not the same across different spelling skills tested in the study. The evidence from the study suggests that the characteristics of L1 orthography have an impact on the cognitive procedures involved in second language spelling explained by the transfer of

cognitive spelling strategies from L1 to L2.

The study contributes to the relatively new area of research investigating spelling in a second language by exploring languages that have not been previously studied in the context of EFL spelling and by considering multiple aspects of spelling proficiency. The implications of the findings for theoretical cognitive-linguistic research and educational practices are discussed.

BIOGRAPHICAL SKETCH

Nadezda Dich graduated from the Department of General Linguistics of Saint-Petersburg State University, Russia, in June 2003 with a diploma cum laude. In August 2006, she started a PhD program at the Department of Human Development at Cornell University. Nadezda's research interests include first and second language acquisition, literacy in first and second language and reading and writing disorders.

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TABLE OF CONTENTS

BIOGRAPHICAL SKETCH.....	iii
ACKNOWLEDGMENTS.....	iv
CHAPTER 1. INTRODUCTION.....	1
CHAPTER 2. BACKGROUND.....	5
2.1 Spelling Acquisition in Different Writing Systems.....	5
2.2. Cross-Linguistic Transfer in Acquisition of Spelling in a Second Language.....	19
2.3. Summary and Literature Critique.....	29
CHAPTER 3. RATIONALE AND DESIGN.....	32
3.1. Research Questions.....	32
3.2. Hypotheses of the Study.....	33
3.3. Design.....	35
CHAPTER 4. METHOD.....	43
4.1. Tasks and Materials.....	43
4.2. Procedure.....	49
4.3. Participants.....	52
CHAPTER 5. RESULTS.....	59
5.1. Survey Results.....	59
5.2. Task 1: Memory for Word-Specific Spellings.....	70
5.3. Task 2: Morphological Awareness.....	77
5.4. Task 3: Context Sensitivity.....	90
5.5. Task 4: Phonological Skills.....	98
5.6. Between-Task Comparisons.....	107
CHAPTER 6. DISCUSSION.....	114
6.1. Summary of Study Goals and Approach.....	114
6.2. Confirmation of the Hypotheses.....	115
6.3. Results Inconsistent with Predictions.....	119
6.4. Additional Findings: Factors Affecting English Spelling Proficiency.....	128
6.5. Implications of the Findings.....	133
6.6. Strengths and Limitations of the Study.....	136
6.7. Conclusions and Future Directions.....	140
APPENDIX.....	145
REFERENCES.....	152

CHAPTER 1

INTRODUCTION

To many people, especially in large industrialized countries, the idea that there are more polyglots in the world than there are monolinguals comes as a counterintuitive revelation. And yet, the data indicate that individuals who can only speak one single language represent a minority within the global population (e.g., Tucker, 1999). What may seem even more counterintuitive to a person who grew up in a monolingual family and spoke the same language at school and at home, is the fact that only a minority of children throughout the world are educated exclusively in their mother tongue. Indeed, for a significant number of students, both in developing countries and in the West, the language of school instruction is not their first (Dutcher, 1994; World Bank, 1995).

The prevalence of instruction in a second or a later-acquired language explains the growing attention on the part of researchers to multilingual literacy – the ability to read and write in more than one language – since reading and writing skills serve a foundation to any formal education. Developmental psychologists, applied linguists and education experts combine their efforts trying to understand the cognitive and linguistic prerequisites of successful learning to read and write in a second language and to uncover the principles of successful L2 literacy instruction. Literacy in *English* as a second/foreign language (ESL/EFL) has been of a particular interest to researchers due to the fact that English is increasingly becoming the world's lingua franca and that its role in formal education is constantly growing (e.g., Figueredo, 2006).

However, despite considerable recent interest in ESL literacy among researchers, many important questions remain unanswered. Some of these questions are related to the role of first language skills in mastering reading and writing in ESL. Researchers of multilingualism have

discovered that when we learn a new language, just like when we master any other new cognitive skill, our existing knowledge and skills play an important role in shaping our successes and failures. In other words, when people learn a new language, they rely on their knowledge about their first language(s) to help them in this task. To illustrate this idea with some examples: when French speakers learn English, they will know to put “a” or “the” before every countable noun because in French countable nouns are also preceded by an article; when German speakers learn Danish, they will know to always put the verb in the second position in the sentence because German has a similar word order rule. In comparison, Russian speakers will make errors in both English articles and Danish word order because Russian neither uses articles nor has strict rules about position of words in a sentence.

Mastering second language literacy is not an exception: the emerging body of evidence on L2 literacy acquisition shows that learners can use what they already know about their first language (L1) writing system when they start to read and write in a second language. For instance, an Italian speaker who doesn't know much about English spelling might still have quite a good idea regarding how to spell some English words, such as *bed* or *stop* because /b/, /d/, /s/, /t/ and /p/ are rendered with the same letters in the two languages. However this is just a simple example; as discussed in the following chapters of the thesis, reading and spelling proficiency involves many more types of knowledge and skills than mere knowledge of the correspondences between letters and sounds. One important and interesting task for researchers in the area of literacy – the one that the work presented here was inspired by – is to uncover and understand different ways in which L1 literacy affects the cognitive mechanisms of reading and writing in L2 and possibly facilitates the acquisition of the various skills involved in L2 literacy. At present, our understanding of the role of first language literacy in the development of L2 reading and especially of L2 writing is still quite limited. The present study starts to fill this gap in literature.

The understanding of how L1 knowledge affects L2 literacy and how these effects depend on the particular two languages involved goes hand in hand with the understanding of the

differences in cognitive prerequisites of literacy in different languages. Most of what we currently know about the cognitive processes underlying proficient reading and writing comes from research on native English speakers (see, e.g., Share, 2008 for a discussion of the anglocentrism of current literacy acquisition models). Cross-linguistic differences in reading and writing is a relatively new topic of inquiry; data in spelling acquisition from languages other than English are particularly scarce. At the same time, the cross-linguistic data that we do have show that while some of the mechanisms of literacy development are common across different writing system, others are language-specific and are shaped by the specific characteristics of the particular orthography. The present work builds on the current knowledge about cross-linguistic differences in L1 literacy acquisition and explores the hypothesis that they result in differences in L2 spelling proficiency between learners of the same L2 from different L1 backgrounds.

However important the practical implications of L2 literacy research may be, they are not the only motivation for studying how people learn to read and write in a second language from a cross-linguistic perspective. Cross-linguistic data on mastering L2 literacy are also interesting from a theoretical perspective of cognitive psychology. As stated above, most of current literacy acquisition models were developed based on English native speakers' data. Evidence that speakers of different native languages approach the acquisition of English literacy with different sets of skills at hand and have different strengths to rely on, but achieve comparable results at the end would not only enrich our knowledge about literacy itself, but would also contribute to research on individual differences by demonstration how the human brain can achieve the same result via different paths.

The present work is based on a large-scale cross-linguistic empirical study investigating how native speakers of different languages transfer different types of literacy-related skills to help them master various components of English spelling proficiency and how the characteristics of their native language writing system, such as orthographic transparency and the nature of orthographic regularities, determine their successes and failures.

The results of the present study suggest that the characteristics of native language writing systems affect the cognitive mechanisms of L2 spelling, but also that the differences in L2 spelling performance between individuals from different L1 backgrounds are not the same across different components of spelling proficiency. In other words, the evidence in the present study suggests that some of the L2 spelling-related skills, for instance the ability to use morphological cues in spelling, are more sensitive to characteristics of learners' L1 orthographies than other skills, such as irregular word memorization.

The thesis starts with a literature review in Chapter 2 summarizing what is currently known about cognitive and linguistic prerequisites of spelling development in different types of orthographies (2.1) and about cross-language transfer in second language spelling (2.2). Chapter 3 introduces the empirical study and outlines the research hypotheses and design. Chapter 4 describes the methodology of the study and gives a detailed descriptions of the tasks employed in the study, the research procedure and the participants. Chapter 5 presents the results of the study accompanied with statistical analyses. Chapter 6 summarizes and discusses the results and their theoretical implications, points out the strengths and the limitations of the study, and outlines the directions for future research.

CHAPTER 2

BACKGROUND

2.1 Spelling Acquisition in Different Writing Systems

As a literacy expert Caravolas puts it, cross-linguistic research in spelling development is still “in its infancy” (Caravolas, 2004, p. 13). However, even though studies on spelling in languages other than English are rare, the evidence accumulated so far suggests that processes of spelling development may look different across languages. This section discusses these cross-linguistic differences and talks about the specific characteristics of languages and their orthographies that shape spelling mechanisms.

2.1.1. Phonographic and Logographic Orthographies

Orthographies of the world vary based on which linguistic units are represented by the written symbols – or graphemes. In *phonographic* orthographies, symbols represent units of sound, e.g., syllables or individual phonemes. For example, in English or Russian orthography, individual consonants and vowels are represented. Japanese kana symbols represent syllables. The acquisition of a phonographic orthography requires attention to the sound structure of words and the ability to segment speech into meaningless sound units in order to convert them into written symbols. It also requires the knowledge of the graphic symbols corresponding to sounds and the sound-to-spelling conversion rules. Phonological skills play an important role in acquisition of phonographic writing systems. The link between phonological skills and spelling acquisition in phonographic orthographies has been demonstrated in multiple studies for a number of languages. Of these studies, papers by Landerl & Wimmer (2008), Caravolas, Hulme, and Snowling (2001), Muller & Brady (2001) and Lundberg, Frost, and Petersen (1988) are just a few examples demonstrating this link.

By contrast, in *logographic* or *meaning-based* orthographies, such as Chinese, symbols represent units of meaning, rather than units of sound. Even though some elements in logographic characters may be indicative of the pronunciation of the character, the correspondences between these elements and sounds are not systematic enough for the reader to rely on them (Coulmas, 1996; Hanley, Tzeng & Huang, 1999).

Because there are many more units of meaning than units of sound in any language, the acquisition of a logographic orthography requires memorization of a vast array of written symbols (Hoosain, 1986). Thus, for example, Chinese children are expected to have learned over 2,000 characters by the end of elementary school (Hanley, 2005). Research has shown that visual skills are of special importance for Chinese literacy acquisition (Cheung, McBride-Chang, & Chow, 2006; Hoosain, 1986), whereas the link between phonological skills and literacy acquisition in Chinese is less unequivocal than in phonographic orthographies (Hanley, 2005).

A few studies have shown that the differences between logographic and phonographic orthographies lead to the adoption of different strategies by learners, which impacts the outcomes of literacy development not only in L1, but also in L2. For instance, Holm and Dodd (1996) tested monolingual English speaking adults and adult ESL speakers whose L1 was Chinese and Vietnamese, on a number of reading, spelling and phonological awareness tasks in English. Whereas there were no differences between groups in reading and spelling of real English words, Chinese speakers from Hong Kong – the group of participants who had never been familiarized with a phonographic principle of writing¹ – scored lower than the other groups on English

¹ The ways Chinese literacy is taught differs across regions. In mainland China and Taiwan children learn an alphabetic script (Pinyin or Zhu-Yin-Fu-Hao) before instruction in reading and writing Chinese characters begins. Then, when characters are introduced, they are accompanied with their Pinyin and Zhu-Yin-Fu-Hao representations which tell students how the character should be pronounced. By contrast, in Hong Kong, children learn characters by rote memorization (Hanley et al., 1999). Thus, Hong Kong children are never exposed to the idea that writing

pseudoword reading and spelling. The authors attributed Hong Kong students' difficulty with pseudowords to their lack of phonological analysis skills. This interpretation is consistent with the finding that Hong Kong students also performed worse than other students on phonological awareness tasks. However, authors suggest that Hong Kong students were able to compensate for their phonological deficits in real word processing by applying visual strategies that they had developed when learning to read in L1, i.e., by rote memorization of spelling of English words.

Similar results were obtained by Wang & Geva (2003) with monolingual English and Chinese speaking ESL children (2nd graders) living in Toronto. The bilingual subjects had started acquiring literacy in Chinese before they started to read and write in English; they had been learning Chinese characters by rote memorization. The study compared monolingual and bilingual children on their English spelling skills and found that whereas there was no significant difference between groups in real word spelling, the bilinguals performed worse than monolinguals in pseudoword spelling. The interpretation of these findings was similar to that by Holm & Dodd (1996): when spelling real words, Chinese ESL children rely on whole-word visual strategies, which are of little use when an unfamiliar sound sequence (a pseudoword) needs to be spelled. Lack of phonological skills causes Chinese children's difficulties in pseudoword spelling.

These findings on spelling acquisition are consistent with the results of cross-linguistic studies on reading acquisition in L2, which have demonstrated that people whose L1 orthography is logographic (Chinese) or has a logographic component (kanji characters in the Japanese orthography) tend to rely more on visual information when reading in L2 than people whose L1 orthography is purely phonographic (Chikamatsu, 1996; Dhanesschaiyakupta, 2004; Sasaki, 2005; Wade-Woolley, 1999).

represents units of sounds that words can be broken into.

Whereas many ancient orthographies were logographic, Chinese is the only one that is in use in the modern time. All other orthographies used today are primarily phonographic. However, even though they share the common principle of transcribing sound units, they differ from each other along multiple dimensions, which will be discussed below.

2.1.2. Size and Type of Units Represented in Orthographies

Even though all phonographic orthographies represent sound units, there are cross-linguistic differences in the size and types of the units represented. In syllabaries, such as Japanese kana, written symbols correspond to whole syllables. In consonantal orthographies, such as Arabic or Persian, only consonants are represented in writing, whereas representation of vowels is optional. In alphabets, all phonemes of words are represented.

The evidence on what role these cross-linguistics differences may play in spelling acquisition is limited. Fender (2008) found that adult Arab ESL learners make significantly more spelling errors in frequent English words than ESL students from other L1 backgrounds (Chinese, Japanese, and Korean), even when English oral proficiency is controlled for. Whereas this may suggest that previous experience with L1 orthography impacts spelling acquisition in L2, it is not quite clear which characteristics of the L1 orthographies were responsible for the result. Indeed, 81% of Fender's non-Arab ESL students were Chinese. As discussed above, Chinese differs from Arabic not only on the size of units that are represent, but also in that Chinese is a logographic orthography, whereas Arabic is phonographic.

However, Fender's results are consistent with data from Cook (1997), who analyzed a corpus of English spelling errors made by English native and non-native speakers. Arabic and Hebrew speakers, whose orthography does not represent vowels, were found to have higher spelling error rates than speakers of other languages, not only Chinese and Japanese, but also languages using alphabetic orthographies.

This suggests that the experience with an orthography in which vowels are underrepresented might make the acquisition of spelling in English more difficult for Arabic and Hebrew speakers than for ESL learners, who have had experience with an orthography where all phonemes are represented. Fender (2008) suggests that one possible explanation for his data is that experience with L1 Arabic orthography teaches students to focus on the consonant structure of words ignoring vowels – a strategy that leads to underspecified spelling knowledge when transferred to English spelling acquisition.

It seems, however, that even if this interpretation is correct, it is difficult to disambiguate between the effect of L1 orthography and the influence of L1 linguistic system in Fenders' study. Indeed, in Arabic, consonants carry lexical information, whereas vowels carry grammatical information and can be predicted by sentence context. It is not clear whether it is the fact that Arabic only represents consonants in print or that consonants and vowels play different linguistic roles that would make Arab ESL learner focus on consonants more than on vowels.

2.1.3. Orthographic Transparency (Depth)

Orthographies also vary greatly on how consistent the mappings between written symbols and sound units are. For instance, English, Danish, Finnish, and Italian orthographies are all based on the same alphabetic principle, but they differ dramatically on how consistently sounds correspond to letters and vice versa. In Italian and Finnish, the vast majority of correspondences between letters and sounds are one-to-one. In English and Danish, a letter can correspond to multiple sounds (e.g., <c> in English *cab*, *city*, *focaccia*; <d> in Danish *din* [d] 'your', *hoved* [ð] 'head', *mødtte* [-] 'met'). There also exist multiple letter correspondences for individual sounds in English and Danish (e.g., [k^h] in English *cab*, *kit*, *quiche*, *choir*; [d] in Danish *din*, *varten* 'the host', *bøtte* 'pot'). Orthographies like Finnish and Italian are called transparent or shallow, whereas orthographies like English and Danish are called opaque or deep (e.g., Katz & Frost, 1992). Shallow vs. deep is not a dichotomous classification; rather, orthographies of the world

represent a continuum of consistency where English and Finnish are at the extremes. Moreover, the degree of consistency of letter-to-sound correspondences may be different from the degree of consistency of sound-to-letter correspondences. Caravolas (2004) notes that it is typical for alphabetic orthographies to be more feedforward than feedback consistent, i.e., have easy rules for reading but more complicated rules for spelling. Examples of such “asymmetric” orthographies include French, Dutch, German, Greek, Russian, and other. This makes it quite difficult to classify orthographies into deep and shallow.

Learning a shallow orthography and learning a deep orthography are tasks of different difficulty: whereas for a shallow orthography, the learner only needs to memorize the set of one-to-one mappings between letters and sounds, the learner of a deep orthography has to master complex orthographic rules and lists of spellings not conforming to rules. Cross-linguistic research has demonstrated a dramatic effect of orthographic depth on the rate of learners’ spelling development. A number of studies have shown that children acquiring literacy in deep orthographies lag behind their counterparts mastering shallow orthographies in spelling acquisition (Caravolas & Bruck, 1993; Caravolas, 2004; Juul & Sigurdsson, 2005; Wimmer & Landerl, 1997)

Thus, Wimmer and Landerl (1997) compared elementary school German-speaking and English-speaking children on how accurately they spell vowels in words. To make the task comparable in the two languages, the authors chose words that were cognates in the two languages, that is they had the same etymology and therefore had similar pronunciation and meaning, e.g., *bread/Brot*, *heart/Herz*. German orthography, even though not perfectly feedback-consistent, is much more transparent than English. Whereas in English, a vowel can have as many as 5 different spellings (e.g., /e/ in *late*, *bait*, *straight*, *eight*, *great*), in German there are most often only two possible ways to spell a vowel (e.g., [a:] in *Saal* (‘hall’) and *Zahl* (‘count’)). The authors found that German-speaking children spelled vowels more accurately than their English counterparts and also omitted vowels less often.

One could argue, of course, that in this study English-speaking children might have performed worse on vowel spelling not because they lagged behind German-speaking children in the development of spelling skills, but because they had greater opportunities to make mistakes: in fact, the likelihood of making a wrong choice when one has to choose between two possible vowel spellings is lower than when one has to choose between five. However, such explanation does not fit all the results: the errors made by English-speaking children were not all phonologically plausible, i.e., were not always acceptable spellings of the target vowels. For example, Anglophone children could spell a vowel with a consonant letter or not provide a letter for a vowel at all. These types of errors were significantly rarer in German-speaking children.

The most compelling evidence suggesting that it is the transparency of orthography in general, rather than the complexity of particular spelling rules that causes delays in spelling acquisition is provided by Juul and Sigurdsson (2005). The authors compared spelling skills of Danish- and Icelandic-speaking children. Danish and Icelandic are both North Germanic languages having a lot of similarities in the phonological structure of words. However, even though not perfectly transparent, Icelandic orthography is shallower than Danish in both sound-to-spelling and spelling-to-sound directions. Juul and Sigurdsson tested school children (grades 2-6 in Denmark, grades 3 & 4 in Iceland) on spelling of medial consonants and word-initial consonant clusters. Medial consonant and word-initial clusters present difficulties for spellers in both languages. In both Danish and Icelandic medial consonants are sometimes spelled with doublets, the doubling rules being simpler in Icelandic. As for consonant clusters, they had been previously found to be difficult for beginning spellers, who have trouble segmenting clusters and tend to represent them with just one letter instead of two (e.g., Caravolas & Bruck, 1993; Treiman, 1993; Wimmer & Landerl, 1997). Importantly, however, the sound-to-letter correspondences for word-initial consonant clusters are perfectly consistent in both Danish and Icelandic. A simpler spelling task – spelling of one-consonant onsets – was also included in the test. The results showed that when Icelandic and Danish children were matched on age and on

spelling of simple onsets, Icelandic children scored higher than Danish children not only on spelling of doublets, but also on spelling of consonant clusters. In other words, children learning the more transparent orthography outperformed children acquiring the more opaque orthography in spelling even when the regularity of letter-sound correspondences was controlled for.

Interestingly, children learning to spell in a transparent orthography are at an advantage not only when the orthography is feedback consistent, but also when it is only feedforward consistent, but feedback inconsistent. Such conclusion can be made from comparisons of spelling development of English- and French-speaking children. Both English and French have inconsistent sound-to-letter correspondences with a comparable degree of inconsistency, however letter-to-sound correspondences are more consistent in French (Ziegler, Stone, & Jakobs, 1997). Caravolas (2004) reports results of a cross-linguistics study showing that French-speaking 3rd graders score significantly higher on word and nonword spelling tasks than their English-speaking counterparts matched on the amount of formal instruction, age, IQ, and a number of other background variables, with the difficulty of the spelling tasks in the two languages being comparable.

The results of cross-linguistics studies of spelling are consistent with the findings of studies on reading acquisition in different orthographies: reading acquisition has been found to progress at a slower rate for children acquiring deep orthographies than for children learning to read in shallow orthographies (e.g., Seymour et al., 2003; Ziegler & Goswami, 2005, 2006).

Why do children mastering shallow orthographies acquire reading and spelling skills faster than children learning opaque orthographies? Phonological skills may be a factor in this cross-linguistic difference. As mentioned earlier, phonological skills, namely phonemic segmentation skills, are an important factor in reading and spelling development. At the same time, phonemic segmentation skills are limited in children who are not familiar with the alphabetic principle of writing. However acquisition of literacy in an alphabet promotes those skills: learning about letters helps children bring phonemes into consciousness and increases the ability to manipulate

them (Dich & Cohn, submitted). As Ziegler and Goswami (2005, p. 9-10) put it, “It is relatively easy to learn about phonemes if one letter consistently maps onto one and the same phoneme or if one phoneme consistently maps to one and the same letter. It is relatively difficult to learn about phonemes if a letter can be pronounced in multiple ways.” In other words, learning a transparent orthography is a better training of phonological skills, which, in turn, contribute to better reading and spelling skills.

Research comparing acquisition of literacy in orthographies of differing transparency suggests that orthographic depth may influence not only the rate of literacy acquisition, but also the *strategies* that learner adopt for processing written language. Two theories address the effects of orthographic depth on reading. The *Orthographic Depth Hypothesis* (Katz & Frost, 1992), states that in deep orthographies readers rely more on whole-word visual strategies than in shallow orthographies, where readers rely more on the sub-lexical decoding strategies. The *Psycholinguistic Grain Size Theory* (Ziegler & Goswami, 2005, 2006), suggests that whereas learners of transparent orthographies rely on phoneme-size units in decoding, in deep orthographies, reliance on small units is inefficient, therefore learners develop decoding skills for units of a larger size as well (e.g., syllables and rhymes). Reliance on units of larger size is more efficient because, at least in English, print-to-sound correspondences are more consistent at these larger levels than at the phoneme level (e.g., Kessler & Treiman, 2001).

Even though both these theories were developed based on research in reading acquisition, some (although limited) data on spelling are also available that are consistent with the idea that orthographic depth may affect mechanisms of written language processing.

For instance, Rickard Liow & Lau (2006) tested Singaporean kindergarteners from different L1 language backgrounds, Chinese, Malay and English, on spelling of intervocalic flaps in English². Studies of American beginning spellers had previously shown that children tend to

² The authors report that in Singapore English, similarly to American English, medial /t/ and /d/ in words are

spell intervocalic flaps, such as the <t> in *water* or <d> in *lady* with letter *d*, thus exhibiting sensitivity to the phonetic qualities of the flap sound, which is closer to the voiced /d/ than to the voiceless /t/ (Treiman, Cassar & Zukowski, 1994). Rickard Liow and Lau replicated this result with Singaporean English-speaking monolinguals and bilinguals: all children exhibited a *d*-bias when spelling English flaps. No *d*-bias was observed for non-flapped /t/ and /d/. Significant differences between language groups were found, however: when spelling flaps in low-frequency words, Malay-speaking children had a stronger *d*-bias than other children; that is, they relied on the phonetic information more than the other two groups of children. At the same time, Chinese speakers' and English monolinguals' spelling was found to be affected by word frequency: they produced more orthographically correct spelling for high-frequency words than for low-frequency words. Malay children's spelling accuracy was not affected by word frequency. The authors attributed their results to the differences in children's prior experience with print in their L1. All tested children had already started acquiring literacy in their home language. Malay uses a very shallow orthography based on the Roman alphabet. Rickard Liow and Lau suggest that the experience with this shallow orthography promoted phonological skills in Malay-speaking children and increased their reliance on these skills in spelling in both L1 and L2. At the same time, English monolinguals and Chinese speakers, who had not had such experience with a shallow orthography, might have relied on their visual memorization skills more when they spelled, which explains why their spelling was affected by word frequency.

Additional evidence that orthographic depth may influence spelling processes comes from research on spelling strategies. Thus, in a study of English beginning spellers' strategies, Rittle-Johnson and Siegler (1999) found that in first grade children used a whole-word strategy (word retrieval) almost as often as a sound-out alphabetic strategy, whereas in the second grade, the use of the sound-out strategy significantly decreased, but the use of retrieval, as well orthographic

flapped.

rules, significantly increased. Reliance on larger-than-phoneme units, as demonstrated by the use of analogy, also increased. At the same time, Job, Peressotti & Mulatti (2006), who reviewed studies on literacy development in Italian, note that Italian children seem to rely mostly on sound-out alphabetic strategy up to grade 5 and that for these children, the onset of orthographic strategies use is delayed. Of course, a caveat is warranted here before any conclusions can be made: these studies were not designed for the purposes of cross-linguistic comparisons, therefore differences in the nature of tasks and stimuli used could have contributed to these cross-linguistic differences³ in spelling strategies use. However, the general pattern of results seems to be consistent with the idea that reliance on visual strategies and on units larger than phoneme is relatively more important for deep than for shallow orthographies. This is supported by the reports of spellers themselves. For instance, in a study by Durgunoğlu (2002), a Spanish-speaking student learning English said: “When you read or write some thing [*sic*], you just sound it out. When you do it [in] English, you have to remember” (Durgunoğlu, 2002, p. 197).

2.1.4. Predictability of Phonology-Spelling Correspondences

Deep orthographies also differ in how predictable the mismatches between sounds and spellings are. For instance, both English and Greek are feedback inconsistent orthographies where one vowel can have 6 different spellings. In English, /o/ can be spelled as <o_e>, as in *Coke*, <oa>, as in *boat*, <o>, as in *stroll*, <ou>, as in *soul*, and <ow>, as in *bow*, and <au>, as in *mauve* (Ziegler et al., 1997). In Greek, the vowel /i/ can be spelled as <ι>, <η>, <υ>, <ει>, <οι>, and <υι>; however unlike in English, morphological rules can disambiguate spelling of vowels in many cases (Harris & Giannouli, 1999).

Even though it has not been tested directly, it seems safe to suggest that an orthography

³ Unfortunately, Job et al. (2006) do not provide much information on the design of the studies investigating spelling strategies; the original studies are published in Italian.

where departures from one-to-one sound-spelling correspondences are predictable is easier to master than an orthography where those departures are more word-specific. In addition, one could also hypothesize that learners of orthographies that differ on predictability of spelling may adopt different spelling strategies: whereas for an unpredictable orthography like English word retrieval may be the most adaptive (e.g., Rittle-Johnson & Siegler, 1999), for an orthography where spelling-sound correspondences are more predictable and can be captured by rules, like in Greek or Russian, analytical strategies of spelling may be more useful. This hypothesis is yet to be empirically tested.

2.1.5. Nature of Inconsistencies in Phonology-Spelling Correspondences

There exist multiple sources of inconsistencies in sound-spelling mappings in orthographies. One of the sources is historical. While phonographic orthographies may originally have been devised to accurately reflect spoken language, the changes in spoken language usually occur faster than orthographies are reformed and therefore mismatches arise between spelling and sound. An example of this is palatalization of the Latin velar consonant /k/ in Romance languages. In classical Latin, /k/ could occur in front of any vowel and was spelled as <c>. Later, /k/ changed its quality before front vowels, evolving into /s/ in contemporary French, /tʃ/ in Italian and /θ/ in Spanish. However, the original Latin spelling <c> was preserved, creating an inconsistency in contemporary Romance languages: in French, for instance, <c> is pronounced as /k/ in *carotte* ‘carrot’, but as /s/ in *ciel* ‘sky’. Phonological processes like palatalization of Latin /k/ create *context-dependent* spellings, such that the spelling of a particular sound depends on preceding/following sounds/letters. In the example above, /k/ cannot be spelled as <c> in front of front vowels <i>, <e>, and <y> in French. (Similar contextual rules for spelling of /k/ also hold for English, where a large part of vocabulary is borrowed from Romance languages).

Another reason why inconsistencies in sound-spelling mappings exist is that in many orthographies, the *morphological* principle of spelling plays an important role. According to this

principle the identity of morphemes is preserved in spelling even when they are pronounced differently in different words. For example, in American English, words *writer* and *rider* have the same medial consonant sound (flap), but are spelled differently to reflect their morphological relationships with *write* [t] and *ride* [d] respectively. Of course, orthographic inconsistencies may be explained by both sound change and the morphological principle of spelling at the same time: e.g., *writer* and *rider* used to be pronounced differently (and still are in other dialects of English); the current English orthography does not reflect the sounds change, but also preserves the morphemic identity.

A third major source of inconsistency is loan words. When words are borrowed from a language using the same script as the borrowing language (e.g., English borrows words from French; both use the Roman alphabet), the original spelling of words is often preserved. If the source language has different phoneme-to-grapheme correspondence rules than the borrowing language, this will create inconsistency of spelling in the borrowing language. For example, in English /ʃ/ is typically spelled as <sh>, however in the French word *quiche* [kiʃ] it is spelled as <ch> because this is how it is typically spelled in French.

Whereas it is often the case that all three types of inconsistencies co-exist in the same language, orthographies of the world differ on what type of inconsistency is more prevalent and therefore which types of cues might be the most helpful to spellers. For instance, in Russian, morphology is one of the major sources of information for disambiguation between spellings, whereas phonological context plays a relatively unimportant role in disambiguating spellings. By contrast, in Germanic languages, e.g., in Dutch or Danish, orthographic rules based on context play an important role (e.g., Juul, 2005b; Van Berkel, 2005).

Do these cross-linguistic differences affect spelling acquisition? In fact, as Fischer et al. (1985) and Kessler & Treiman (2001) point out, it is one thing to demonstrate regularities in an orthography and another thing is to show that spellers actually take advantage of them. Research in individual languages has found that spellers do indeed develop sensitivity to spelling patterns

in their languages, such as morphological or contextual patterns.

Thus, a number of studies in different languages, such as Hebrew, Dutch, English, Danish, and Greek, have shown that without being explicitly taught them, spellers master some of the morphology based regularities in spelling (Bryant, Nunes, & Aidinis, 1999; Fischer et al., 1985; Gillis & Ravid, 2006; Harris & Giannouli, 1999;), although morphological principle of spelling is acquired later than the alphabetic principle (Bryant et al., 1999; Juul, 2005a; Juul & Elbro, 2004; Rispen, McBride-Chang, & Reitsma, 2008). For instance, English learners may notice that morphemes tend to be spelled the same way across words despite differences in pronunciation and this generalization helps them spell reduced vowels in words that have cognates with the vowel stressed, such as *grammar* (cf. *grammatical*) or *inspiration* (cf. *inspire*) (Fischer et al., 1985). Morphological awareness, the understanding of morphemic structure of words, has been shown to be associated with the ability to apply the morphological principle in spelling, so that people more sensitive to morphemic structure of words are better at using morphological spelling rules (Bryan et al., 1999; Figueredo & Varnhagen, 2004; Fischer et al., 1985; Siegel, 2008).

Similarly, spellers have also been found to develop sensitivity to context-driven orthographic patterns in orthographies where such patterns exist (Dich, 2010; Juul, 2005b; Perry & Ziegler, 2004; Treiman, Kessler, & Bick, 2002; Treiman & Kessler, 2006). For example, both L1 and L2 English learners have been shown to take advantage of the fact that consideration of the following consonant can help spell an ambiguous vowel in English (e.g., /o/ is always spelled <oa> when followed by <ch>, as in *coach*) (Dich, 2010, Treiman & Kessler, 2006). Little is known about the mechanisms and prerequisites for developing context sensitivity, however.

Because, as discussed above, orthographies differ on the prevalence of certain types of inconsistencies and therefore on the types of cues (e.g., morphological vs. orthographic) that are of most use for spellers, one could hypothesize that the ability to take advantage of certain cues also differs among spellers, depending on the orthography they learn. For example, one could

imagine that spellers learning an orthography such as Russian, Hebrew or Greek, where morphological rules are very important, develop better morphological awareness and the ability to rely on morphological cues than spellers of orthographies where morphology is somewhat less important, e.g., Dutch (Van Berkel, 2005).

This hypothesis is consistent with findings by Gillis & Ravid (2006). They compared Dutch- and Hebrew-speaking children on their ability to use morphological cues in spelling. Both Dutch and Hebrew have words the spelling of which is ambiguous. Morphological information can sometimes help resolve the ambiguities in both languages. The authors administered a spelling test containing such words to the participants and found that whereas Hebrew speakers did rely on morphological cues, the Dutch participants largely ignored morphological information. However, in this study characteristics of orthography are likely to have interacted with characteristics of spoken languages to produce the results. Not only morphological cues play a less important role in Dutch orthography than in Hebrew orthography, but also Dutch has a less rich morphological system than Hebrew. As the authors suggest, because of the salience of morphological processes in Hebrew, Hebrew speaking children may have better developed morphological awareness than Dutch speakers, which in turn enables Hebrew speakers to apply morphological strategies in spelling more successfully.

2.2. Cross-Linguistic Transfer in Acquisition of Spelling in a Second Language

Evidence discussed in the previous section shows that there are cross-linguistic differences in types of skills and knowledge involved in spelling acquisition. In other words, spelling in one language may be a different cognitive task than spelling in another language, suggesting that there exist language-specific requirements imposed on language learners acquiring literacy. This has important implications for second language literacy since the skills that a learner developed for spelling in L1 may not always be adequate, or sufficient, for spelling in L2. However, the data discussed so far also show that spelling acquisition does not rely *exclusively* on language-

specific skills.

Indeed, if learning to spell in a second language required a set of *completely* new skills, i.e., skills that had not been developed for spelling in L1, we would not expect to see differences in L2 spelling acquisition associated with learners' different L1 background: no matter what their first language is, all learners would have to acquire the same new set of skills that their L1 did not require. Similarly, we would not expect proficiency in L1 spelling to play a role in L2 spelling development. This is not what we see, however. As this section discusses, learning to spell in a second language that shares many orthographic characteristics with first language may sometimes be easier than learning to spell in an L2 that is very different from the L1. In addition, research has shown that correlations exist between L1 and L2 spelling skills, such that good spellers in L1 perform better on certain L2 spelling tasks than poor L1 spellers (Dich, 2010; Sparks, Patton, Ganschow, Humbach, & Javorsky, 2008; Sparks, Patton, Ganschow, & Humbach, 2009). These correlations are explained by the existence of *language-independent*⁴ factors of learning to spell (Cummins, 1981; Durgunoğlu, 2002). Indeed, certain types of skills and knowledge may be useful for spelling in more than one language; therefore if they have already been acquired when learning to spell in L1, they can be transferred across languages and

⁴ A distinction needs to be made here between the terms *language-independent* and *language-universal*.

When talking about types of knowledge and skills underlying spelling development, the use of *language-independent* rather than *universal* seems more justified for two reasons. First, if some type of knowledge or skills underlies spelling acquisition in more than one language, it does not mean that this type of knowledge or skills is universal: it may not be language-specific, but orthography-type specific. Second, as Caravolas (2004) puts it, the cross-linguistic research of spelling is still sparse: we simply have too little evidence as of now to be able to talk about universals in spelling development. Even phonological awareness, the factor that has been widely implicated in successful acquisition of literacy in various alphabetic orthographies, does not seem to be a universal requirement when spelling in Chinese is considered (e.g., Cheung et al., 2006).

applied to L2. Thus, the explanation for the facilitating effect of similarities between L1 and L2 on L2 spelling acquisition is that the learner may benefit from the transfer more if the two languages share a lot of orthographic characteristics and therefore call for similar types of knowledge and skills (Bialystok, 2002; Durgunoğlu, 2002; Figueredo, 2006, Geva, 2006).

To summarize, spelling acquisition in L2 appears to be a complex product of interaction between language-specific requirements imposed by L1 and L2 and the similarities between L1 and L2 that allow cross-linguistic transfer of skills underlying spelling development. The previous section described cross-linguistics *differences* along multiple dimensions and discussed how those differences make learning to spell different across languages. This section talks about *similarities* between languages and discusses how these similarities may aid (and sometimes interfere with) L2 learning through cross-linguistic transfer of knowledge and skills.

2.2.1. Transfer in L2 Learning

In the studies of second language acquisition, the concept of transfer is one of the most fundamental. It refers to learners' falling back to the knowledge of their first language, primarily in the initial periods of L2 learning, when their L2 knowledge and skills are deficient. For instance, L2 speakers with no solid knowledge of L2 grammar may use the syntactic structures of their first language to construct L2 sentences. Thus, Russian learners of ESL often violate the rule of inversion that applies to English interrogative sentence (i.e., the rule telling the speaker to put the verb in front of the subject in a question) because in Russian inversion is not required to form a question.

Transfer can be both positive and negative. In cases when there are similarities between L1 and L2, falling back to L1 knowledge can produce "correct" results in L2. For instance if ESL learners' native language uses inversion for question formation, they will be likely to form questions correctly in English. However, when L1 and L2 have differences, language transfer may lead to errors. Importantly, however, not all errors can be explained by transfer and

differences between L1 and L2 items and structures.

Both positive and negative transfer has been documented in literacy acquisition. The next section reviews the evidence on transfer in the development of spelling in L2.

2.2.2. Kinds of Linguistic Knowledge and Skills that L2 Learners Transfer from L1 When They Learn to Spell in L2

To recapitulate what was said in 2.1., learning to spell involves multiple types of skills and knowledge, with the specific set of skills varying across languages. For learners of alphabetic orthographies, those skills include phonological awareness and more specifically phonemic awareness, the knowledge of letter-sound correspondences, morphological awareness and the ability to rely on morphological cues in spelling, and context sensitivity. In addition, research on spelling has identified multiple strategies involved in skilled spelling, and some data suggest that the preference towards certain strategies may depend on the type of orthographic system. This section reviews what is currently known about the transfer of spelling skills and strategy preferences from L1 to L2.

Alphabeticity and phonological awareness transfer in L2 spelling acquisition. As discussed in the previous section, in an alphabet, letters represent individual phonemes, therefore phonemic awareness, the ability to segment words into phonemes, is an important factor in spelling in an alphabet. If both L1 and L2 use an alphabetic orthography, an L2 learner who has already developed basic literacy skills in L1 approaches spelling in L2 already equipped with some important knowledge. Such a learner already knows that letters represent phonemes and how to segment words into phonemes in L1. The phonemic awareness skills may be transferred across languages to benefit L2 spelling acquisition. Indeed, a number of studies have shown that phonological awareness in L1 contributes significantly to L2 reading and spelling proficiency when L2 is a language with an alphabetic orthography (Cardenas-Hagan, Carlson, & Pollard-Durodola, 2007; Durgunoglu, 2002; Sparks et al., 2008; Wang, Park, & Lee, 2006). For instance,

Sparks and colleagues (2009) studied L2 literacy skills in English native speakers learning three different foreign languages: French, German and Spanish. They found that both English spelling proficiency and English phonological awareness were important predictors of L2 spelling.

Are learners of L2 alphabetic orthography whose L1 orthography is also alphabetic at an advantage compared to learners whose L1 orthography is not alphabetic? In other words, do we know that the opportunity to transfer phonemic awareness skills across languages gives learners an edge in L2 spelling acquisition? Research shows that the answer is yes. To recapitulate the results of the study Holm and Dodd (1996), Chinese-speaking ESL learners from Hong Kong, who had never been exposed to an alphabetic orthography, scored worse on English pseudoword spelling (imitating spelling of unfamiliar words) than other ESL learners who had had experience with an alphabet, including Vietnamese students and Chinese students who had learned pinyin.

More evidence that prior experience with an alphabetic orthography gives L2 learners an advantage when they acquire literacy in a foreign language comes from studies by Schwartz and colleagues (Schwartz, Geva, Share, & Leikin, 2007). They compared bi-literate Russian-Hebrew bilinguals and mono-literate (Hebrew only) Hebrew-Russian bilinguals learning English as a foreign language on the performance in English reading and spelling tasks. The bi-literate children outperformed mono-literate children in pseudoword reading and spelling. This result was attributed to bi-literate children's better phonological skills gained from prior experience with an alphabetic writing system (Russian). The mono-literate participants lacked such experience since Hebrew is not an alphabetic orthography.

Script and transfer of phoneme-to-grapheme correspondence rules. Alphabetic orthographies of the world, sharing the same principle of one letter representing one phoneme, differ from one another on the script, i.e., the actual form of written symbols. For example, English, Russian, and Greek are all alphabetic orthographies, but the symbols representing the same phoneme look different: e.g., /n/ is represented as <n>, <H> and <v> respectively.

If a second language has an orthography that is based on the same script as the learner's L1

orthography, the learner can transfer the knowledge of the written symbols from L1 to L2. For example, unlike a literate Russian or Greek speaker a literate Spanish speaker approaches spelling acquisition in English already knowing the Roman alphabet, whereas the Russian and Greek spellers have to learn it. Would this put the Spanish speaker at an advantage? The most intuitive answer is yes. However, it seems that this prediction has not been tested directly. Such transfer of the knowledge of script brings about the transfer of specific phoneme-grapheme correspondence (PGC) rules -- the mappings between phonemes and the graphemes representing them in print. This type of transfer can have both a positive and a negative effect. When L1 and L2 shares PGC rules, (e.g., /s/ is spelled as <s> in both English and Spanish), the transfer of such knowledge may be useful. However, orthographies based on the same script often differ on PGCs. For example, in English, the consonant /ʃ/ is typically rendered as <sh>, whereas in German it is spelled as <sch>, and in Welsh it is spelled as <si>. These differences cause spelling errors in L2 due to PGCs transfer: for instance, German ESL students will erroneously spell /ʃ/ as <sch>, e.g., <stesch> for *station* (Luelsdorff, 1990), whereas Welsh students will misspell the same consonant as <s>, e.g., <sip> for *ship* (James, Scholfield, Garrett, & Griffiths, 1993). Such spelling errors are very common and have now been well documented (e.g., Cronell, 1985; Fashola, Drum, Mayer, & Kang, 1996; James et al., 2003; Luelsdorf, 1990).

Figueredo (2006) suggested that the knowledge of L1 PGC rules can impact L2 spelling learning only when L1 and L2 orthographies are based on the same script. It seems, however, that such a claim may not be fully accurate. There is some evidence suggesting that L1 PGC rules can influence L2 spelling across scripts. For example, Russian ESL learners have been documented to spell English diphthong /aɪ/ as <ai> (e.g., <haifen> for *hyphen*) (Dich, 2010). In English, such spelling is hardly ever used for this vowel (except for, maybe, word *aisle*). A possible explanation of this misspelling is that in Russian, letter <a> is used to denote /a/, which is similar in quality to the first part of English /aɪ/, and that this knowledge of sound-to-spelling correspondences in their native language interferes with Russian speakers' spelling in English

even though these two languages use different scripts. Additional evidence for cross-script transfer of PGC knowledge in L2 spelling comes from an analysis of Russian speakers' slips of the pen when writing English words (Dich, 2002), e.g., *have* misspelled as *habe* (Cyrillic <В> denotes /v/).

In sum, evidence regarding whether a common script aids L2 spelling acquisition and provides an advantage to L2 learners is mixed. First, the transfer of PGSs from L1 to L2 can be both useful and leading to errors depending on how different PGC rules are in L1 and L2. Second, it is not quite clear that PGC transfer occurs only across orthographies that share the same script.

Transfer of spelling strategies. Section 2.1. discussed evidence demonstrating that different orthographies may require reliance on different spelling *strategies*. Do spellers transfer strategies that they developed for L1 to spelling in L2 and can such transfer facilitate L2 spelling acquisition? Evidence that may help address this question is quite limited.

In the study by Holm and Dodd (1996), Hong Kong ESL learners performed worse on pseudoword spelling than other ESL groups, however no difference was observed in real word spelling. The authors' interpretation of the results was that Hong Kong spellers relied on visual strategies developed for L1 spelling (rote memorization) to spell English words. This example shows that even when the two orthographies are very dissimilar, L1 strategies may be helpful for mastering certain components of L2 spelling. Interestingly, however, supposedly better visual and rote memorization skills of Chinese L1 spellers (Hoosain, 1986) do not make them *better* than other ESL groups at real word spelling.

More evidence suggesting that spelling strategies are transferred across languages comes from studies of Spanish-speaking children literate in L1 who are learning to read and write in English (Durgunoglu et al. 2002; Fashola et al., 1996). In both studies Spanish children were reported to make more English spelling errors resulting from applying a sound-out strategy than English native speakers of the same age. At the same time, Faschola et al. (1996) report that the

number of other types of errors, which could not be explained by the application of sound-out strategy, was similar across the two groups of participants.

As discussed in Section 2.1., in a transparent orthography like Spanish, sounding out is an appropriate strategy leading to correct spelling. Familiar with this strategy from their spelling experience in L1, Spanish speakers transferred it to spelling in L2. However in English, such strategy is non-adaptive and English L1 spellers do not rely on it much beyond the first year of spelling instruction (Rittle-Johnson & Siegler, 1999). This example shows a negative effect of strategy transfer of across orthographies.

2.2.3. Levels of L1 and L2 Proficiency and their Interaction with Cross-Linguistic Transfer

According to researchers of bilingual literacy, the extent to which spellers transfer the knowledge about their L1 orthography when they learn to spell in L2 depends on how solid their knowledge about L2 orthography is: the more proficient in L2 the learners are, the less they rely on their L1 knowledge (e.g., Figueredo, 2006; Lefrancois, 2001). For instance, Zutell and Allen (1988) administered a spelling test to 2nd - 4th Spanish speaking ESL learners and found that the stronger the students' orthographic skills in L2 were, the fewer errors attributable to the transfer of Spanish knowledge they made. Even though this suggests that the effects of transfer fade over time as L2 learners become more proficient in the second language, it is not clear from current research if these effects completely disappear at any point of second language development and if not, how prevalent the errors attributable to native language orthographic knowledge are in proficient L2 learners.

Little is also known about how long lasting the transfer of spelling strategies is. Do proficient spellers abandon their L1 spelling strategies altogether as they acquire strategies that are required by the L2 orthographic system or can the effect of L1 strategies also be observed in proficient spellers? The findings by Holm and Dodd (1996) suggest that the reliance on L1 strategies may be seen in proficient L2 speakers: in fact, their Hong Kong ESL learners, who were reported to

rely on their memorization strategies developed for spelling in Chinese, had on average 15 years of English literacy exposure, had spent on average 5 years in an English speaking country (Australia) and had the level of English proficiency sufficient to study in a college. However, because this seems to be the only study that addresses spelling strategies in proficient ESL speakers, it is hard to make any generalizations about the persistence of L1 spelling strategies: it may as well be the case that when L1 and L2 are closer to each other than English and Chinese, it is easier for spellers to adopt strategies required by L2 and stop relying on their L1 strategies. In that case, we would not see much of strategy transfer effects in L2 spelling in proficient L2 speakers.

Related to the issues of L2 proficiency are the questions of age of L2 acquisition onset and the way L2 is taught. Even though the question of age of acquisition has not been explored with relation to L2 spelling, research in other aspects of bilingualisms has identified age of L2 acquisition onset as an important variable. In general, it has been suggested that younger learners have better chances of attaining native-like proficiency in L2, which also means having less influence of L1 on L2, such as L1 accent, for instance (see, e.g., Hyltenstam & Abrahamson, 2000, for a review). One can imagine that the same relationship holds for literacy skills: the later an L2 learner starts reading and writing in his/her second language, the more well-practiced his/her literacy skills in L1 are likely to be and the more they are likely to be transferred and exert influence on L2 literacy acquisition (Figueredo, 2006). Thus we should expect to see more transfer of L1 knowledge and skills in late L2 learners; cross-linguistic differences in L2 spelling skills should also be more easily observable among individuals who started to learn their L2 late.

The way L2 is taught also seems likely to influence the mechanisms of L2 spelling. Even though this is not confirmed empirically, it can be hypothesized that being taught to read and spell in a second language by a native speaker together with other native speakers (e.g., an immigrant child attending a school with English language instruction in the U.S.) might yield different results than being taught to read and spell in L2 by a non-native speaker, in the context

of foreign language instruction. In the former case, the learner is less likely to be explicitly aware of the differences between the two languages and their writing systems; as this thesis will argue further, explicit awareness of linguistic phenomena is an important factor in L2 literacy development.

Studies suggest that not only written L2 proficiency, but also oral proficiency, in particular foreign contrast discrimination, play a role in L2 spelling development. For instance, Cook (1997), who analyzed ESL spellers' errors, notes that Japanese ESL students substitute <l> by <r> and vice versa in English words, which results in spellings like <familiality> instead of *familiarity*, or <grobal> instead of *global*. No other group of ESL students was found to make such mistakes. These mistakes are explained by the phonological properties of Japanese: in Japanese, the contrast between /l/ and /r/ is not phonemic, unlike in English where these two sounds can distinguish between words. Japanese students have previously been shown to have difficulties with the perception of this English phonemic contrast (Miyawaki, Strange, Verbrugge, Liberman, Jenkins & Fujimura, 1975). Thus, their spelling errors reflect their difficulties with oral language rather than with a particular orthography.

Another example of errors caused by differences in L1 and L2 phonologies is provided by Ibrahim (1987), who showed that Arabic students sometimes substitute for <p> when they spell in English (e.g., <bicture> instead of *picture*). Such errors are caused by the lack of /p/ sound and therefore of the /p/ - /b/ contrast in Arabic.

Feroli (1991, as cited in Lefrançois, 2001), who tested writing skills in 2nd and 3rd grade Spanish speaking children learning English, found that oral English competence predicted orthographic skills in English in these children. Supporting the role of oral language proficiency in spelling, Seeff-Gabriel (2003), who studied English spelling abilities in adolescents learning English as a second language, found that their spelling improved as their discrimination of non-native contrasts improved: as the participants were able to hear the sounds correctly, they were better able to spell them correctly. This study shows how developing oral L2 proficiency can

reduce the effects the difference between L1 and L2 phonological systems on L2 spelling. However, it remains unclear from these studies whether development of L2 oral proficiency per se affects changes in L2 spelling strategies.

In addition to L2 proficiency, L1 skills may also be a source of individual differences among L2 spellers. Research in L1 spellers has shown that not only in children, but also in adults, a lot of variability exists in spelling skills (Burt, 2006; Fischer et al., 1985; Shankweiler, Lundquist, Dreyer, & Dickinson, 1996). In addition, in children, as well as in adult fully proficient L1 speakers, there is a large amount of variability in the degree of phonological awareness and morphological knowledge (Allyn & Burt, 1998; Burt, 2006; Fischer et al., 1985). Because L1 spelling skills and L1 oral skills, such as phonological awareness, have been found to be correlated with L2 spelling (Bialystok, 2002; Durgunoğlu et al., 2002; Sparks et al., 2008, 2009), the sources of individual differences in L1 spelling and oral skills may also contribute to the variation among L2 spellers, even if they are adults.

2.3. Summary and Literature Critique

The literature reviewed in this chapter discussed cross-linguistic evidence on the cognitive prerequisites of spelling acquisition and the evidence for cross-language transfer in learning to spell in L2. To summarize, the degree of complexity of writing systems and the principles on which writing systems are based determine the set of skills necessary to master literacy and thus shape the cognitive processes of reading and spelling, resulting in cross-linguistic differences in cognitive skills and strategies involved in spelling in different languages. The largest differences are observed between learners of alphabetic and non-alphabetic writing systems: while mastering a logographic writing system requires sophisticated visual skills, for phonographic writing systems, including alphabets, phonological awareness – the ability to segment the sound stream into phonological units, e.g., syllables and phonemes – seems to be the fundamental skill underlying literacy.

However, even within the family of alphabetic languages, cross-linguistic differences in cognitive mechanisms of reading and spelling exist. The differences that have been identified thus far are mainly related to the dimension of *orthographic depth* or *transparency*. Learners of transparent orthographies have been shown to learn to spell faster than learners on opaque orthographies. One of the hypothesized reasons of why this is so is that learning transparent orthographies promotes phonological awareness, the fundamental skill underlying alphabetic literacy, in a more efficient way than learning opaque orthographies.

Another reason why opaque orthographies take longer to learn is that they require skills besides the mere ability to segment words in phonemes and convert them into letters. Psycholinguistic Grain-Size Theory suggests that because in opaque orthographies letter-sound correspondences are inconsistent, spellers have to develop the ability to learn phonology-orthography correspondences for units larger than phonemes and to employ strategies involving different grain-size levels. Cross-linguistic evidence from reading supports this idea.

The types of units that spellers have to learn to rely on in opaque orthographies depend on the type of orthography, more specifically on the principles underlying the rules of sound-spelling correspondences. If rules are morphology-based, morphological awareness skills and the ability to rely on morphemic units in spelling are necessary. If rules are context-based, context-sensitivity skills need to be developed and the size of units that the speller will need to rely on will depend on the type of context that constraints spelling. Limited empirical evidence exists suggesting that the more a certain type of rules is prominent in an orthography, the better spellers are at relying on the linguistic units which that type of rules involves, so that if orthographic rules are primarily morphology based, spellers are better at relying on morpheme-size units than if the dominant type of rules is context-based.

Finally, learners of opaque orthographies deal with many more irregularly spelled words that need to be memorized as a whole than learners of transparent orthographies where letter-sound correspondences are regular. Accordingly – consistent with the Orthographic Depth Hypothesis

(Katz & Frost 1992) – evidence shows that visual whole-word spelling strategies play a more important role for opaque orthography learners than for transparent orthography learners, who rely more on sound-out strategies.

To sum up, learning to spell in alphabetic orthographies, in addition to phonological awareness skills, may involve morphological awareness skills, context sensitivity and whole-word memorization. The extent to which these skills are needed and the degree to which they are developed in learners and used as spelling strategies are determined by the characteristics of the writing system being learned.

Cross-linguistic research also shows that when individuals learn to spell in a second language, they transfer some of the skills that they developed for their native language. Such cross-linguistic transfer may be beneficial: for instance, the phonemic awareness training provided by acquisition of alphabetic literacy in L1 benefits spelling development in an alphabetic L2 allowing the learner to succeed in tasks requiring phonological skills. At the same time, the transfer from L1 can also lead to errors, e.g., when L1 PGC rules not valid in L2 are applied to L2.

Transfer of phonological awareness and of L1 PGC rules are the two aspects that research in L2 spelling acquisition has been mostly focused on so far and for which the most evidence has been gathered (see, e.g., Figueredo, 2006, for a review). Very little, however, is known about whether and how spellers transfer other types of literacy related skills and strategies, e.g., morphological skills, context sensitivity and their whole-word visual strategies. The goal of the present work was to gather empirical evidence that would help to address these questions.

CHAPTER 3

RATIONALE AND DESIGN

3.1. Research Questions

The research goals of the study were to gain a better understanding of cross-linguistic transfer in the acquisition of second language spelling. As our understanding of skills involved in native language spelling improves, questions arise regarding how these skills may aid learners in second language spelling acquisition. It has long been known that phonological awareness is involved in literacy in any alphabetic language and that it can be transferred across languages. Research has also identified other components of spelling proficiency: morphological awareness skills, which allow learners to efficiently pick up on morphological spelling cues, context sensitivity, which helps spellers consider phonological units larger than phoneme when such phonological contexts conditions spelling, and finally whole-word processing. Little is known, however, about how these other components of spelling proficiency in L1 can be used when a second language is learned.

As the previous chapter discussed, the extent to which different components of spelling proficiency are developed in L1 spellers seems to depend on characteristics of a particular orthography. The present study uses these cross-linguistic differences in order to investigate how different aspects of spelling proficiency transfer across languages. One way to test whether or not certain linguistic ability or knowledge can be transferred from L1 to benefit L2 learning is to compare learners of the same L2 from different L1 backgrounds, such that proficiency in one of them requires this particular ability/knowledge and proficiency in the other one does not. To illustrate the logic of such a study, let's return to the example not related to literacy: the use of the articles "a" and "the" in English. Suppose we are interested in whether the ability to use articles correctly can be transferred across languages. We recruit two groups of learners of

English as a second language – e.g., French and Russian native speakers. Like English, the French language has definite and indefinite articles and therefore French speakers have to learn how to use them when they learn their native language. The Russian language does not have articles and therefore Russian speakers never learn to use them when they acquire their native language. We ask our subjects to insert appropriate articles in an English text where all articles have been omitted. If we find that French participants do that better than Russians, then, provided that we have controlled for other possible variables that might have influenced the results, we can conclude that the French speakers must have relied on their knowledge of how to use articles that they developed for their native language, and that this knowledge can be transferred across languages.

The exact same logic was used in designing the present study, which compared phonological skills, whole-word processing skills, morphological skills and context sensitivity skills in learners of English as a foreign language coming from three different native language backgrounds: Danish, Italian, and Russian. As explained further in this section, all of the above mentioned skills can be helpful when spelling in English, while the three first languages chosen for this study differ in how well they “train” these skills in spellers.

3.2. Hypotheses of the Study

Orthographic Depth Hypothesis (Katz & Frost, 1992), which has been partially supported by empirical evidence from spelling, suggests that opaque orthographies promote the development of whole-word processing skills, whereas learners of shallow orthographies rely more on phonological skills and use sound-out strategies in spelling. The first hypothesis of the present study states that L2 learners will transfer their spelling strategies to L2 and the prediction following from this hypothesis is that L2 learners whose L1 orthography is opaque will be more successful in L2 irregular word spelling because their L1 whole-word strategies will help them learn L2 irregular words. On the other hand, the sounding out strategies which are useful in a

shallow orthography will result in negative transfer in L2 learning when it comes to L2 irregular word spelling, where these strategies are not adaptive.

At the same time, the reliance on phonological skills, that have been shown to be better promoted by shallow orthographies (e.g., Caravolas, 2004), will be helpful in the L2 spelling tasks that require accurate phonological processing, e.g., unfamiliar word spelling. Thus the prediction is that the transfer of sound phonological skills will put L2 learners whose L1 orthography is shallow at an advantage when it comes to unfamiliar word processing.

The Psycholinguistic Grain Size Theory (Ziegler & Goswami, 2005, 2006) postulates that in opaque orthographies, in addition to sound-to-spelling correspondences at the level of letter/grapheme, spellers learn correspondences at larger unit levels. As discussed in Chapter 2, the nature and size of the units depends on the nature of rules in the particular orthography. Thus, morphology-based orthographies promote the awareness of and spelling strategies based on *morphemes*, orthographies with context-based rules promote the awareness of units corresponding to the context that can condition spelling (e.g., rhymes in English). Another hypothesis of the study is that L2 learners can transfer the ability to consider larger-than-phoneme units in spelling, and thus individuals whose L1 orthography is opaque will be better able to do it in L2 than individuals whose L1 orthography is shallow, but the nature of the units that L2 learners will rely on will be determined by the nature of their L1 orthographic rules. L2 spellers whose L1 orthography requires attention to morphological structure of words are expected to transfer their morphological skills across languages and to outperform other L2 learners in spelling words where morphology can disambiguate spelling. At the same time, spellers whose L1 orthography requires knowledge of context-sensitive spellings will transfer their ability to pay attention to context and will be better than other L2 spellers at using contextual cues when spelling in English.

3.3. Design

3.3.1. Languages Chosen to Test the Hypotheses of the Study

The present study tested L2 spelling skills in learners of English as foreign language from three different first language backgrounds: Danish, Italian, and Russian. This section discusses the characteristics of the four orthographies and the skills needed to spell in them.

English. English orthography is a phonographic orthography and therefore, the acquisition of English spelling, just like the acquisition of any other writing system where symbols map onto sounds, requires developing phonological skills or *phonological awareness*. Indeed, multiple studies have found that phonological skills are an important predictor of spelling in English, not only in children, but also in adults (e.g., Allyn & Burt, 1998; Burt, 2006; Burt & Butterworth, 1996).

Further, English orthography is an opaque (deep) orthography, where multiple letters can map onto one sound and vice versa. Thus, according to the discussed above *Orthographic Depth Hypothesis* (Katz & Frost, 1992), whole-word memorization plays an important role in proficient English spelling. Indeed, the spelling of many English words does not follow any rules and has to be memorized. In fact, there are so many of these words that whole word-retrieval has been shown to be the most successful strategy for spelling in English and good English spellers have been found to rely more on word retrieval (accessing the spelling of the whole word from memory), whereas poor spellers rely more on backup analytical strategies (Figueredo & Varnhagen, 2004; Holmes & Malone, 2004; Rittle-Johnson & Siegler, 1999).

However, there are also a lot of words in English whose spelling follows certain regularities. There exist both context-based and morphology-based regularities in the English orthography (see e.g., Chomsky, 1970; Venezky, 1999). Thus, the identity of a morpheme is often preserved in spelling even when its pronunciation differs across words, for instance: the final <n> in *hymn* is not pronounced, but it is preserved in spelling reflecting the connection between *hymn*, *hymnal* and other morphologically related words where /n/ is pronounced. Paying attention to

morphological cues can help spellers in many instances, such as this. In addition, morphological cues can often help with spelling of double consonants in English. For instance a morphemic analysis is needed in order to decide whether words like *overrule*, *overeat*, *hilly* and *oily* are spelled with one or two consonants. Just like phonological awareness, morphological skills have been shown to be a predictor of spelling proficiency in English (Bryan et al., 1999; Figueredo & Varnhagen, 2004; Fischer et al., 1985; Siegel, 2008).

Further, there are many spelling regularities in English that are based on context. For instance, Kessler & Treiman (2001) demonstrate that in monosyllabic English words, coda (word-final consonant or consonant cluster) can constrain the spelling of the vowel (e.g., /e/ is more likely to be spelled as <ai> than as <a_e> before <n>, as in *plain*). Thus sensitivity to such regularities can be helpful for spelling in English and it has been found that this sensitivity correlates with other aspects of English proficiency (e.g., Dich, 2010; Treiman & Kessler, 2006).

To summarize, English orthography, which is an opaque alphabetic orthography, requires that proficient spellers not only possess phonemic awareness and the knowledge of letter-sound correspondences at the level of phoneme, but also morphological skills, sensitivity to contextual orthographic patterns, and finally, whole-word memorization skills. Thus it allows testing the transfer of all these components of spelling proficiency in learners of English as second language. The three L1s chosen for the study differ on how well they “train” these components of spelling proficiency in native language speakers. Thus, the EFL learners from the three different backgrounds studied in the present work likely approach the task of mastering English literacy with different sets of skills already in place and possess different opportunities to rely on their first language expertise.

Italian. On the continuum of orthographic depth (e.g., Katz & Frost, 1992), Italian orthography is very close to the “shallow” extreme. Almost perfect one-to-one correspondences exist between letters and sounds, although there are a few exceptions. A small number of sounds have more than one spelling, but the choice between those spellings is determined by very simple

and consistent rules (Job, Peressotti, & Mulatti, 2006). For instance, [g] is rendered as <g> before <a>, <o>, <u> and consonants, but as <gh> before <i> and <e>.

Thus, phonetic (sounding out) strategies - simply converting sounds into letters one by one - is an effective spelling strategy in Italian, and learners do not need to memorize spellings of whole words.

Several properties of Italian phonology and morphology will also be important for further discussion. Thus, Italian phonology has a number of phonotactic rules that impose multiple restrictions on the co-occurrence of consonants in consonant clusters. The maximum number of consonants in a cluster is three, and the number of consonant combinations permitted in the language is very limited.

Italian has rich morphology, meaning that there exist a lot of inflected word forms; however, because the pronunciation of the same morpheme tends to be consistent across words and because letter-sound relationships are so consistent in Italian, in order to spell correctly it is not necessary to analyze the morphological structure of words.

Danish. Danish is closer to the opposite end of the orthographic transparency continuum. Danish orthography is a very archaic one; it does not reflect a large number of sound changes that occurred in Danish after the current spelling norms were instituted. Thus a large number of inconsistencies between sound and spelling exist (Elbro, 2006). Many of the sound changes were restricted to certain positions, giving rise to complex context-dependent spelling patterns. To illustrate such patterns, it may be useful to give an analogy from English. Just like in Danish, in English consonants sometimes condition the spelling of the preceding vowel (Kessler & Treiman, 2001). For instance, /e/ can be spelled multiple ways in English: *way, fate, wait, weight*; however, before <nt> this vowel is most often spelled as <ai>, as in *paint*. Learners of Danish are required to develop sensitivity to such context-driven patterns. And indeed, knowledge of context-sensitive spellings is associated with spelling ability in Danish (Juul, 2005b). Adding to inconsistencies caused by sound change, Danish has a lot of loan words

borrowed in their original spelling. As the result, some Danish phoneme-grapheme correspondences are only valid for loan words, e.g., spelling of [o] as <au> only in words of French origin.

A small number of cases exist in Danish where morphological knowledge can help disambiguate between homophone spellings. For example, Danish verbs with stems ending in /r/ sound the same way in the infinitive and the present tense form with the inflection pronounced as [ʌ] (e.g., *stirre* ‘to stare’ and *jeg stirrer* ‘I stare’). The correct spelling of such homophones requires the knowledge of parts of speech and word forms. There is not much research on how Danish speakers learn morphologically conditioned spelling, but from the available data (e.g., Juul & Elbro, 2004) it appears that these spellings present problems for students and may not be fully mastered until as late as 10th grade. Finally, multiple word-specific irregular spellings exist in Danish, which have to be memorized as whole words.

Importantly for further discussion, the phonotactic properties of Danish are different from Italian in that there are fewer restrictions on consonant clusters: higher number of consonants can co-occur in one cluster and there are fewer constraints on which consonants can be combined.

Russian. Russian orthography has a somewhat intermediate position between the shallow Italian and the opaque Danish orthographies. Last reformed in early 20th century, Russian orthography is more consistent with the contemporary phonology of the language and therefore more predictable than Danish. At the same time, sound-to-spelling correspondences are less consistent in Russian than in Italian. Russian does not have many historical spellings that reflect the ancient pronunciation. Context-sensitive spellings, where the spelling of the vowel would be condition by a following consonant, like in English or Danish, are non-existent in Russian. A major source of complexity in Russian orthography is morpho-phonemic alternations, which are not reflected in written language. In other words, the pronunciation of the same morpheme is very often inconsistent across words, while its spelling is consistent. In particular, two processes are not reflected in the written language:

- 1) The word-final devoicing and the regressive assimilation in voicing of consonants. Only voiceless consonants occur in Russian word-finally and before another voiceless consonant. Only voiced consonants occur before other voiced consonants. These phonotactic rules bring about morpho-phonological alternations. For example, due to the assimilation processes, the prefix v^5 - ‘in’ is pronounced as [v] before voiced consonants, e.g., *vdoh* (‘inhale’), but as [f] before voiceless consonants, e.g., *vhod* (‘entrance’). These differences in pronunciation are not reflected in spelling: the prefix is spelled as <v> across all words that have this prefix.
- 2) The reduction of vowels in the unstressed position. There are five contrastive vowels in Russian: /a/, /o/, /u/, /i/, and /e/⁶. Under stress, all these vowel phonemes are pronounced distinctly, but in the unstressed position, /o/ is pronounced the same way as /a/, and /e/ is pronounced the same way as /i/. The vowel reduction also brings about morpho-phonological alternations. For instance, the morpheme *vod*- ‘water’ is pronounced as [vʌd] in *voda* (nominative singular), where it is unstressed, but as [vod] in *vody* (nominative plural), where it is stressed. However, the morpheme is spelled with an <o> regardless the position of the stress.

From the examples above it is clear that Russian spelling preserves the identity of morphemes rather than reflects the actual pronunciation. This often creates ambiguities in spelling, which can be solved if a reference is made to morphologically related words or inflected forms of the same word. For instance, the spelling of an unstressed vowel in *voda* (<a> vs. <o>) can be determined if one considers another form of this word – *vody* – where the vowel is stressed and its spelling is straightforward.

⁵ Russian examples are given in Roman transliteration.

⁶ According to some descriptions, there are six vowel phonemes in Russian. The phonemic status of /i/ is debated (Kodzasov & Krivnova, 2001). It has a separate letter in the alphabet, but is in almost perfect complimentary distribution with /i/.

Spelling ambiguities occurring in word endings are harder to solve. For example, the word *dacha* ‘summer house’ is spelled differently in the genitive and dative case forms: *dachi* and *dache* respectively, but the pronunciation is the same (with an [i] at the end). In order to spell such words correctly, the explicit knowledge of noun cases is needed.

In addition, the morphological principle of spelling motivates the spelling of some silent letters. For instance, in the word *solnce* [‘sontsə] ‘sun’ the *l* is not pronounced, however it is preserved in spelling because it is pronounced in other words with the same root, e.g., *solnechnyj* [‘soln’itʃnɨj] ‘sunny’.

Thus, like Italian, Russian has rich morphology, but unlike Italian speakers, Russian speakers need to learn to be aware of morphological forms in order to spell correctly because morphology plays the most important role in conditioning spellings in Russian.

Not all spellings can be disambiguated using morphology-based rules in Russian. Some spellings, such as those of borrowed words or old words, are not explained by any rules and require rote memorization. For instance, in a loan word *periferija* [p’ir’iɸi’i’r’ijə] ‘periphery’, the first three vowels are unstressed and pronounced as [i] and therefore, unless the speller knows Greek, the spelling of this word has to be memorized as a whole.

Finally, of all the three languages, Russian has the most relaxed phonotactic rules with the largest amount of consonant permutations allowed.

3.3.2. *Specific Predictions of the Study*

To sum up, speakers of Italian are the group of EFL learners whose first experience with print is in a shallow orthography where sound-letter correspondences are consistent and phonetic spelling strategies are adaptive. Danish and Russian speakers are two groups who first learned to spell in an opaque orthography. Thus, unlike Italian speakers, Russian and Danish speakers were required to learn sound-spelling correspondences for units larger than phonemes and to learn to memorize whole word spellings in order to become proficient spellers in their native language.

The differences between Danish and Russian are that the Russian orthography is more regular and the majority of Russian spelling rules are morphology-based, promoting morphological awareness in spellers. In Danish, on the other hand, a number of complex context-based spelling regularities exist, which do not exist in Russian, promoting context sensitivity in Danish spellers.

Based on these specific characteristics of the four languages, the following predictions about the transfer of components of spelling proficiency in EFL learners were made.

- (1) If the ability to memorize whole word spellings and whole-word strategies are transferred across languages, Russian and Danish EFL learners will outperform Italian learners on tasks testing memory for word-specific English spellings because, unlike Danish and Russian orthography, Italian orthography does not promote whole-word strategies.
- (2) If morphological awareness and morphological spelling strategies are transferred across languages, Russian speakers should outperform the other two EFL groups in tasks requiring morphological awareness because learning to spell in Russian promotes relying on morphology.
- (3) If context sensitivity, more specifically using rhymes as spelling units, is transferred across languages, Danish speakers should be better than other EFL learners at English spelling tasks requiring context sensitivity at the level of rhyme because Danish is the only one of the three languages where rhyme phonological context is a major source of information for disambiguating between spellings.
- (4) Finally, Italian and Russian speakers, who first learned to read and write in an orthography that is transparent in at least one direction – which is supposed to promote phonological skills (e.g., Caravolas, 2004) – were expected to outperform Danish spellers on tasks relying on phonological skills, such as unfamiliar word (pseudoword) spelling.

3.3.3. Methodology Overview

To test the prediction of the study, the three groups of adult EFL learners: Danish, Italian, and Russian were administered four English spelling tasks measuring four different aspects of English spelling proficiency: memory for word-specific (irregular) spellings, sensitivity to morphological structure of words, sensitivity to orthographic patterns at the level of rhyme (context sensitivity) and unfamiliar (pseudoword) word spelling. In addition, a group of educated adult English native speakers was tested using the same tasks in order to obtain a baseline spelling performance against which EFL learners' performance could be assessed.

In addition to spelling tasks, the participants were administered a questionnaire, the purpose of which was to control for the variables that affect L2 spelling, namely L2 proficiency and ways of L2 acquisition, L1 spelling proficiency, knowledge of foreign languages and linguistic curiosity.

As discussed in Chapter 2, L1 and L2 proficiency, the age when learners started acquiring L2 and the method of L2 acquisition may all interact with cross-linguistic transfer. In addition to L2 proficiency variables, amount of reading (Burt, 1996), knowledge of foreign languages (Carlisle, 1993, Dich, in preparation) and linguistic curiosity (Dich, in preparation) have been shown to predict spelling performance; therefore questions were also included to control for these variables.

The design of the tasks and the questionnaire was based not only on the review of previous literature, but also on the results of a pilot study done in the preparation for the present study. The purpose of the pilot project was to confirm that all task instructions were clear for the participants and that the tasks were neither too difficult nor too easy for the target population. Based on the results of the pilots study and the feedback that some participants kindly provided, the difficulty of the tasks was adjusted. The details of the methodology are discussed in the next chapter.

CHAPTER 4

METHOD

This chapter presents the methodology of the study, starting with the description of the four spelling tasks and the criteria for stimuli selection (4.1.). Further, the procedure of the study is outlined (4.2.). Finally, the last section of the chapter (4.3.) discusses the criteria for participant selection and describes the participant sample of the present study.

4.1. Tasks and Materials

4.1.1. Task 1: Memory for Word-Specific Spellings

Task 1 tested irregular word spelling. According to prediction (1) of the study, Italian participants were expected to make more errors in spelling irregular English words than the other two EFL groups.

The task consisted of 30 commonly misspelled irregular English words. The following criteria were used for creating the list:

- Breaking the words up into morphemes or using analogies with words that sound similar would not help to deduce the correct spelling of the words.
- The words were not direct borrowings from Danish, Italian (Latin), or Russian.
- The words had familiarity ratings higher than 6.5 on the 7-point scale (the familiarity estimates were taken from Nusbaum, Pisoni, & Davis, 1984)

The words were selected from four databases available online: About.com (n. d.), Ballard (n. d.), LoveToKnow, Corp. (n. d.), and WWW.ESLDesk.com (n.d.). Examples of words for Task 1 include: *Wednesday*, *neighbor*, *pigeon*. The complete list of words is given in the Appendix.

The task took a form of spelling to dictation: participants were instructed to listen to the

recorded list of test words and type them as they listened. Each word was spoken twice on the recording, by two different speakers.

The recording of the words was made in a sound proof booth with a Marantz PMD660 digital sound recorder and Electro-Voice RE-20 microphone at a sampling rate of 44 kHz and with 16-bit conversion. Two female speakers recorded the words. Both women were born and currently live in the North-Eastern part of the United States (Massachusetts and Pennsylvania) and both have General American pronunciation.

Participants were asked to revise their spelling after the recording was over, to mark the words whose meaning was unfamiliar to them with a question mark, and to make any other comments about words or the task if they wished to. The screenshot of Task 1 is given in the Appendix.

After participants spelled the whole list of words, revised their spellings and submitted their answers, a screen appeared on which participants could see their answers next to the correct spellings.

4.1.2. Task 2: Morphological Awareness

Task 2 tested spellers' ability to use morphological cues in spelling. Prediction (2) of the study stated that Russian speakers would show superior morphological skills than the other two EFL groups.

Spellers' ability to reflect on morphological structure of words and use morphological information in spelling was tested using a list of morphologically complex words. The property of each word in the list was that breaking the word up into parts or thinking about morphologically related words would help deduce the correct spelling. The spelling problems included in Task 2 were of three kinds:

- Double vs. single consonants at the morphemic boundary, e.g., *typical-ly* vs. *crazi-ly* or *mis-spell* vs. *mis-apply*. The correct spelling of these four words with double or

single <l> and <s> respectively can be deduced by analyzing the morphemic structure of these words. There were 24 words in which participants had to choose between a single vs. double consonant.

- Ambiguity in spelling that can be resolved by reference to morphologically related words. For instance, considering the word *breathe* may help spell the vowel in *breath* correctly; the /ʃ/ in *cognition* can be spelled as <t>, <sh> (as in *fashion*), <ss> (as in *mission*) or <c> (as in *suspicion*), but the right choice can be made if one considers a related word, e.g., *cognitive*.
- Presence vs. absence of a word-final silent <n>. There were four words in the task ending in /m/. In two of them, the word-final /m/ was spelled as <m> (*atom*, *emblem*), in the other two, it was spelled as <mn> (*solemn*, *column*). The choice between the two spellings could be made if one considered other words with the same root (e.g., *columnist*, but *atomic*).

The words included in the list either did not have cognates in Danish, Italian, or Russian, or had cognates in all the three languages.

Task 2 was a 'fill in the gaps' test. For each word, participants needed to supply missing letters. The letters were omitted from the segment of the word where morphological analysis could be applied to deduce the spelling (i.e., double consonants at morphemic borders, silent letters, and ambiguous consonants and vowels). Participants were asked to listen to each word before they filled in the gap by pressing a “play” button, located next to each word. If participants did not know a word and could not guess its meaning, they were asked to leave the gap blank. The complete list of words and the screenshot of Task 2 is given in the Appendix.

After participants filled in all the gaps and submitted their answers, they could see the correct spellings on the next page and compare them to the spellings they submitted.

Even though morphological cues can be helpful in spelling words in Task 2, one can also spell the words from memory without applying any morphological analysis. In order to find out,

whether participants relied on morphological cues at all, on the screen following the correct answers they were asked to describe what particular strategies, if any, they used to complete Task 2.

4.1.3. Task 3: Context Sensitivity

Task 3 tested spellers' context sensitivity – the knowledge of context-driven spelling regularities in English. According to prediction (3) of the study, Danish speakers should be better than other EFL spellers at English spelling tasks requiring sensitivity to rhyme context.

As discussed earlier, phonological context of the rhyme often conditions spellings of vowels in English and therefore paying attention to the context can often help choose the correct spelling when an ambiguity exists. For example, the vowel /e/ can be spelled multiple ways in English: *day, take, plain, weight*, etc. However, before <nt> this vowel is most typically spelled as <ai>, as in *paint*. The knowledge of this particular spelling regularity will help spell words ending in /ent/ correctly.

Context sensitivity was tested using a list of 32 monosyllable pseudowords that rhymed with existing English words. There were two groups of pseudowords: experimental and control.

The *experimental* pseudowords were designed in such a way that the vowel would have two competing spellings. One spelling would be the most typical spelling of the vowel across all monosyllable English words. The other would be the only possible spelling of the vowel within the context of the particular rhyme. In all the rhymes selected for the experimental words, these two spellings were not the same. For example, the most frequent spelling for the vowel /o/ across all monosyllable words is <o_e>, as in *stone*. However, in words rhyming with *coach* such spelling of the vowel (i.e., <oche>) is impossible; <oa> is the most typical spelling of the vowel in these words. Thus, for the pseudoword /foʊtʃ/ the spelling <foche> would have the most typical spelling of the vowel, but would not conform with English spelling regularities on the rhyme level, whereas the spelling <foach> would be consistent with these regularities.

Each control pseudoword was matched with an experimental pseudoword on the onset and the vowel, but had a different coda, one that does not condition the spelling of the vowel. That is, in control words, the most frequent spelling of the vowel would also yield the most typical spelling of the rhyme. For example, words rhyming with *hope* are most typically spelled with <o_e>, which is also the most typical spelling of the vowel /o/ across all English monosyllables.

For each pseudoword, participants were presented with two spelling options, one of which would have the most typical spelling of the vowel across all monosyllables and the other would have a less typical spelling of the vowel. In case of the experimental words, the first spelling would not conform to spelling regularities on the rhyme level, but the second one would. For the control words, the first spelling would be consistent with rhyme-level regularities, and the second one would be impossible in the context of the rhyme. It was expected that sensitivity to rhyme context would make participants more likely to choose the less typical spelling of the vowel in experimental words, where it was the most typical spelling in the context of the rhyme, than in control words, where it was not the most typical spelling in the context of that rhyme.

Participants were told that they would be presented with 32 English names. They were instructed to listen to each “name”, for which they had to press a “play” button located next to the “name”, and choose which of the two options was more likely to be the actual English spelling of the “name”. The answer “both are equally possible” was also available.

In previous studies using context sensitivity (e.g., Dich, 2010; Treiman & Kessler, 2006), participants had to listen to pseudowords and come up with spellings for them, rather than choose the spelling from the options that were given to them. Because it is the spelling of the vowel that is of the most interest, it is crucial that participants hear the right vowel when they listen to pseudowords. However, because in the present study participants were non-native English speakers and because they did not have the same native language with the same vowel inventory, it would be very difficult to ensure that all participants heard the correct vowel, or that

they even heard the same vowel if pseudowords were presented to them only in an audio recording. Therefore the design of the study was modified to have participants choose from the options already given to them to account for the differences in native language vowel inventories.

The pseudowords were recorded using the same facilities and equipment as words for Task 1. A male native English speaker from New York State recorded the pseudowords. The speaker had General American pronunciation. The complete list of pseudowords and the screenshot of Task 3 is given in the Appendix.

4.1.4. Task 4: Phonological Skills

Task 4 tested English phonological skills. The prediction for this task was that Italians and Russians would outperform Danes. Phonological skills are often tested using pseudoword reading and spelling tasks, since it is known that the processing of unfamiliar words, which pseudoword tasks mimic, relies on phonological skills (Campbell & Butterworth, 1985; Marsh, Friedman, Desberg, & Saterdahl, 1981). The present study also employed pseudoword spelling.

Pseudowords used to test phonological skills in this study were multisyllables with a complex syllable structure, e.g., containing consonant clusters, which have been previously shown to present a problem for learners to spell (Caravolas & Bruck, 1993; Juul & Sigurdsson, 2004). The pseudowords were constructed in such a way that they could not be easily spelled using analogy with real words. That is, the pseudowords were phonotactically legal, but not very similar to existing words. The pseudowords did not contain any phonemes that do not exist in Danish, Italian or Russian – the native languages of the participants. The consonant clusters occurring in the pseudowords were also legal in all three languages. Examples of the pseudowords include: *kreskornity*, *scroolafilar*. The complete list is provided in the Appendix.

Task 4 was a spelling to dictation task. Participants were told that they would be presented with a list of unusual long names which they would have to spell trying to reflect the

pronunciation as accurately as possible. They were instructed to listen to the recorded “names” and type them as they listened. Each “name” was only repeated once with 8 second intervals between the “names”. The screenshot of Task 4 is given in the Appendix.

The pseudowords were recorded by a female American English speaker from New York State using the same facilities and equipment as the materials for Tasks 1.

4.2. Procedure

The study was a web-based experiment, in which subjects participated remotely from their home computers. They accessed the study, completed the tasks and submitted their responses online. The use of Internet was an innovative aspect of the present study: this method of remote data collection has not been previously used in spelling research. The main advantage of collecting data over Internet, which motivated the use of this approach in the present study, is that it allows testing participants from multiple countries simultaneously and creating a relatively large dataset in a relatively short period of time. Of course, the remote method of data collection also has its disadvantages – those will be discussed in Chapter 6 in the context of the results of the study.

The study started with a welcome page, which briefly explained the contents of the study and the conditions for participation: being a native speaker of Danish, Italian, or Russian and having at least an intermediate level of English proficiency. On the following two pages, participants were asked to select their native language and to answer seven screening questions, the purpose of which was to make sure that participants met the selection criteria of the study (see section 4.3. for more detail). If a participant did not meet one or more criteria, s/he could not proceed: a message appeared on the screen explaining that s/he did not qualify to take part in the study and providing an email address to which the individual was invited to submit their questions if s/he had any.

If all the criteria were met, the next page of the study appeared on which participants were

instructed to plug in their headphones and to make sure they could hear sounds files embedded into the page. Participants were also asked to confirm by checking the appropriate box that they had not participated in the study before and promise that they would read the instructions carefully, would not answer at random and would not consult anything or anyone as they completed the tasks of the study. Participants could not continue unless the box was checked.

Then participants proceeded to complete the four tasks of the study described in 4.1. The page following the tasks was a survey containing questions about participants' demographic characteristics, such as their age, gender, occupation, place of birth and countries where they had lived, as well as their learning disabilities and hearing problems. The survey also contained questions about participants' language background, in particular about L1 literacy, foreign language knowledge and English proficiency – the factors that could have influenced their English spelling performance. The complete list of survey questions is given in the Appendix.

Thus, participants were asked when they started to read and write in their first language, how much they read for pleasure in their native language (“rarely”, “from time to time”, and “on a regular basis”), how many languages they knew and what those languages were, how interested they were in language and/or linguistics (“not interested”, “somewhat interested” and “very interested”).

Participants were also asked to assess their native language spelling proficiency using a 10-point scale, where 1 was “very low” and 10 was “perfect”. It has previously been found (e.g., Schulte-Korne et al., 1997) that individuals are quite accurate when asked to subjectively assess their spelling abilities, i.e., their self-reported spelling ability correlate with their actual ability and therefore self-reports can be used for spelling proficiency assessment.

Further, participants were asked at what age they started learning English. They were also asked to rate their English proficiency and specify how often they use English in their everyday lives. To assess their English proficiency, participants used a 10-point scale, where 1 was “very low” and 10 was “perfect”. They assessed their speaking, understanding, and reading skills. The

use of self-reports for English proficiency assessment was based on the finding by Marian et al. (2007) that self-reported L2 proficiency correlates with the results of objective assessments. The authors of the study argue that self-reports can be used as the means for language proficiency assessment instead of language tests.

To specify how often they used English, participants were asked to choose between five options: “not at all”, “occasionally”, “quite regularly”, “every day/almost every day” and “almost as much as (in) my native language”. They assessed separately how often they spoke English, heard spoken English, read and wrote in English.

In the survey, participants were also asked how much each of the following factors contributed to their learning of English:

- Learning English as a foreign language in school/college/language courses
- Living in an English speaking country
- Traveling abroad
- Interacting with friends or colleagues
- Interacting with family
- Reading in English
- Watching movies or TV shows/listening to the radio

Participants used a 10-point scale, where 1 was “a minimal contributor” and 10 was “the most important contributor” (the option “not a contributor – 0 – was also available).

After completing the survey, participants were asked to provide their email and invited to submit their comments. Participants' emails were used to send them information about compensation.

Participants completed the study in one sitting. The study took approximately 35-40 minutes.

Participants' answers were stored in text files located on the same server where the study was hosted. There was a separate file for each task of the study and also one for the survey and one for participants' contact information. The access to the files was password-protected. When a

participant started the study, the program assigned a unique participant number to him/her, which was preserved as the participant navigated between pages of the study. Once participant completed a task, his/her answers together with his/her unique number were written into the file where everyone's answers for that task were stored.

4.3. Participants

EFL participants were recruited from Danish, Italian, and Russian universities. The two main strategies of recruitment were sending emails to universities asking to distribute the information about the study among students and advertising the study in social networks, of which students were members, such as student groups on *Facebook* and student communities in *LiveJournal*. The control group of English native speakers were all Cornell University students.

One hundred Danish speakers, 98 Italian speakers, 104 Russian speakers and 95 English native speakers took part in the study. Fourteen participants (5 Danes, 2 Italians, 1 Russian and 6 Americans) were excluded due to reported learning disabilities or hearing problems. Thus, only the data from 95 Danes, 96 Italians, 103 Russians, and 89 Americans were used in the analyses.

All of the participants had met the following selection criteria:

- Participants' native language had to be the first language they learned to speak and read.
- Participants' native language had to be the one they are the most fluent in, both in speaking and in writing.
- Participants' native language had to be the dominant language of their everyday communication.
- Participants' native language had to be the native language of their both parents (or caregivers).
- Participants must have lived in the country where their native language is spoken for the most part of their lives.
- Participants had to be living in the country where their native language is spoken at the

moment of testing.

- For Danish, Italian, and Russian speakers, English had to be a foreign language.

These purpose of imposing these conditions was to restrict the variation in types of bilingualism and to match participants groups on their L1 proficiency and also to make sure that the three EFL groups were comparable in their English proficiency and the way English was acquired (i.e., primarily through explicit instruction rather than through immersion resulting from living in an English-speaking country or having an English-speaking parent).

As mentioned above, all participants were either undergraduate or graduate students. Restricting the pool of participants to university students was done in an effort to make the four groups as homogeneous and as similar across countries as possible.

The survey administered to the participants at the end of the study asked them to specify their place of birth and indicate whether or not they had ever lived outside their home country. The vast majority of participants were born in the countries where their native language is spoken (i.e., Denmark, Italy, Russia or former Soviet Union Republics, and the US). The few exceptions included one Danish speaker who was born in South Korea and brought to Denmark at the age of three months, one Russian speaker who was born in Germany to Russian parents and lived in a Russian speaking German village until he was four years old, and two English native speakers, one of whom was born and lived for the first three years in Austria and the other was born in Australia.

Many EFL participants reported having lived abroad, including English-speaking countries. More specifically, 19 Danes, 15 Italians, and 12 Russians indicated that they had lived in countries where English is spoken for a period between several months and two years. Two participants, one Italian and one Russian, had lived in the US for a longer period of time: four and 8 years respectively. By the time of testing, all of the participants had come back to their home countries (as stated above, this was one of the selection criteria).

Further characteristics of the four groups of participants are presented in Table 1. Even

though participants from different countries were recruited from similar environments and were all university students, the resulting groups were still not perfectly matched on all of the characteristics that the study controlled for. Thus the differences in age ($F_{3, 376} = 38.7, p < .0001$) and in gender distribution ($\chi^2_6 = 25.0, p = .0003$) were significant. The groups also differed on the average age when participants started to learn to read and write in their native language ($F_{3, 370} = 59.2, p < .0001$) and in their self-reported spelling proficiency in their native language (Kruskal-Wallis Rank Sums test: $\chi^2_3 = 60.0, p < .0001$): English native speakers' reported L1 spelling proficiency was significantly lower than that of participants from the other three groups; the differences between the three EFL groups were not significant (Kruskal-Wallis Rank Sums test: $\chi^2_2 = 4.2, p = .12$).

Table 1. Participants' Characteristics

		DA	IT	RU	EN
N		95	96	103	89
Average Age (Range)		23 (19-32)	24 (18-35)	22 (18-35)	20 (18-22)
Gender	Male	47	22	24	23
	Female	48	73	78	75
Average Age (SD) Started Reading and Writing in L1		6 (1.5)	5 (.9)	4 (1.2)	4 (1.3)
L1 Spelling: Median Rating on a 10-pt Scale		9	9	9	8
Interest in Language/ Linguistics	Not Interested	6	0	1	18
	Somewhat Interested	55	15	38	54
	Very Interested	34	81	64	16
Avg. nr. of Foreign Languages (SD)		2.9 (1.0)	2.7(1.0)	2.6 (1.5)	1.1 (.9)
Read for Pleasure in L1	Rarely	22	5	3	15
	Occasionally	39	36	37	46
	Regularly	34	55	63	27

The four L1 groups also differed on how interested on average participants were in languages and/or linguistics ($\chi^2_6 = 114.2; p < .0001$). Native English speakers were the least interested in languages, while the Italians were the most interested.

Further, EFL participants knew (or had studied) on average more languages than English native speakers ($F_{3, 379} = 47.9, p < .0001$, the difference between the three EFL groups is not significant: all p 's $> .1$). This may be partially explained by the fact that the nature of the study required EFL learners to know at least one foreign language (i.e., English), whereas this requirement did not apply to English native speakers. In addition, the relationship between interest in language and the number of foreign languages learned by a participant ($F_{2, 379} = 24.5, p < .0001$) may explain why English speakers knew fewer foreign languages, since this group was also the one the least interested in languages.

Finally, there were between group-differences in how much participants read for pleasure: the Italians and Russians were more likely to read for pleasure regularly than the Danes and Americans ($\chi^2_2 = 37.1, p < .0001$). The difference between Italians and Russians was not significant, as well as the difference between Danes and Americans (both p 's $> .3$)

4.3.1. EFL Learners' English Proficiency and Methods of English Acquisition

EFL learners rated their speaking, understanding and reading English using a 10-point scale, where 1 was “very low” and 10 was “perfect”. The median ratings for speaking, understanding, and reading for each of the three EFL groups are given in Table 2.

Table 2. Median Ratings and Ranges of Participants' English proficiency (10-pt scale)

	DA	IT	RU
Speaking	8 (4-10)	7 (2-10)	7 (1-9)
Understanding	9 (5-10)	8 (2-10)	7 (2-10)
Reading	9 (5-10)	8 (3-10)	8 (4-10)

According to these ratings, the Danish group had the highest English proficiency, whereas the Russian group had the lowest. All between group differences proved significant in a series of Kruskal-Wallis Rank Sums test – speaking: $\chi^2_2 = 28.1, p < .0001$; understanding: $\chi^2_2 = 56.3, p < .0001$; reading: $\chi^2_2 = 20.5, p < .0001$.

Participants were also asked to estimate how regularly they spoke and heard spoken English and read and wrote in English. Five answer options were available: 1 – “not at all”, 2 – “occasionally”, 3 – “quite regularly”, 4 – “every day/almost every day” and 5 – “almost as much as (in) my native language”. The most frequent answer for each group and each aspect of English use are given in Table 3.

Table 3. Modal Frequency of Participants’ English Use

	DA	IT	RU
Speaking EN	2	2	2
Listening to spoken EN	4	3	2
Read in EN	4	3	3
Writing in EN	2	2	2

Overall, Danes reported hearing English and reading in English more often than the other two groups ($\chi^2_8 = 87.3, p < .0001$ and $\chi^2_8 = 97.6, p < .0001$).

The mean age of the onset of English learning was 9 ($SD = 2.0$) for Danes, 9 ($SD = 2.8$) for Italians and 8 ($SD = 3.2$) for Russians. The difference between Russians and the other two groups was significant ($F_{2, 288} = 8.7, p = .0002$).

Participants were also asked how much each of various factors contributed to their learning of English, namely: learning English as a foreign language in school/college/language courses; living in an English speaking country; traveling abroad; interacting with friends or colleagues; interacting with family; reading in English; watching movies or TV shows/listening to the radio. Participants rated each factor on a 10-point scale, where 1 was “a minimal contributor” and 10

was “the most important contributor”. The median ratings for each of the contributing factors are given in Table 4, for each EFL group separately, and plotted on Figure 1.

Table 4. EFL Learners’ Median Ratings and Ranges of Importance of Contributors to their English Proficiency

	DA	IT	RU
School/ language courses	8 (2-10)	8 (0-10)	9 (0-10)
Living in an EN speaking country	0 (0-10)	0 (0-10)	0 (0-10)
Travel	6 (0-10)	6.5 (0-10)	5 (0-10)
Communication with friends/colleagues	5 (0-10)	6 (0-10)	4 (0-10)
Communication with family	1 (0-10)	0 (0-10)	0 (0-10)
Reading	8 (1-10)	8 (1-10)	7 (1-10)
Movies/TV/Radio	8 (3-10)	9 (0-10)	7 (1-10)

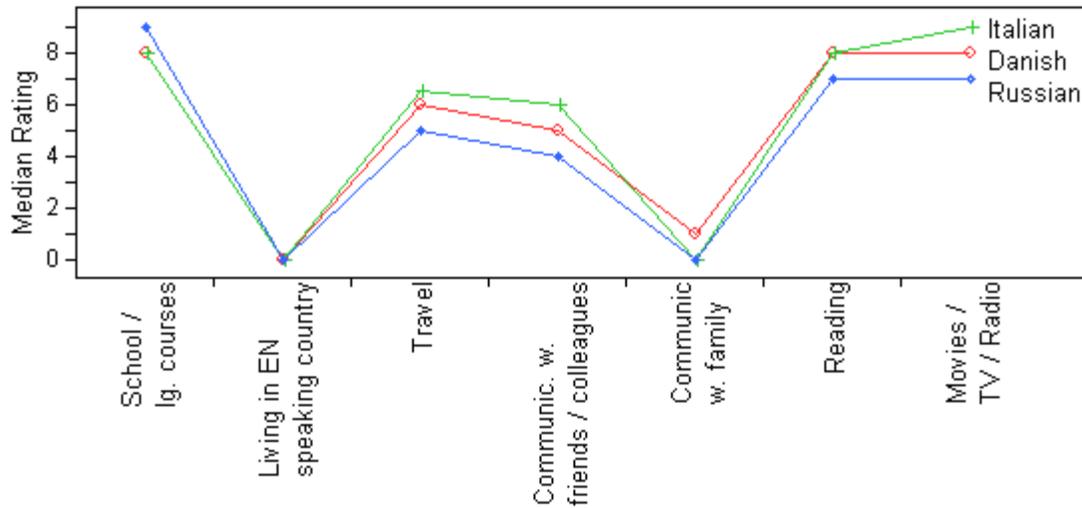


Figure 1. EFL Learners’ Median Ratings of Importance of Contributors to their English Proficiency

As Figure 1 illustrates, for all the three groups, the three main factors contributing to learning English were school and/or language courses, reading in English and watching movies and TV shows and/or listening to the radio. The role of the latter factor differed significantly between the three groups (Kruskal-Wallis Rank Sums test: $\chi_2^2 = 27.0, p < .0001$). Traveling and communication with friends and colleagues were less important factors. Between-group differences in the role of these two factors were also significant ($\chi_2^2 = 11.1, p = .004$ and $\chi_2^2 = 11.8, p < .003$ respectively). Living in English speaking countries and communication with family did not seem to play an important role in participants' acquisition of English.

In sum, the four groups of participants were not perfectly matched on all demographic and linguistic variables. In the analysis of the results, these between-group differences were accounted for.

CHAPTER 5

RESULTS

The presentation of the results in this chapter has the following structure: first the results of the survey are explored in order to give a full picture of participants' characteristics and how they are interrelated. Next, the results of each of the four tasks are discussed individually, in the order they were administered to the participants. Finally a summary of results is given and across-tasks comparison of participants' performance is analyzed.

5.1. Survey Results

5.1.1. General Linguistic and Native Language Proficiency

This section looks at the relationships between seven variables: Age, Gender, interest in language and linguistics (ordinal variable, 3 levels, further "Interest in Language"), the age when the participants started to read and write in their native language (continuous variable⁷, further "Age NL Literacy"), how much participants read in their native language (ordinal variable, 3 levels, further "Reading in NL"), number of foreign languages participants knew (continuous variable, further "#FL") and native language spelling (ordinal variable 4 levels, further "NL Spelling"). The native language spelling proficiency was originally measured on a 10-point scale. However, because there were very few individuals who rated their spelling proficiency as 7 or lower, rating 1 through 7 were merged into one category.

The first step of the analysis was to test whether Age and Gender predicted the other five variables. Age was not a significant predictor of any of the five variables. Gender predicted

⁷ Because there was not much variance in the number of known foreign languages, this variable could have also been treated as categorical.

Interest in Language ($\chi^2_1 = 8.3, p = .004$), Reading in NL ($\chi^2_1 = 9.2, p = .003$), #FL ($F_{1, 372} = 7.4, p = .007$), Age NL Literacy ($F_{1, 364} = 4.9, p = .03$), with Native Language controlled for. Gender \times Native Language interactions were not significant predictors of any of these four variables. In all language groups females read more, were more interested in languages and knew more foreign languages than males, but started to read and write on average three months later than males. NL Spelling was not predicted by gender.

Further, relationships between NL spelling, Age NL Literacy, #FL, Interest in Language and Reading in NL were analyzed. The results of the analysis are presented in Table 5.

Table 5. Relationships between NL Spelling, Age NL Literacy, #FL, Interest in Language and Reading in NL

	NL Spelling	#FL	Interest in Language	Reading in NL
Age NL Literacy	$\chi^2_1=10.4,$ $p = .001 \searrow$	$F_{1, 369} = 10.5,$ $p = .001 \searrow$	$\chi^2_1= 5.7,$ $p = .02 \searrow$	n.s.
Reading in NL	$\chi^2_2=9.1$ $p = .01 \nearrow$	n.s.	n.s.	
Interest in Language	$\chi^2_2= 22.0,$ $p = <.0001 \nearrow$	$F_{2, 376} = 9.5,$ $p < .0001 \nearrow$		
#FL	$\chi^2_1= 12.8,$ $p = .0003 \nearrow$			

Each cell shows the test statistic and the p-value of a test where the row header was a predictor and the column header was the response. Native Language was controlled for in all the ten tests. The interactions of each predictor with language group were also tested, but none was significant. The arrows \nearrow and \searrow indicate whether the association between the predictor and response was positive or negative.

Table 5 shows that all the five variables: NL Spelling, Age NL Literacy, Interest in Languages, #FL and Reading in NL were interrelated. To summarize the data in the table, individuals who rated their native language spelling proficiency high tended to be more interested in languages, know more foreign languages, read for pleasure more and have started reading and writing in their native language earlier than those who rated their native language spelling skills low. It is important to note, with respect to the age of reading and writing onset, that it was not the absolute age that mattered: rather, it was important when an individual started to read and write *compared to the average in his/her language group*. This is illustrated in Figure 2. Thus, for instance, the poorest English native spellers started to read and write earlier than the best Danish native spellers.

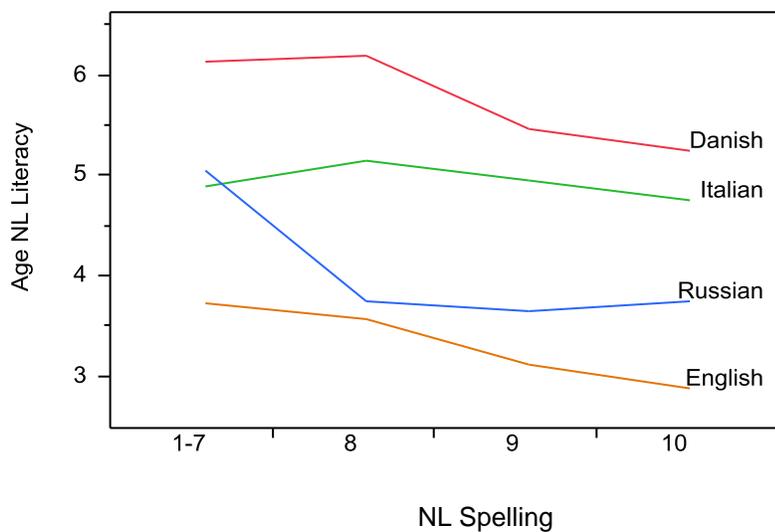


Figure 2. The Relationship between L1 Spelling Proficiency Rating and the Average Age of L1 Reading and Writing Onset for Each Language Group

Despite the fact that interest in language, amount of reading, number of known foreign languages and the age of reading and writing onset were interrelated, they were all significant predictors of native language spelling, when entered simultaneously as IVs into an ordinal logistic regression model, as Table 6 illustrates.

Table 6. Predictors of Native Language Spelling

	DF	χ^2	p
Native Language	3	15.2	.002*
Interest in Language	2	12.1	.002*
Age NL Literacy	1	6.0	.01*
Reading in NL	2	7.1	.03*
#FL	1	4.5	.03*

5.1.2. English Proficiency

Participants rated their English proficiency on the scale from 1 to 10, where 1 was *very low* and 10 was *perfect*. Very few participants rated their English proficiency lower than 6⁸, therefore the 10-point scales was converted into 5-point scales as shown in Table 7. The relationships between the three aspects of reported English proficiency were further analyzed. The three variables were highly interrelated, as Table 8 shows.

Participants were also asked how regularly they speak, listen to, read in and write in English. Because few people answered “not at all”, the answer “not at all” and “occasionally” were combined into the same category. The regularity of English use was positively associated with English proficiency. Thus, English speaking proficiency was predicted by how often participants spoke English ($\chi^2_3 = 56.0, p < .0001$), the regularity of hearing spoken English predicted understanding ($\chi^2_3 = 84.5, p < .0001$), and reading proficiency was associated with how often participants read in English ($\chi^2_3 = 78.6, p < .0001$)⁹.

⁸ The reason for this is probably that a fair knowledge of English was required to understand the study instructions and to complete all the tasks. Relatively high level of English proficiency was probably also required for participants to be interested in the study at all.

⁹ The relationship between the regularity of English use and English proficiency is probably that of bidirectional causality: while the proficiency improves with increased use, good EFL skills likely promote frequent use of

Table 7. Frequency of English Proficiency Ratings

SPEAKING			
Rating on the 10-pt Scale	Corresponding Proficiency	Count	Reassigned Rating
1-4	<i>slightly less than adequate or lower</i>	33	1
5-6	<i>adequate/slightly more than adequate</i>	51	2
7	<i>good</i>	79	3
8	<i>very good</i>	95	4
9-10	<i>excellent/perfect</i>	35	5
UNDERSTANDING			
Rating on the 10-pt Scale	Corresponding Proficiency	Count	Reassigned Rating
2-6	<i>slightly more than adequate or lower</i>	51	1
7	<i>good</i>	68	2
8	<i>very good</i>	81	3
9	<i>excellent</i>	73	4
10	<i>perfect</i>	20	5
READING			
Rating on the 10-pt Scale	Corresponding Proficiency	Count	Reassigned Rating
3-6	<i>slightly more than adequate or lower</i>	28	1
7	<i>good</i>	48	2
8	<i>very good</i>	100	3
9	<i>excellent</i>	95	4
10	<i>perfect</i>	22	5

English.

Table 8. Relationships between Aspects of English Proficiency

	Reading	Understanding
Speaking	$\chi_4^2 = 115.7,$ $p < .0001$	$\chi_4^2 = 151.9,$ $p < .0001$
Understanding	$\chi_4^2 = 150.9,$ $p < .0001$	

Because the three aspects of English proficiency were closely interrelated, a combined measure of English proficiency was created (further EN Proficiency). This measure was the sum of the ratings for speaking, understanding, and reading. The resulting variable ranged from 3 to 15 and was approximately normally distributed. In further analyses this variable was treated as continuous.

5.1.3. Predictors of English Proficiency

English proficiency was not affected by participants' gender or age. The following variables predicted English language proficiency, controlling for Native Language: Interest in Language ($F_{2,281} = 9.0, p = .0002$); Age NL Literacy ($F_{1,278} = 18.7, p < .0001$); Reading in NL ($F_{2,281} = 3.1, p = .05$); NL Spelling ($F_{3,263} = 3.7, p = .02$); #FL ($F_{1,283} = 35.9, p < .0001$), and the age participants started learning English – further “Age EN” ($F_{1,279} = 14.9, p < .0001$). Thus, the more proficient English learners were, the higher their interest in language was, the more they read in the native language, the better spellers they were in the native language, the more foreign languages they knew and the earlier they started learning to read and write in the native language and to learn English, relative to the average in their country. The interactions of all of these predictors with language group were not significant, meaning that the observed trends were equally valid in all three language groups.

When all of these variables were entered simultaneously as predictors of English proficiency into a multiple regression model, NL Spelling and Reading in NL were not significant. After those two variables were removed from the model, the two significant predictors were #FL and

Age NL Literacy, whereas Age EN and Interest in Language were only marginally significant, as Table 9 shows.

Table 9. Predictors of English Proficiency

	DF	F	p
Native Language	2	33.6	<.0001
Interest in Language	2	2.6	.08
Age NL Literacy	1	7.8	.006
#FL	1	20.3	<.0001
Age EN	1	3.5	.06

Contributors to English Learning as English proficiency predictors. Participants were asked to rate seven factors: learning English as second language in school or in language courses (further “School”), living in an English speaking country (further “EN Country”), travel, communication with friends and colleagues (further “Friends”), communication with family (further “Family”), reading, and watching movies or TV in English (further “TV”) according to how much they contributed to their learning of English. A 10-point scale was used, where 1 was “a minimal contributor” and 10 was “the most important contributor”. Just like for English proficiency variables, the 10-point scale turned out to be too fine a gradation. Therefore for each of the seven contributors some points on the scale were merged together and the ratings were reassigned as shown in Table 10.

The relationships within each pair of the seven factors were analyzed controlling for Native Language. The results are presented in Table 11.

Table 10. Frequency of Ratings of Contributors to English Proficiency

Rating	School		EN Country		Travel	
	Level	Count	Level	Count	Level	Count
1 – low importance	0-5	49	0-4	208	0-4	131
2 – moderate importance	6-9	100			5-7	76
3 – high importance	9-10	145	5-10	86	8-10	85
	Friends		Family		Reading	
	Level	Count	Level	Count	Level	Count
1 – low importance	0-4	128	0	183	0-5	69
2 – moderate importance	5-7	93	1-4	70	6-8	128
3 – high importance	8-10	72	5-10	38	9-10	97
	TV					
	Level	Count				
1 – low importance	0-5	68				
2 – moderate importance	6-8	99				
3 – high importance	9-10	127				

Table 11. Relationships between Predictors of English Proficiency

	School	EN Country	Travel	Friends	Family	Reading
EN Country	$\chi^2_1 = 3.4,$ $p = .06 \searrow$					
Travel	n.s.	$\chi^2_2 = 36.2,$ $p < .0001 \nearrow$				
Friends	n.s.	$\chi^2_2 = 18.4,$ $p = .0001 \nearrow$	$\chi^2_2 = 48.7,$ $p < .0001 \nearrow$			
Family	n.s.	$\chi^2_2 = 14.5,$ $p = .0007 \nearrow$	$\chi^2_2 = 29.9,$ $p < .0001 \nearrow$	$\chi^2_2 = 19.5,$ $p < .0001 \nearrow$		
Reading	$\chi^2_2 = 8.7,$ $p = .01 \searrow$	n.s.	n.s.	$\chi^2_2 = 26.1,$ $p = .0003 \nearrow$	n.s.	
TV	$\chi^2_2 = 10.1$ $p = .006 \searrow$	n.s.	$\chi^2_2 = 8.8$ $p = .01 \nearrow$	$\chi^2_2 = 8.9$ $p = .01 \nearrow$	n.s.	$\chi^2_2 = 50.1$ $p < .0001 \nearrow$

Based on the results shown in Table 11, it seems that the factors contributing to learning English fall into three groups. Living in an English speaking country, traveling, communication with friends and colleagues and communication with family are closely related to each other and form one group. Reading and watching TV, movies or listening to the radio form the second group. Finally learning English at school or language courses is a single factor in the third group. It is negatively associated with factors from the second group, suggesting that the fewer opportunities participants had to learn English from natural communication, reading or watching English films or shows, the more important the contribution of language courses had to their knowledge of English.

Because there were strong correlations between EN Country, Travel, Friends, and Family, these four factors were combined into one variable in order to reduce the number of dimensions for further analyses. The combination variable was created by summing the ratings for the four variables and then dividing the resulting range into 3 categories again: low, moderate, and high importance. The combined variable is further referred to as Travel/Friends.

Each of the contributors was analyzed as a predictor of English proficiency, controlling for Native Language. Neither School nor Travel/Friends were a significant predictor of English proficiency, whereas TV and Reading were both strong predictors ($F_{2, 281} = 8.7, p = .0002$ and $F_{2, 281} = 9.6, p < .0001$ respectively).

5.1.4. Summary of Survey Results

General linguistic proficiency and native language variables. The first result of the survey analysis was that female participants read more, were more interested in languages and knew more foreign languages than males. This is consistent with previous studies in gender difference in language learning showing that girls typically outperform boys in language tasks, including reading and writing (e.g., Van de Gaer, Pustjens, Van Damme, & De Munter, 2009).

Age did not predict any of the native language variables, but it is also important to keep in

mind that the age range of participants was quite limited: 90 percent of them fell in the range of 18–28 years old. Therefore, even if age affected any of the native language variables, the present sample would probably not have enough age variability to detect these effects.

Further, it was found that the age when participants started learning to read and write, interest in language, amount of reading, and number of known foreign language were all interrelated and were all predictors of native language spelling skills. Thus, better spellers were more interested in language, knew more foreign languages, read more and also started reading and writing earlier, compared to the average in their country. These data are correlational and therefore do not allow for establishing causality of these relationships, but some conjectures can be made. For instance, it seems unlikely that the biological age when a child starts to read and write has a direct impact on his/her adult spelling proficiency, especially because the “early” readers were of different ages in each country. Rather, it is probably the underlying verbal abilities that explain the correlation between spelling proficiency and age when a child starts to read. Thus it is conceivable that children who develop verbal skills earlier than their peers will earlier possess the linguistic prerequisites (e.g., phonological awareness) and possibly motivation necessary to learn to read and write. Further, better developed linguistic skills will contribute to better spelling proficiency, which has been shown to depend on linguistic sensitivity, e.g., sensitivity to phonological and morphological structure of words (e.g., Fischer et al., 1984, Pollo et al. 2008). The ease with which a child will master oral and written linguistic skills might further determine his or her interest in language and the desire to learn foreign languages: indeed we are more likely to be interested in something we are good at than in something we are bad at. However, it is also likely that increased interest in language may feed back on linguistic sensitivity and thus also improve spelling. In other words, being good at language makes one more interested in it, and vice versa, being interested in language makes one more sensitive to linguistic structures and thus impacts the skills that depend on language sensitivity, e.g., spelling.

The amount of reading for pleasure correlated with spelling skills, but not with the other

three variables. This relationship has been earlier reported in literature (e.g., Burt, 2006). One possible explanation for it that has been offered is that the amount of reading determines the amount of learning opportunities for spellers to form strong orthographic representations (e.g., Burt, 2006).

English proficiency. The main predictors of English proficiency were found to be the regularity of English use, as well as the age when participants started to read and write in the native language, the number of foreign languages they knew, and how much reading, watching movies and TV and listening to the radio in English contributed to their English learning.

The relationship between the age when participants started to learn to read and write, the number of foreign languages they knew, and their English proficiency suggests that foreign language learning shares some underlying cognitive and linguistic factors with native language skills – a finding previously discussed in language acquisition literature (Sparks, Ganschow, Fluharty, & Little, 1995).

Results of the survey also suggest that the fewer opportunities participants had to learn English from natural communication, reading or watching English films or shows, the more important to their English proficiency was learning English as a foreign language in school. The results also indicate that learning involving direct exposure to English, namely reading, watching movies and television was the most efficient.

5.2. Task 1: Memory for Word-Specific Spellings

5.2.1. Scoring

In Task 1, participants were asked to spell 30 irregular words that were played to them as an audio recording. The first step of the analysis was to code all the responses as correctly spelled, misspelled, misperceived, or unknown/unrecognized.

Both American and British spellings were counted as correct. If a word was spelled correctly, but it was not the word that was dictated (e.g., *surgery* instead of *surgeon*, or *coast* instead of *ghost*), such response was coded as misperceived. A response was coded as unknown/unrecognized when a word was missed altogether, if there was a question mark next to a spelling (as explained in 4.1., participants were asked to put a question mark next to the words they did not know), or if there was no question mark, but the response was quite far from the correct spelling and seemed an attempt to render the pronunciation of the word (e.g., <aqnglement> for *acknowledgement* or <litiar> for *leisure*). In all other cases, responses were counted as misspellings. In a small number of cases, when there was no question mark next to an incorrectly spelled word, it was quite difficult to tell whether it was a misspelling or if the speller did not know the word (e.g., <forfill> for *fulfill* or <untell> for *until*). In such cases the participants were given “the benefit of doubt”, i.e., the response was coded as unknown/unrecognized, consistently across all participants, if that spelling occurred more than once.

Two participants did not finish the task and were excluded from the analysis of Task 1 results.

5.2.2. Descriptive Statistics

The distribution of the responses across the four language groups is shown in Table 12.

Table 12. Descriptive Statistics of Task 1 Results

	English	Danish	Italian	Russian
Correctly spelled	2542	2111	1876	2271
Misspelled	125	661	596	588
Misperceived	3	14	80	80
Unknown/unrecognized	1	64	268	151
TOTAL	2671	2850	2820	3090

5.2.3. Between-Group Differences in Task 1 Performance

With misperceived and unknown/unrecognized words excluded, the proportion of misspelled words was 5% for the native English speakers, 24 % for Danish speakers, 24% for Italian speakers and 21 % for Russian speakers. Misperceived and unknown/unrecognized responses were excluded from the analysis based on the assumption that whether or not a participant knew certain words or could recognize them on the recording depended on his/her overall English proficiency rather than his/her spelling skills proper. Counting unknown and misperceived words as misspelled would have created a bias against individuals with lower English proficiency.

In order to determine whether these between-group differences were statistically significant, the proportions of correct answers in Task 1 in the four language groups were compared using a generalized linear model (GLM)¹⁰. The response variable was each subject's Response Accuracy – the number of correct out of the total number of eligible responses. Eligible responses were correctly spelled and misspelled words. The predictor was Native Language.

Native Language was significant $\chi^2_3 = 144.4, p < .0001$. In order to see whether the difference

¹⁰ All generalized linear models in this study used Logit link function and controlled for overdispersion.

between the non-native speaking groups was also significant, a second predictor was added to the model, namely English Native [yes, no] (e.g., whether or not the participant was a native language speaker) and Native Language was nested within English Native. English Native was still significant in this analysis ($\chi^2_2 = 141.3, p < .0001$), but the difference between non-native speakers was not significant.

To summarize these results, native speakers performed the best in Task 1, while the EFL learners did not differ in Task 1 performance, when no other variables were controlled for.

5.2.4. Predictors of Task 1 Performance

The next step of the analysis was to test whether participants' characteristics accounted for in the study (listed in Table 13) predicted Task 1 performance, controlling for Native Language. This was done by using the same model described above with one of the variables listed in Table 13 as a predictor (i.e., this analysis was repeated 14 times, for each of the predictors in Table 13 individually).

To summarize the data in the Table: controlling for native language, the following variables predicted Task 1 performance, when tested independently from other covariates: Interest in Language, Age NL Literacy, NL Spelling, #FL, Age EN, EN Proficiency and # of Unknown words in Task 1.

In addition to the English proficiency variable created based on participants' self-reports (see section 5.1), another measure of English proficiency was added to the analysis: namely the number of Task 1 words participants did not know or recognize. The assumption was that this measure would be correlated with participants' English vocabulary size. This measure was negatively correlated with the self-reported EN proficiency ($F_{1, 285} = 23.6, p < .0001$), which was to be expected and which shows that subjective self-ratings give a reliable estimate of language skills. In order to be able to account for both self-reported proficiency and vocabulary size without running into multicollinearity problems, a combined English proficiency variable was

created using principle component analysis – the first component was the combined English proficiency measure, further referred to as EN Proficiency 1.

Table 13. Predictors of Task 1 Results, Controlling for Native Language

Predictor	χ^2	p	Comment
Age	$\chi_1^2 = .2$	n. s.	
Gender	$\chi_1^2 = 2.1$	n.s.	
Interest in Language	$\chi_2^2 = 31.2$	< .0001	The higher interest in language, the lower proportion of misspellings.
Age NL Literacy	$\chi_1^2 = 14.0$	< .0001	The proportion of misspelling increases as the age increases.
Reading in NL	$\chi_2^2 = .02$	n. s.	
NL Spelling	$\chi_3^2 = 41.5$	< .0001	The proportion of misspellings decreases as NL spelling proficiency increases.
# FL	$\chi_1^2 = 15.1$	< .0001	The proportion of misspellings decreases as #FLs increases.
*Age EN	$\chi_1^2 = 9.7$	.002	The proportion of misspellings increases as the age increases.
*School	$\chi_2^2 = 1.8$	n.s.	
*Travel/Friends	$\chi_2^2 = 2.0$	n.s.	
*Reading	$\chi_2^2 = .6$	n.s.	
* TV	$\chi_2^2 = .73$	n.s.	
*EN Proficiency	$\chi_1^2 = 16.1$	< .0001	The proportion of misspellings decreases with increased proficiency.
*# Unknown Words in Task 1	$\chi_1^2 = 65.1$	< .0001	The proportion of misspellings increases with increased number of unknown words.

*Analysis done only for the non-native English speakers.

5.2.5. Explaining Between-Group Differences in Task 1 Performance

The next step of the analysis was to determine whether the between-group differences in Task 1 performance would be affected when all of the predictors of Task 1 performance discussed in the previous section were accounted for. First, the difference between native and non-native English speakers was explored. In order to do that, a GLM Model was fit to the data, with Response Accuracy being the response and English Native, Age, Gender, Interest in Language, Age NL Literacy, NL spelling, Reading in NL, #FLs, and the interaction of these effects with Native Language being the predictors. None of the interactions was significant and therefore they were excluded from the model. The main effects of age and Reading in NL were also not significant. The other predictors were significant at $\alpha = .05$, including English Native ($\chi^2_1 = 143.0, p < .0001$).

Further, the differences in performance between the three EFL groups were explored. The predictors included in the model were: Native Language and all of the predictors listed in Table 13, except for EN Proficiency and #Unknown words, which were replaced by the combined measure of English proficiency EN Proficiency 1, and their interactions with Native Language. Native language speakers were not included in this analysis.

None of the interaction terms was significant. The main effects of Age, Reading in NL, School, Reading, TV, Age NL literacy and #FL were also non-significant. The final model with these non-significant predictors removed is presented in Table 14. Native Language was marginally significant: $\chi^2_2 = 5.2, p = .07$. A contrast analysis showed that Russian speakers had a slightly lower proportion of errors than both Danes and Italians (both $ps = .06$), while the difference between the latter two was not significant.

Table 14. Predictors of Task 1 Results Controlling for All Significant Covariates

	DF	χ^2	p
Native Language	2	5.2	.07
Interest in Language	2	14.1	.0009*
NL Spelling	3	14.8	.002*
Age EN	1	3.3	.07
Travel/Friends	2	7.6	.02*
EN Proficiency 1	1	20.4	<.0001*
Gender	1	5.5	.02*

Even though Travel/Friends and Gender were not significant when tested as independent predictors of Task 1 results (Table 13), they were significant when other covariates were accounted for (Table 14). As illustrated by the left panel of Figure 3, male participants performed better in Task 1 than females; the right panel of the figure shows that the more important was traveling and communication with friends and family as contributors to participants' English learning, the worse were their irregular word spelling.

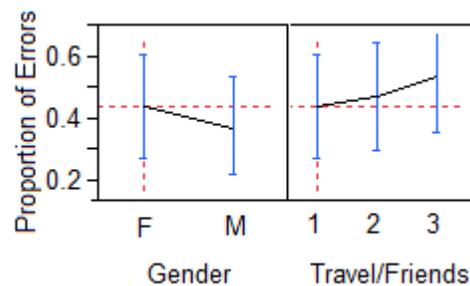


Figure 3. The Relationship between Task 1 Performance and Two Predictors: Travel/Friends and Gender

5.2.6. Summary of Task 1 Results

Task 1 was designed to test English learners' ability to spell irregular words – the ones that need to be memorized as a whole. The prediction of the study was that EFL learners whose L1 orthography is opaque, at least in the sound-to-spelling direction (Danes and Russians) would outperform EFL learners whose L1 orthography is transparent (Italians) in the task that requires whole word memorization. Task 1 results did not fully confirm this prediction. Whether or not covariates were accounted for, Danes and Italians performed equally well in Task 1, whereas Russians did slightly better than the other two EFL groups, accounting for the covariates. At the same time, all EFL learners performed significantly worse on Task 1 than native English speakers.

The most important predictors of the number of errors in irregular word spelling were English proficiency, interest in language and linguistics and native language spelling. Participants who performed the best had the highest English proficiency, were the most interested in languages and linguistics and had the highest spelling proficiency in their native language. The ways participants acquired English also played a role in their performance: the more important was traveling and communication with friends and colleagues as a contributor to English knowledge, the more errors participants made. In this sample, participants' gender also played a role: male participants performed better than female participants.

One other important result was the correlation between the number of unknown words in Task 1 and English proficiency, which was assessed based on participants' self-reports. This result confirmed a previous finding that self-reported language proficiency correlated with objective language proficiency measurements (Marian et al., 2007). A combined measure of English proficiency was created based on both self-reports and the objective measurement (the number of unknown words). This combined measure was used in all further analyses.

5.3. Task 2: Morphological Awareness

5.3.1. Scoring

In Task 2, participants were presented with a list of words with missing letters and asked to fill in the letters. All responses were coded as correct, incorrect, misinterpreted, or unknown. A correct response was the one supplying the appropriate letters. An incorrect response was the one of the few phonologically plausible, but not the correct one (e.g., <i> for “beaurocr_cy”, or <nn> for “lio_ess”). A misinterpreted response was a correctly spelled English word, but not the one that participants heard on the recording (e.g., <i> for “m_nt”, which was supposed to be *meant*, or <ck> for “thi_ess”, which stood for *thinness*). These responses might have resulted from participants not listening to the audio recording provided for each word. Finally, if a participant missed the word or supplied letters that produced a phonologically implausible spelling for the target and did not yield a real word, such response was coded as unknown (e.g., <rm> or <rh> for “to unde_ate”, which was to *underrate*).

5.3.2. Descriptive Statistics

The distribution of the responses across the four language groups is shown in Table 15.

Table 15. Descriptive Statistics of Task 2 Results

	English	Danish	Italian	Russian
Correct	2919	2976	2742	3245
Incorrect	599	722	994	721
Misinterpreted	10	2	28	19
Unknown	32	100	76	135
TOTAL	3560	3800	3840	4120

5.3.3. *Between-Group Differences in Task 2 Performance*

With misinterpreted and unknown words excluded, the proportion of misspelled words was 21% for native English speakers, 24% for Danish speakers, 36% for Italian speakers and 22% for Russian speakers.

To test whether these between-group differences were significant, a Generalized Linear Model was fit to the data with the Response Accuracy (proportion of correct responses out of all eligible responses) as the response and Native Language as a predictor. Native Language was significant ($\chi^2_3 = 45.3, p < .0001$). Contrast analysis showed that English speakers were better than all non-native speakers considered together ($\chi^2_1 = 11.1, p = .001$), but that this difference was driven by Italians: in pairwise comparisons, the difference between Danes and Americans was only marginally significant ($\chi^2_1 = 2.8, p = .10$), whereas the difference between Russians and Americans was not significant ($\chi^2_1 = .6, p = .4$). Within the three EFL groups, not controlling for the covariates, both Russians and Danes outperformed Italians (both $ps < .0001$), and the difference between Danes and Russians was not significant.

5.3.4. *Predictors of Task 2 Performance*

The predictors of Task 2 results were analyzed the same way as in Task 1: each predictor listed in Table 16 was analyzed using a GLM model controlling for Native Language.

To summarize the results in the table, when tested independently of other covariates, the following variables were significant predictors of Task 2 results: Interest in Language, age NL literacy, NL spelling, # FL, Age EN, and English proficiency. High interest in language, early acquisition of literacy, good spelling proficiency in the native language, high number of known foreign languages, early starting age of English acquisition, and high English proficiency were associated with good Task 2 performance. Gender was marginally significant: as in Task 1, males performed slightly better than females.

Table 16. Predictors of Task 2 Results, controlling for Native Language

Predictor	χ^2	p	Comment
Age	$\chi_1^2 = 1.1$	n. s.	
Gender	$\chi_1^2 = 3.1$	.08	The proportion of errors was slightly higher for females.
Interest in Language	$\chi_2^2 = 14.9$	.0006	The stronger interest in language, the lower proportion of misspellings.
Age NL Literacy	$\chi_1^2 = 13.5$	.0002	The proportion of misspellings increases as the age increases.
Reading in NL	$\chi_2^2 = 1.4$	n.s.	
NL Spelling	$\chi_3^2 = 20.4$	.0001	The proportion of misspelling decreases as NL spelling proficiency increases.
# FL	$\chi_1^2 = 18.8$	.0001	The proportion of misspelling decreases as #FL increases.
*Age EN	$\chi_1^2 = 19.0$	.0001	The proportion of misspelling increases as the age increases.
*School	$\chi_2^2 = .2$	n. s.	
*Travel/Friends	$\chi_2^2 = 3.5$	n. s.	
*Reading	$\chi_2^2 = 4.6$	n. s.	
*TV	$\chi_2^2 = .24$	n. s.	
*EN Proficiency 1	$\chi_1^2 = 53.7$	.0001	The proportion of misspellings decreases with increased proficiency.

*Analysis done only for the non-native English speakers.

5.3.5. Explaining the Between-Group Differences in Task 2 Performance

In order to see how accounting for all the covariates affected the difference between English native speakers and the three EFL groups, a GLM model was fit to the data with Response Accuracy as the response and Native Language, Age, Gender, Interest in Language, Age NL

Literacy, Reading in NL, #FL and the interactions with Native Language as predictors. None of the interactions was significant, except Gender \times Native Language, which was marginally significant ($\chi^2_3 = 7.2$; $p = .07$): male participants performed better than females in the three EFL groups, but not in the English native group (see Figure 4). Age and Reading in NL were also not significant. With the non-significant predictors removed from the model, all other predictors were significant at $\alpha = .05$ level, including Native Language ($\chi^2_3 = 35.2$, $p < .0001$).

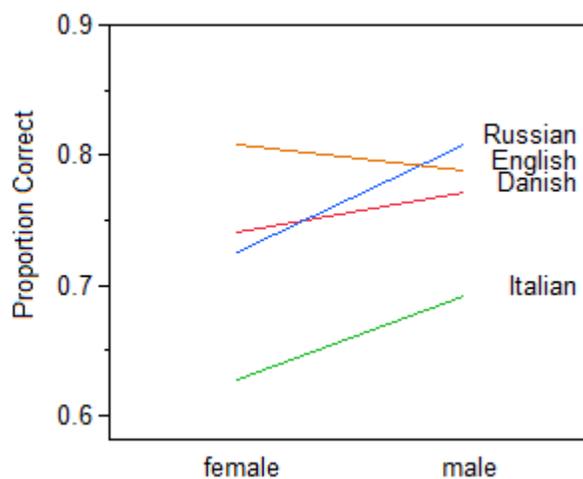


Figure 4. The Interaction of Gender and Native Language as predictors of Task 2 Results

Contrast analysis showed that while English speakers performed better than all EFL speakers considered together ($\chi^2_1 = 10.7$, $p = .001$), this difference was only significant for Italians ($\chi^2_1 = 27.3$, $p = <.0001$) and marginally significant for Danes ($\chi^2_1 = 3.1$, $p = .08$). The difference between Americans and Russians was not significant. In order to further explore the differences between non-native English speakers, English native speakers were removed from the analysis. All the covariates listed in Table 16 and their interactions with Native Language were analyzed as predictors of Response Accuracy using a GLM model.

All interactions except Gender \times Language, as well as Age, NL reading, School, Reading,

#FL, Age NL Literacy, and Native Spelling were not significant. The final Model with non-significant effects removed is presented in Table 17.

Table 17. Predictors of Task 1 Results Controlling for All Significant Covariates

Predictor	DF	χ^2	<i>p</i>
Native Language	2	24.8	<.0001*
Interest in Language	2	7.3	.03*
Age EN	1	11.8	.0006*
Travel/Friends	2	7.5	.02*
TV	2	5.5	.06
Gender	1	13.6	.0002*
Gender × Native Language	2	5.1	.08
EN Proficiency 1	1	44.1	<.0001*

Table 17 shows that Native Language was a significant predictor of Task 2 results. The difference between Russian speakers and both Danish and Italian speakers was significant (both $ps < .01$), as well as the difference between Italians and Danes ($\chi^2_1 = 3.8, p = .05$).

In this model, Travel/Friends was significant and TV was marginally significant, even though they were not significant when tested as independent predictors. As illustrated by Figure 5, participants whose English proficiency benefited a lot from watching TV, traveling and communication with friends scored lower than participants for whom TV, traveling and communication with friends were not important contributors to their English proficiency. There was also a marginally significant interaction between Native Language and Gender. Males performed better than females in all the three groups, but this difference was the most pronounced in the Russian group.

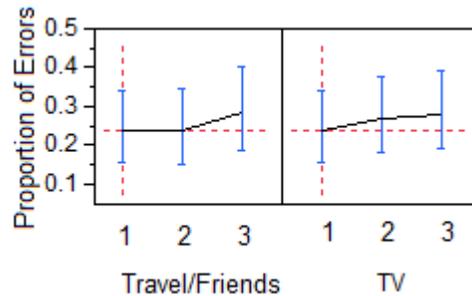


Figure 5. The Relationship between Task 2 Performance and Two Predictors: Travel/Friends and TV

5.3.6. Strategies Used by Spellers in Task 2

After participants completed Task 2, they were asked to describe the strategies that they had used to complete it, if they had used any and were aware of them. Based on the most prominent themes in participants' answers, their responses were classified along 4 dimensions:

1. Whether the participant mentioned any morphological strategies, e.g., breaking words up into morphemes, considering word derivation rules or considering cognate words in English or their native language. Examples of morphological strategies (participants' responses are given with the original spelling and punctuation):

“My strategy was, eg at misspelled, to remember that the word is combined with the two meanings: “ mis” (such as “dis”), and spelled as the other part of the word. They are two words and two meanings put together. Such as eg “dislike”. But I like this!”

“I looked at the meaning of the word, for instance it was obvious to me that baroness had one end as it is like the word baron - but for a woman, hence the ending -ess.

Plainness would have two n's as it is turning an adjective into a noun by adding -ness to the word plain”.

“Well, actually I sort of did it on intuition which in retrospect might have been a bad idea, but some strategies I did use. For instance, the words ending in -nm like sollemn is a loan word from the Latin adjective sollemnis which you could call an

etymological approach. For other words, especially words where “problem area” was the double consonants like -ll- og -nn-, I really didn't have a specific approach but trying to remember what I had learned in my English classes years ago (in which I didn't exactly excel ...)”

“many words associated with their “brothers” in my native language and this association influenced to spelling”.

“I tried to analyze every foreign word by knowledge of my native language”.

“Something - according to the corresponding words in the native language. Mostly by analyzing what part of the word misses letter(s) and what part of speech this word is”.

“I thought about the root of the word, and other words with similar roots, then added the endings”.

“I thought of other words which could help (column – columnist, etc.)”

Forty two percent of participants mentioned a morphological strategy in their answer.

2. Whether or not the participant mentioned visual strategies, e.g., trying to visualize words in their head, remember how it looked when they saw it written previously, check their answer to see if it “looked right”. Examples of visual strategies:

- *“I tried to visualize the words”.*
- *“I just wrote as I remember words as I saw them, without any strategy or grammar rules”.*
- *“I just tried to imagine the word written. I chose the spelling that didn't annoy me in any way”.*
- *“I watched on it and thought “if it looks like right” and if it looked like unright, I've thought about it once more”.*

Eighteen and a half percent of responses mentioned a visual strategy.

One of the rationales behind having participants fill in the gap in this task, instead of having

them chose from multiple answer options that differed in the spelling of the “problematic” segment was to make the use of the holistic visual strategy more difficult. Some participants indeed said that because of the nature of the task, they could not rely on the image of the word as a whole, as they normally do:

- *“Tried to visualize the complete word in my head. But this was difficult, since in daily life, the words I see aren't interrupted by a blank box in the middle”.*
- *“I must admit I am usually able to see if a word is misspelled once I write it completely, thus the mere fact that there was a white box in the middle of the word disrupted this ability. I could clearly see my mistakes on the following page for several of the words I misspelled”.*
- *“just tried to see if I could see it visueal but it was hard do to the grafic”.*
- *“Having the word split into two different fonts made it hard to see if the word looked right”.*

3. Whether or not the participant mentioned phonetic strategies, e.g., trying to sound out the words in their head, trying to rely on what they heard in order to determine the spelling.

Examples of responses that mentioned a phonetic strategy:

- *“I tried to say the word bit by bit for myself”.*
- *“I listened to the words, and tried to sound them out myself, as to see if I 'tasted' a letter that was not there”.*
- *“I already knew most of the words and their correct spelling. For those I didn't know I tried my best to determine the spelling from the pronunciation”.*

Eighteen percent of participants mentioned a phonetic strategy in their response.

4. Whether the participant said that s/he relied on his/her intuition. For example:

- *“I didn't “think” too hard about each word, instead I wrote what came naturally to me”.*
- *“No strategy... just gave it my best shot”.*

- “*I just followed my intuition. I think that is basically the way I approach grammar!*”
- “*No, I just filled in what I felt was suitable. Grammar isn't about analysis or knowing the rules, it's rather a feeling of what is right and what is wrong*”.

Eighteen percent of participants mentioned relying on their intuition.

Some participants mentioned more than one strategy in their response, e.g., applying a morphological strategy and then seeing if the word “looked right”, or using one strategy for some words and a different strategy for other words. Eighteen percent of responses did not mention any of the four approaches.

To see if some strategies tended to be used together (e.g., intuition and visual memory), pairwise relationships between all the four strategies were analyzed. All of the associations, except the one between visual and phonetic strategies, were significant (all $ps \leq .02$), and all of them were negative: the more a participant relied on one strategy, the less s/he relied on the other, which suggests that each person had, or at least was consciously aware of and described, one prominent strategy for Task 2 and no two particular strategies tended to be used (or at least mentioned) together.

5.3.7. Between-Group Differences in Strategy Use

While all four groups of participants made use of all the four types of strategies when working on Task 2, there were significant differences in how popular each type of strategy was in each group. This is illustrated in Table 18. The lower row of the table specifies p -values for between group comparisons (chi-square) on each type of strategy. Capital letters next to each proportion are used to indicate the significance of between-group differences on each type of strategies. If two groups share the same letter, the difference between them is not significant at $\alpha = .05$ level (e.g., Danes and Americans were equally likely to use a phonetic strategy).

Table 18. Use of Spelling Strategies across the Four L1s

	Morphological	Visual	Phonetic	Intuition
English	23% C	35% A	18% B	15% B
Danish	47% B	21% B	18% B	31% A
Italian	27% C	8% C	31% A	10% B
Russian	67% A	12% BC	6% C	16% B
<i>Average</i>	42%	18.5%	18%	18%
<i>p</i>	< .0001	< .0001	< .0001	.003

The numbers in Table 18 suggest that Italians used phonetic strategies significantly more often than the other three groups, followed by English and Danish speakers, followed by Russian speakers. English native speakers relied on visual strategies more than the EFL groups, while Danes relied on visual strategies slightly more than Russians and significantly more than Italians. Russian speakers were significantly more likely to use morphology to help them spell words than all other groups, followed by Danes, followed by Italians, who relied on morphology as much as native English speakers. Finally, Danes relied on their intuition more than the other three groups, who did not differ on their use of intuition.

5.3.8. Predictors of Strategy Use

Morphological Strategies. The use of morphological strategies was predicted by Interest in Language ($\chi^2_2 = 7.3, p = .03$), #FL ($\chi^2_1 = 4.5, p = .03$), and EN Proficiency 1 ($\chi^2_1 = 7.8, p = .005$). The more participants were interested in languages and linguistics and the more foreign languages they knew, the more likely they were to use a morphological strategy.

Visual Strategies. The use of visual strategies was predicted by Reading ($\chi^2_2 = 9.6, p = .008$). The highest number of visual strategies was used by participants who said that reading was less than a moderately important contributor to their English learning, while participants for whom

reading was a moderately important contributor were the least likely to report using visual strategies.

Phonetic Strategies. None of participants' characteristics assessed in the study was a significant predictor of phonetic strategy use when native language was controlled for, with the exception of Travel/Friends ($\chi^2_2 = 5.8, p = .05$). The more important was travel and communication with friends and colleagues as a contributor to English learning, the more likely participants were to use a phonetic strategy in Task 2.

Intuition. The use of intuition in Task 2 was predicted by Interest in Language ($\chi^2_2 = 6.5, p = .04$) and Reading ($\chi^2_2 = 12.3, p = .002$). Participants who reported being somewhat interested in languages and linguistics relied on their intuition more than both individuals who were not interested in languages and individuals who were very interested in languages. The more important was reading as a contributor to English knowledge, the more participants tended to rely on intuition.

5.3.9. Strategies as Predictors of Task 2 Performance and Explanation of Between-Group Differences in Task 2 Performance

To investigate whether the use of each of the four types of strategies affected Task 2 performance, each type of strategies was tested as a predictor of Task 2 Response Accuracy in two ways: independently, controlling for Native Language, and as one of the predictors in the model presented in Table 17.

Whether or not a speller used a morphological strategy was a significant predictor of Task 2 results in both analyses ($\chi^2_1 = 43, p < .0001$ when tested independently and $\chi^2_1 = 23, p < .0001$ when tested together with other predictors). Participants who used a morphological strategy scored higher on Task 2 than participants who did not use morphological strategies. When the use of morphological strategies was added to the model presented in Table 17, the differences between the three EFL groups became smaller: the difference between Danes and Italians

became non-significant ($\chi_1^2 = 1.8, p = .17$ compared to $\chi_1^2 = 3.8, p = .05$) and the difference between Russians and Danes became less significant ($\chi_1^2 = 4.7, p = .03$ compared to $\chi_1^2 = 7.8, p = .005$). These results suggest that the cross-linguistic differences in Task 2 performance are at least partially explained by how participants approached the task.

The use of visual strategies or intuition was not significant in either of the two analyses.

When tested independently, the use of a phonetic strategy was associated with a lower proportion of correct answers ($\chi_1^2 = 6.1, p = .01$), however, this predictor was not significant when controlling for other participants' characteristics listed in Table 17.

5.3.10. Summary of Task 2 Results

Task 2 was designed to assess how English language spellers with different native language backgrounds use morphological cues in spelling. In the task, participants saw words with missing letters, replaced by an empty box. They were required to supply the missing letters. In all the words, there were morphological cues to the right answer. Before the results of Task 2 can be discussed, the important question to address is whether participants used morphological cues at all when they completed the task, i.e., whether the Task in fact measured what it was supposed to measure. Indeed, in order to fill in the gaps correctly, participants might have relied on their whole word visual memory rather than on morphological analysis. To tap into the cognitive procedures involved in completing Task 2, participants were asked to reflect on the strategies they used. While some participants were not consciously aware of using any particular strategies, those who were, talked about morphological strategies more often than any other type of strategies. This suggests that the task was appropriate for testing the use of morphological cues in spelling. At the same time, it is important to note that a lot of participants did rely on holistic strategies and on visual memory, even though some of them said that the design of the task (an empty box in the middle of the word) disrupted these strategies. Even those participants who analyzed the morphological structure of words did not necessarily do it on every word of the

task.

The prediction of the study was that Russian speakers would outperform other EFL groups on the task requiring the use of morphological cues. This prediction was confirmed: controlling for participants' characteristics covarying with native language, Russian EFL learners outperformed both Danes and Italians; Danish speakers had an advantage over Italian speakers.

Another important finding pertaining to between-group differences was that unlike in Task 1, where native speakers outperformed all EFL learners, in Task 2 one of the EFL groups, namely Russians, performed as well as the English native speaker group, even when the covariates were controlled for.

The most important predictors of Task 2 performance were English proficiency, age when participants started to learn English, and interest in language. The ways participants acquired English also had an influence on their results: learning English from TV and/or via traveling and communication with friends and colleagues had a detrimental effect on participants' performance. Finally, gender was a significant predictor of the results as well: males performed better than females in the present study.

A set of findings pertained to the use of spelling strategies by participants completing Task 2. While each language group used various strategies, there were significant differences in how prevalent each type of strategy was in different groups. Thus, confirming the prediction of the study, Russian participants were the most likely to use morphological strategies, followed by Danish speakers, followed by Italian speakers and English native speakers. The use of morphological strategies was associated with interest in language and linguistics and the number of known foreign languages: not surprisingly, people who were linguistically-oriented tended to use more morphological analysis in spelling.

Further, the use of morphological strategies was predictive of the number of correct responses in Task 2, suggesting once again that the task was adequate to measure the ability to rely on morphological cues in spelling. The use of morphological strategies partially explained

the differences between EFL learners: Russian spellers scored better than Italians and Danes partly because they relied more on morphological cues. Interestingly, however, Russian participants scored as well as native English speakers despite the fact that the latter relied on morphology to a much lesser extent. Apparently, English speakers' disadvantage in strategies was compensated by their advantage in the amount of exposure to English print.

Indeed, English native speakers used visual strategies more than EFL learners, while Italians used them the least. Danes and Russians were in between. It was also found that phonetic strategies were the most popular in Italians and the extent to which these strategies were used was associated with the importance of travel and communication with friends as a contributor to English proficiency. These findings on strategies will be important for further discussion when we turn to the question of cross-linguistic transfer in Chapter 6.

5.4. Task 3: Context Sensitivity

5.4.1. Scoring and Descriptive Statistics

In Task 3, participants were presented with audio recordings of 32 pseudowords and asked to choose between two spellings for each pseudoword. The two spelling variants differed in the vowel spelling. The first spelling (further referred to as *typical vowel* spelling) was the most typical spelling of the vowel across all English monosyllabic words; the second spelling was a less typical spelling of the vowel (further referred to as *atypical vowel* spelling). In the 16 *experimental* pseudowords, the second spelling was the most typical spelling of the rhyme, whereas in the 16 *control* pseudowords the second spelling was an impossible spelling of the rhyme (section 4.1.3). Participants also had the option to indicate that both spelling variants were equally possible.

For each participant, the number of *typical vowel*, *atypical vowel* and *both possible* responses was calculated separately for experimental and control pseudowords. These results are presented in Table 19. The right column of the table presents ANOVA results showing the significance of

between-group differences on each measure.

Table 19. Descriptive Statistics of Task 3 Results

	English	Danish	Italian	Russian	ANOVA
Experimental Typical	32%	26%	21%	26%	$F_{3,379} = 6.4, p = .0003^*$
Experimental Atypical	43%	49%	58%	56%	$F_{3,379} = 13.4, p < .0001^*$
Experimental Both	25%	24%	20%	17%	$F_{3,379} = 3.3, p = .02^*$
Control Typical	53%	55%	54%	59%	$F_{3,379} = 1.7, p = .17$
Control Atypical	18%	20%	24%	21%	$F_{3,379} = 3.2, p = .03^*$
Control Both	29%	24%	22%	20%	$F_{3,379} = 3.7, p = .01^*$

5.4.2. Measuring Context Sensitivity

In previous research using a similar design (e.g., Treiman & Kessler, 2006) context sensitivity was measured as the difference in the number of atypical vowel spellings between experimental and control words. Indeed, if spellers are sensitive to the rhyme context, they should prefer the atypical vowel spelling over the typical vowel in experimental pseudowords more often than in control pseudowords, because in experimental pseudowords the atypical vowel spelling is the most common spelling of the rhyme, while in control words, it is the typical vowel spelling that is also the most typical spelling of the rhyme. Larger difference in the number of atypical vowel spellings between experimental and control pseudowords would indicate stronger context sensitivity.

The same logic was applied in the present study. A paired *t*-test was used to compare the number of atypical vowel spellings in experimental vs. control pseudowords across participants. This analysis was conducted separately for each native language group. Table 20 shows the mean difference in the number of atypical vowel spellings between experimental and control pseudowords for each language group.

Table 20. Context Sensitivity across the Four L1 Groups

	Mean Difference	t	DF	p
English	4.1	12.1	88	<.0001
Danish	4.5	16.1	94	<.0001
Italian	5.4	16.8	95	<.0001
Russian	5.6	18.3	102	<.0001

The difference in atypical vowel spellings between control and experimental pseudowords, further referred to as Context Sensitivity, had an approximately normal distribution ($M = 4.9$, $SD = 3.1$), therefore parametric statistical methods, such as ANOVA and Linear Regression were used for further analyses involving this variable.

ANOVA showed that not controlling for any covariates, the between-group differences in Context Sensitivity were significant ($F_{3, 379} = 5.2$, $p = .002$) and that native English speakers had a significantly lower score than Russians and Italians (both $ps < .02$ in a Tuckey's pairwise comparison test) and were not significantly different from Danes, while none of the differences between EFL learners themselves was significant.

5.4.3. Predictors of Context Sensitivity

As in Task 1 and Task 2, all participants' characteristics assessed in the study, namely: Age, Gender, Interest in Language, Age NL Literacy, Reading in NL, NL spelling, #FL, Age EN, School, Reading, TV, Travel/Friends and EN Proficiency 1, were tested as independent predictors of Context Sensitivity controlling for Native Language. A linear regression model was used for this analysis. Of all these variables, only TV was significant as an independent predictor ($F_{2, 289} = 3.1$, $p = .04$ respectively). High levels on this variable were associated with higher Context Sensitivity scores. EN Proficiency 1 was marginally significant and was associated with higher context sensitivity scores ($F_{1, 282} = 3.2$, $p = .08$).

To test if the difference between EFL learners remained insignificant when covariates were

accounted for, all participants' characteristics and their interactions with Native Language were included as predictors into a multiple regression model with Context Sensitivity being the response. The final model with non-significant predictors removed is presented in Table 21.

Table 21. Predictors of Context Sensitivity Controlling for All Significant Covariates

Predictor	DF	F	p
Native Language	2	9.5	.0001*
NL Spelling	2	3.2	.03*
School	2	2.7	.07
TV	2	4.3	.01*
Travel/Friends	2	.6	.54
EN Proficiency 1	1	.06	.8
NL Spelling × Native Language	6	2.0	.07*
School × Native Language	4	4.9	.0009*
Travel/Friends × Native Language	4	2.6	.04
EN Proficiency 1 × Native Language	2	3.6	.03

Italians had a higher score than both Danes and Russians (both $ps < .005$); the difference between the latter two groups was not significant. NL Spelling was significant, but only for Italians: better spellers had a lower Context Sensitivity score than poor spellers. TV had a positive effect on Context Sensitivity score. Travel/Friends was only significant for Italians: participants for whom Travel/Friends was a moderate contributor to English learning had lower context sensitivity score than participants for whom this was not an important contributor or a very important contributor. Finally, English Proficiency had a positive effect in Italians, negative effect in Danes and no effect in Russians.

5.4.4. The Ability to See Spelling Alternatives

In previous research on context sensitivity using a similar design participants were asked to

spell pseudowords played to them as an audio recording, rather than choose between spelling options. Therefore they did not have the option to indicate that they thought more than one way to spell a pseudoword was possible. In the present study, participants did have an opportunity to indicate that. It was interesting to find out whether the ability to see that there are two competing spellings for experimental words, each of which is “the best” at a different grain-size level (phoneme vs. rhyme), was correlated with any other linguistic or English proficiency skills. Therefore the number of *both possible* responses for the experimental pseudowords was also analyzed. A GLM model was used for this analysis: the response was the number of *both possible* responses to experimental words out of total possible (16).

There were significant between-group differences in the number of *both possible* answers for experimental pseudowords ($\chi^2_3 = 3.3, p = .02$). Danes and native English speakers were significantly higher on this measure than Russians and Italians ($\chi^2_1 = 8.6, p = .003$). There was no difference between Russians and Italians or between Danes and Americans.

In addition to Native Language, the following variables predicted the number of *both possible* responses when tested independently from other covariates and controlling for Native Language: Age ($\chi^2_1 = 4.9, p = .03$), NL spelling ($\chi^2_3 = 11.6, p = .009$). Older participants had more *both possible* responses. Participants who rated their native language spelling as 8 and 9 scored higher than those who rated their NL spelling as 10 or lower than 7. Age EN was a marginally significant predictor ($\chi^2_1 = 3.6, p = .06$): the older participants were when they started to learn English, the lower the number of *both possible* responses tended to be.

The differences between the four language groups remained the same controlling for all covariates: Danes and Americans had higher scores than Russians and Italians, while the difference between Danes and Americans and the difference between Russians and Italians remained insignificant. After non-significant predictors were removed, the final model included seven predictors, listed in Table 22. TV was marginally significant in this analysis and had a negative effect on the number of *both possible* answers. Travel/Friends \times Native Language was

also significant: the advantage of Danes over Italians and Russians did not exist in the group of participants for whom Travel/Friends was a moderately important contributor to English learning.

Table 22. Predictors of the Ability to see Spelling Alternatives Controlling for All Significant Covariates

Predictor	DF	χ^2	p
Native Language	2	13.4	.001*
Age EN	1	6.4	.01*
NL Spelling	3	12.3	.007*
TV	2	5.3	.07
Travel/Friends	2	2.0	.4
Age	1	5.7	.02*
Travel/Friends × Native Language	4	16.0	.003*

5.4.5. Summary of Task 3 Results

The purpose of the task was to assess EFL learners' context sensitivity in spelling – the ability to consider the context of a vowel when its spelling is ambiguous and when the context conditions the spelling. Sensitivity to such contextual orthographic pattern is not an analytical strategy – rather it is a type of implicit knowledge, considered by some researchers a type of statistical learning (see, e.g., Dich 2010, Treiman & Kessler, 2006 for discussion). Context sensitivity has been previously measured by asking participants to spell pseudowords containing ambiguous vowels. If participants chose the same spelling of a vowel more often in the pseudowords where that spelling was conditioned by the context than in pseudowords where that spelling would not be conditioned by the context, it would be taken as a proof that participants are sensitive to the rhyme context. The same logic for measuring context sensitivity was used in the design of the present experiment. But unlike in previous studies, rather than asking participants to spell the pseudowords presented auditorily, the study asked the participants to

choose between two spelling options or indicate that both options are valid. This was done in order to make results less dependent on participants' English sound recognition abilities and to deal with the differences in the vowel inventories between Danish, Russian, and Italian.

It appears from the results that given the differences in the design between the present study and previous studies, measuring context sensitivity the same way as it was measured before, i.e., as the difference in the number of atypical vowel spellings between experimental words, where the atypical spelling was conditioned by the context, and control words, where the spelling of the vowel was not conditioned, does not make sense. Indeed the results do not only disconfirm the prediction of the study that Danish EFL learners would do the best in the task, but also contradict many other theoretical expectations. First of all, it seems peculiar that native speakers demonstrated less sensitivity to context than Russians and Italians, whose native languages do not have orthographic patterns similar to those in English and Danish, i.e., vowel spelling conditioned by the following consonant(s). Second, it is also unexpected that the subset of Italian participants who are bad spellers in their native language outperformed all other participants. Further, it is unclear why learning English from TV, i.e., from auditory exposure, would be beneficial to developing an orthographic skill. Finally, it is also unclear why English proficiency would have the opposite effect on context sensitivity in speakers of different native languages. In sum, it is extremely difficult to find a theoretical explanation for this pattern of results, possibly suggesting that the context sensitivity measure used in the analysis is not appropriate for the present design.

As mentioned above, context sensitivity is thought of as a type of implicit knowledge that spellers might not be aware of, rather than a conscious spelling strategy. When participants are asked to provide the best spelling for a pseudoword, they might simply rely on their intuition about probabilistic orthographic patterns in the language. However, giving participants two spellings as well as an option to choose both arguably engages a more analytical approach to the problem and brings the fact that more than one spelling is possible to their awareness. Asking

people to compare two options might in a way block their intuitive response bringing to their awareness an alternative to what might have been their first intuitive choice otherwise. It is not clear what participants who said “both spellings are equally possible” to some of the pseudowords would have responded were they not made aware of two spelling options.

As explained in 4.1.3., for experimental words, both spelling options were “the best” in a way, both reflecting the most regular orthographic patterns, but at the different grain sizes: phoneme vs. rhyme. One could argue that the preference towards one or the other could indicate the level of granularity that each participant was more attuned to. But because in English there are spelling patterns involving both phonemes and larger units, such as rhyme, one could also argue that the ability to consider both levels is an important skill for spelling in English and that choosing the answer “Both spellings are equally possible” for experimental words reflects this ability. Therefore, it was also interesting to look at the number of *both possible* answers for the experimental words as a variable measuring one aspect of English spelling proficiency.

On this measure, English and Danish native speakers performed better than Russian and Italian EFL learners. If the number of *both possible* answers indicates the awareness of two grain-size levels of English orthographic patterns, this result is consistent with the prediction that spellers whose L1 orthography has context-driven orthographic rules (Danish) would be better able to see English spelling regularities at both the phoneme level and levels larger than phonemes.

This measure was best predicted by participants’ biological age, the age when they started to learn English, and native language spelling. The relationship between the number of *both possible* answers and NL spelling was not linear: good spellers did better than bad spellers, but also better than the ones who indicated that their native language spelling was perfect. As in previous tasks, the later participants started to learn English, the worse their performance was. Interestingly, in this task, biological age played a role as well, despite the fact that the age range of participants was quite limited. The way participants acquired English was also significant:

participants for whom watching TV and movies in English was a moderately important factor in English learning tended to score lower than individuals for whom this was an unimportant contributor to English knowledge.

5.5. Task 4: Phonological Skills

5.5.1. Scoring

In Task 4 participants were asked to spell 20 pseudowords presented to them as an audio recording. Each of the 20 responses from each participant was coded as *correct*, *incorrect*, *partial* or *missed*. If a participant did not make an attempt to spell a pseudoword, the response was counted as missed. If an attempt to spell was made, but more than one syllable was missing, that response was coded as partial. If all syllables were preserved or no more than one syllable was missing, the response was coded as either correct or incorrect. Any of the following three types of errors would lead to a spelling being coded as incorrect:

- Syllable structure was not preserved. Two possible errors of that type could occur:
 - o A syllable was missing, e.g., <guesstobe> for /spɪnsɪs'tʊpɪ/.
 - o An extra syllable was added, e.g., <budaloodaboo> for /bud'ludubu/.
- Consonantal structure was not preserved. Three possible errors of that type could occur:
 - o A consonant was missing, e.g., <pensistube> for /spɪnsɪs'tʊpɪ/.
 - o An extra consonant was added, e.g., <melrinloran> for /mɛlɪrɪ'lɔːrən/.
 - o A consonant was missing from one cluster, but added to a neighboring cluster, e.g., <si**p**nsestupie> for /spɪnsɪs'tʊpɪ/.
- Consonant substitution. Only those substitutions where the manner of articulation was not preserved were considered errors, e.g., a fricative in the place of a stop, a stop in the place of a sonorant, etc. For example: <hudalodaboo> for /bud'ludubu/, <gesttaluti> for /geskrɪ'tʊdɪ/. Substitution for consonants of the same manner of articulations, e.g., <s> for /f/, <g> for /b/ were not counted as errors.

5.5.2. *Descriptive Statistics and Between-Group Differences*

Table 23 gives the number of incorrect, partial and missed responses for each participant group.

Table 23. Descriptive Statistics of Task 4 Results

	EN	DA	IT	RU
Correct	1301	1162	747	1249
Incorrect	439	580	640	525
Partial	5	19	57	39
Missed	35	139	476	247
TOTAL	1780	1900	1920	2060

Partial and missed responses were excluded from further analysis. The proportion of incorrect responses out of all considered was 26% for native English speakers, 29% for Russian speakers, 33% for Danish speakers and 46% for Italian speakers. Not accounting for any covariates, the differences were non-significant between English speakers and Russian speakers and between Russians and Danes. All other differences were significant at the $\alpha = .05$ level. Further, the number of errors of each type was calculated for each language group (Table 24).

Table 24. Frequency of Three Types of Errors in Task 4 across the four L1s

	Syllable Structure	Consonant Structure	Consonant Type
English	71	462	90
Danish	129	570	111
Italian	105	672	124
Russian	81	515	112

5.5.3. Predictors of Task 4 Performance

The number of incorrect responses, as well as the number of each of the three types of errors was analyzed similarly to the analysis of the results of Task 1 and 2. GLM models were used for the analysis. For the analysis of the number of incorrect responses, the outcome variable was the number of incorrect responses out of the number of legitimate responses (e.g., not missed or partial).

For the analysis of the number of errors of each type, the outcome was the number of errors out of the number of legitimate responses. Using the number of legitimate responses as an approximation for the total possible number of errors was justified by the fact that the average number of errors of each type per word containing this type of error was close to one. In other words, if a participant made, for instance, a consonant structure error when trying to spell a word, most of the times there would be only one such error in that word, and only occasionally there would be more than one. The distribution of the number of consonant structure errors and consonant type errors is given in Table 25. As mentioned earlier, there could be more than one syllable structure error, but such cases were excluded from the analysis, meaning that there could only be 0 or 1 syllable structure error per word in the words that were analyzed.

Table 25. The Distribution of the Number of consonant structure and Consonant Type Errors

Number of Errors per word	Consonant Structure	Consonant Type
1	1224	292
2	237	27
3	35	6
4	4	0

Just like in previous tasks, the first step was to test each of the participants' characteristics assessed in the study as an independent predictor of Task 4 performance controlling for language group. The results of this analysis are presented in Table 26.

Table 26. Predictors of Task 4 Results, controlling for Native Language

Predictor	Incorrect	Syllable Structure	Consonant Structure	Consonant Type
Age	n. s.	n. s.	n. s.	n. s.
Gender	n. s.	$\chi_1^2 = 2.8$ $p = .09$	n.s.	n. s.
Interest in Language	$\chi_2^2 = 13.9$ $p = .0009$	$\chi_2^2 = 18.6$ $p < .0001$	$\chi_2^2 = 9.4$ $p < .009$	$\chi_2^2 = 7.9$ $p = .02$
Age NL Literacy	$\chi_1^2 = 16.5$ $p < .0001$	$\chi_1^2 = 9.2$ $p = .002$	$\chi_1^2 = 15.7$ $p < .0001$	n. s.
Reading in NL	n. s.	n. s.	n. s.	n. s.
NL Spelling	$\chi_3^2 = 15.7$ $p = .001$	$\chi_3^2 = 29.0$ $p < .0001$	$\chi_3^2 = 7.3$ $p = .06$	n. s.
# FL	$\chi_1^2 = 8.7$ $p = .003$	$\chi_1^2 = 6.4$ $p = .01$	$\chi_1^2 = 5.3$ $p = .02$	n. s.
*Age EN	$\chi_1^2 = 12.9$ $p = .0004$	$\chi_1^2 = 3.8$ $p = .05$	$\chi_1^2 = 11.0$ $p = .0009$	n. s.
*School	n. s.	n. s.	n. s.	n. s.
*Travel/Friends	n. s.	n. s.	n. s.	$\chi_2^2 = 6.4$ $p = .04$
*Reading	n. s.	n. s.	n. s.	n. s.
*TV	$\chi_2^2 = 11.3$ $p = .004$	n. s.	$\chi_2^2 = 16.6$ $p = .0003$	$\chi_2^2 = 5.9$ $p = .05$
*EN Proficiency 1	$\chi_1^2 = 48.8$ $p < .0001$	$\chi_1^2 = 5.2$ $p = .02$	$\chi_1^2 = 33.3$ $p < .0001$	$\chi_1^2 = 20.1$ $p < .0001$

*Analysis done only for the non-native English speakers.

To summarize, all of the four measures of Task 4 performance were predicted by Interest in Language and English Proficiency 1. Higher levels of interest in language and English proficiency were associated with fewer errors of all types and the number of incorrect responses. All of the measures of Task 4 performance but the number of consonant type errors were predicted by Age NL Literacy, NL Spelling, #FL and Age EN: better performance was associated with earlier age of NL literacy acquisition, better native language spelling skills, greater number of known foreign languages and earlier age of English acquisition onset.

Travel/Friends predicted the number of consonant type errors: higher levels of this predictor were associated with lower number of errors. The same was true for the relationship between TV and the number of incorrect responses, the number of consonant structure responses and the number of consonant type responses: the more important watching TV and movies was as a contributor to English learning, the fewer errors there were in Task 4. Finally, gender was a marginally significant predictor of the number of syllables structure errors: as in other tasks, males tended to perform better than females.

5.5.4. Explaining Between-Group Differences in Task 4 Performance

Differences in the number of incorrect responses. To test whether the difference between English native speakers and EFL learners was significant on this measure when covariates were controlled for, English Native, Age, Gender, Interest in Language, Age NL Literacy, Reading in NL and #FL and the interactions with Native Language were entered as predictors into the GLM model described above.

The analysis showed that controlling for all covariates, English native speakers spelled fewer words incorrectly than EFL learners ($\chi^2_1 = 20.3, p < .0001$). Other significant main effects included Interest in Language ($\chi^2_2 = 6.7, p = .04$), Gender ($\chi^2_1 = 6.0, p = .01$) and #FL ($\chi^2_1 = 6.5, p = .01$). The interaction between Native Language and Age NL literacy was significant ($\chi^2_2 = 7.3, p = .007$): Age NL literacy only had effect on EFL learners' results, but not on native speakers' results.

To see whether there were significant differences between EFL learners on the number of incorrect responses controlling for covariates, Native Language, all participants' characteristics listed in Table 26 and their interactions with Native Language were included in the model as predictors. The final model with insignificant predictors removed is given in Table 27.

Table 27. Predictors of Number of Incorrect answers in Task 4, Controlling for All Significant Covariates

Predictor	DF	χ^2	<i>p</i>
Native Language	2	9.0	.01*
Gender	1	3.7	.06
Age NL Literacy	1	9.7	.002*
Age EN	1	4.5	.03*
TV	2	11.1	.004*
EN Proficiency 1	1	26.4	< .0001*
Travel /Friends	2	1.6	.5
Travel /Friends × Native Language	4	13.7	.008*

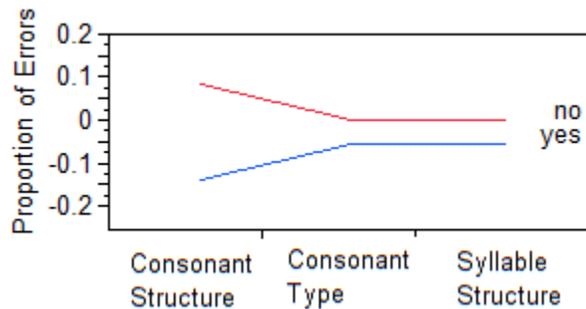
Native Language was a significant predictor, but contrast analysis showed that only the difference between Russians and Italian speakers was significant and only for those participants for whom Travel/Friends was an unimportant or moderately important contributor to English learning.

Comparison between Different Types of Errors. The next step was to see whether the magnitude of the differences between language groups in Task 4 results depended on the type of errors; in other words, where between-group differences in the number of errors in syllable structure were the same as in the number of errors in consonant structure and consonant type. In order to do that, a new data table was created whether instead of one response, each participant had three responses: number of syllable structure errors out of total legitimate responses, number of consonant structure errors out of total legitimate responses and number of consonant type errors out of total legitimate responses. The GLM model used for this analysis had the proportion of errors as the response and the predictors were English Native/Native language, Error Type and English Native/Native Language by Error Type interaction, as well as other covariates, which were participants' characteristics listed in Table 26.

**Table 28. Predictor of Number of Errors in Task 4,
Controlling for English Native and All Significant Covariates**

Predictor	DF	χ^2	p
English Native	1	12.5	.0004*
Error Type	2	571.5	< .0001*
Error Type \times English Native	2	.1	.9
Interest in Language	2	10.7	.005*
Age NL literacy	1	1.5	.22*
NL Spelling	3	25.8	< .0001*
#FL	1	8.5	.004*
Gender	1	11.8	.0006*
Age NL literacy \times English Native	1	10.1	.001*
NL Spelling \times English Native	3	16.6	.0009*

First, English native speakers were compared to EFL learners. Controlling for significant covariates (Table 28), English speakers made fewer errors of each of the three types; the interaction between Error Type and English Native was not significant (Figure 6).



**Figure 6. Interaction between English Native and Error Type
as Predictors of number of Errors in Task 4**

**Table 29. Predictor of Number of Errors in Task 4,
Controlling for Native Language and All Significant Covariates**

Predictor	DF	χ^2	p
Native Language	2	14.6	.0007*
Error Type	2	942.5	< .0001*
Error Type \times Native Language	4	11.9	.02*
Age NL Literacy	1	6.6	.01*
Reading in NL	2	10.2	.006*
NL Spelling	3	15.7	.001*
Age EN	1	8.7	.003*
Reading	2	2.9	.2
TV	2	17.8	.0001*
Travel/Friends	2	3.9	.14
EN Proficiency 1	1	18.3	< .0001*
Gender	1	4.2	.04*
Reading \times Native Language	4	11.5	.02*
Travel/Friends \times Native Language	4	18.2	.001*

Next, the three EFL groups were compared to each other. The final model with non-significant predictors removed is presented in Table 29. Both Native Language and Native Language \times Error Type were significant. The interaction is illustrated by Figure 7. Italians had more errors than Danes and Russian, but this difference was the most pronounced on the consonant structure errors and the least pronounced on the syllable structure errors: in fact, the difference between Italians and Danes in the number of syllable errors was not significant.

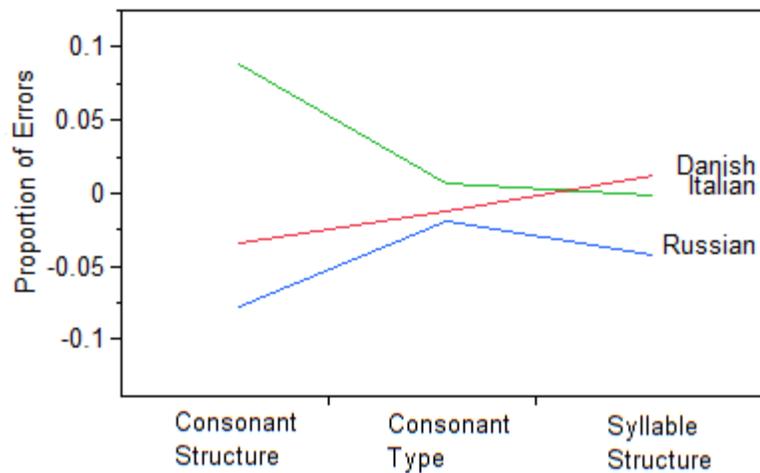


Figure 7. Interaction between Native Language and Error Type as Predictors of number of Errors in Task 4

5.5.5. Summary of Task 4 Results

The purpose of Task 4 was to assess participants' phonological skills in English. One of the typical tasks for assessing phonological awareness is spelling of unfamiliar words, or pseudowords. The study predicted that participants whose native language orthography is transparent in at least one direction (i.e., Italians and Russians) would perform the best on the phonological awareness task. This prediction was not confirmed: Italians performed worse than Russian and Danish participants and the difference between the latter two was not significant. The differences between the three EFL groups depended on the type of errors: the differences in the number of errors involving consonant clusters were the most pronounced, while the differences in the number of errors in syllabic structure were the least significant. English speakers performed better than all EFL groups, regardless of the error type.

The strongest predictors of Task 4 performance, which were significant in all analyses of Task 4 results, were age when participants started to read and write in their native language, age when participants started learning English, English proficiency, the importance of watching TV

and movies as a contributor to learning English, and gender. As in previous tasks, later age of beginning to read and write in the native language and beginning to learn English, lower English proficiency, and female gender were associated with worse performance. Unlike in other tasks, the importance of watching TV and movies as a contributor to English learning had a positive effect on Task 4 performance: the more important this contributor was, the fewer errors participants made.

5.6. *Between-Task Comparisons*

5.6.1. Between-Group Differences across Tasks

Data analysis discussed up to this point has shown that in all the four tasks of the study the performance of participants differed by their native language, and also that the nature and the magnitude of these between-group differences varied across tasks. Table 30 gives the summary of the results across the four tasks described in 5.2–5.5. and shows that overall, Russian EFL learners had the largest advantage, and the Italians were the poorest spellers, but these differences were not the same across different tasks.

To quantify these between-task differences, the data from all the four tasks were analyzed once again, this time all together in one GLM model. In that model, the response was the proportion of correct answers (the number of correct answers out of all eligible responses for each task), and the predictors were Task, English Native, Native Language nested in English Native, English Native \times Task, and Native Language \times Task (Table 31). In Task 3, the number of *both possible* responses to experimental words was taken as the measure of response accuracy.

Table 30. Summary of Between-Group Differences across Tasks

	Highest Score	Intermed. Score	Lowest Score	Comment
Task 1: Irregular words Spelling	Russian		Danish, Italian	Between-group differences marginally significant
Task 2: Morphological skills	Russian	Danish	Italian	
Use of visual strategies	Danish	Russian	Italian	
Use of morphological strategies	Russian	Danish	Italian	
Use of phonetic strategies	Italian	Danish	Russian	
Task 3: Alternative spellings	Danish		Russian, Italian	
Task 4: Complex pseudoword spelling	Russian	Danish	Italian	The difference between Danish and Russian and between Danish and Italian non-significant

Table 31. Interaction of Native Language and Task as Predictors of Number of Correct Answers across Tasks

Predictor	DF	χ^2	p
English Native	1	129.0	<.0001
Native Language[English Native]	2	29.1	<.0001
Task	3	1840.0	.0001
English Native × Task	3	85.7	<.0001
Language × Task[English Native]	6	30.7	<.0001

As Table 31 shows, all of the predictors were highly significant, proving that both the difference between English Native speakers and EFL learners and the difference between EFL learners themselves were not the same across all tasks.

The interaction of Native Language and Task was further tested controlling for covariates. All participants' characteristics previously analyzed as predictors of their spelling performance in this study were included in the model as predictors of the proportion of correct responses in addition to Native Language, Task and Native Language \times Task. When controlling for the covariates, both Native Language and its interaction with Task were significant ($\chi^2_2 = 20.3$, $p < .0001$ and $\chi^2_6 = 33.3$, $p < .0001$ respectively), once again confirming that English spelling proficiency was predicted by learners' native language, but the magnitude of the cross-linguistic differences depended on the particular component of spelling competence.

5.6.2. Correlations between the Results of the Four Tasks

The next step of the between-task comparisons was to assess the correlations between the results of the four tasks. In order to control for the covariates, studentized residuals derived from the model described above were used for this analysis, rather than the raw task scores. The correlations and their significance are shown in Table 32.

Table 32. Correlation between Results of Four Tasks

	Task 2	Task 3	Task 4
Task 1	$r = .46$ $p < .0001$	$r = .17$ $p = .005$	$r = .08$ n. s.
Task 2		$r = .19$ $p = .002$	$r = .17$ $p = .007$
Task 3			$r = .007$ n. s.

The analysis showed that the pairwise correlations between the results of the four tasks were all positive and almost all significant: complex pseudoword spelling (Task 4) seems to be the least related to other tasks. At the same time, it is important to note that even though the correlations were statistically significant, they were weak.

In sum, the results of the four tasks testing four components of English spelling proficiency were weakly correlated with each other, and in each task, except Task 1, participants' score was affected by their native language. However, the nature and magnitude of between-group differences depended on the specific task.

5.6.3. The Effect of Predictors of Spelling Performance across Tasks

The study tested a number of participants' characteristics as predictors of performance in each of the tasks. Table 33 summarizes the findings regarding each predictor and its significance in each of the tasks. The checks in the cells of the table indicate whether the predictor was significant in the particular task, controlling for other covariates.

In order to quantify the between-task differences in the effects of various predictors, the data were analyzed using a GLM model where the proportion of correct answers was the response and the predictors were Task, Native Language, and all of the variables listed in Table 33 and their interactions with Task. Table 34 shows all the main effects and interactions that were significant.

Table 34 shows that most predictors did not interact with Task: their effect on spellers' performance was comparable across tasks. The predictors that turned out to be the strongest, i.e., had a consistent effect in all the four tasks, were: Interest in language, Gender, Age EN and Travel/Friends. In this study, the best spellers in all tasks were the ones who were the most interested in language and linguistics, who started learning English earlier than their peers, for whom traveling and communication with friends, colleagues and relatives was not a very important contributor to English learning, and who were male.

Table 33. Effect of Participants' Characteristics on Spelling Performance across Tasks

	Taks 1 Irregular Words	Task 2 Morphology	Task 3 Alternat. Spellings	Task 4 Complex Pseudowords
Age			✓	
Gender	✓	✓		✓
Interest in Language	✓	✓		
Age NL literacy				✓
Reading in NL				
NL spelling	✓		✓	
# FL				
Age EN	✓	✓	✓	✓
School				
Travel/Friends	✓	✓		✓
Reading		✓*		
TV		✓		✓
En Proficiency 1	✓	✓	✓	

*Did not affect the number of correct answers, but predicted the used of visual strategies and intuition.

For three predictors, NL spelling, TV, and EN Proficiency 1 the effect depended on the task, as illustrated in Figure 8. In Tasks 1, 2 and 4 native language spelling skill tended to have a positive effect on English spelling performance, with the trend being the most noticeable in Task 1, irregular word spelling. In Task 3, where the ability to see alternative spellings was measured, this relationship is nonlinear. The importance of watching TV and movies in English as a contributor to English proficiency had a negative effect on Task 1 results – irregular word spelling – and Task 2 results – morphological awareness. It had a positive effect on Task 4 results – complex pseudoword spelling, and a weak nonlinear relationship with Task 3 results – the ability to see alternative spellings. English proficiency had a positive effect in Tasks 1, 2 and 4, and no effect in Task 3.

Table 34. Interactions of Predictors of Spelling Performance with Task

Predictor	DF	χ^2	p
Native Language	2	22.9	<.0001*
Task	3	108.4	<.0001*
Interest in Language	2	20.5	<.0001*
NL Spelling	3	22.3	<.0001*
Age EN	1	19.7	<.0001*
TV	2	4.5	.10
Travel/Friends	2	17.4	.0002*
EN Proficiency 1	1	48.6	<.0001*
Gender	1	14.1	.0002*
Native Language \times Task	6	37.2	<.0001*
NL Spelling \times Task	9	20.2	.02*
TV \times Task	6	16.4	.01*
EN Proficiency 1 \times Task	3	8.5	.04*

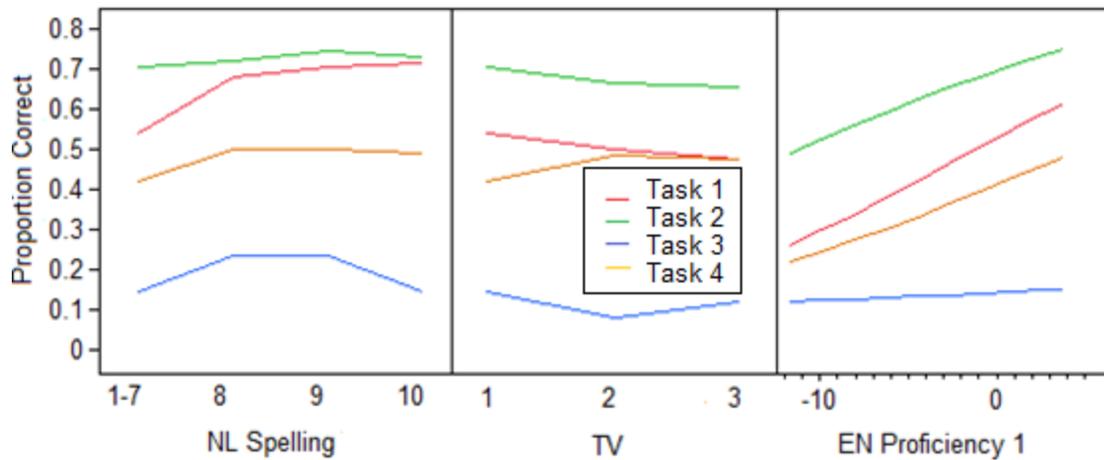


Figure 8. Interaction of NL Spelling, TV and English Proficiency 1 with Task in predicting Spelling Performance

To summarize, the between-task comparisons show that the four components of English spelling proficiency tested in the study were somewhat independent from one another: they were only weakly correlated with one another and they were predicted by different variables. In addition, between-group differences in spelling performance were not the same across the four tasks. Some of the between-group differences discovered in the study were consistent with the predictions, while others were not. The next chapter discusses which initial hypotheses were confirmed and the reasons why some of the hypotheses were not confirmed.

CHAPTER 6

DISCUSSION

6.1. Summary of Study Goals and Approach

The study tested several predictions derived from the evidence that different orthographies “train” different types of skills in spellers and therefore English-as-foreign-language learners from different first language backgrounds approach the task of learning to spell in English with different sets of skills in place. Because native speakers of different languages have different sets of literacy-related skills and therefore different opportunities for cross-linguistic transfer that would benefit English spelling, the study predicted differences in English spelling proficiency between individuals from different first language backgrounds.

Unlike many previous studies looking at spelling competence as a whole, the present study considered four separate skills that have been previously identified as components of English spelling proficiency. In addition to the hypothesis that English spelling performance would depend on EFL learners’ native language, the study also predicted that the nature and size of these cross-linguistic differences would not be the same across the four different components of spelling proficiency because cross-linguistic transfer of L1 spelling skills would benefit only some, but not all of the components.

The study compared three groups of EFL learners: Danish, Italian, and Russian speakers, and one English native speaker group on their performance in four tasks designed to test four different components of English spelling proficiency: irregular word spelling (Task 1), sensitivity to morphological cues (Task 2), context sensitivity (Task 3) and phonological awareness (Task 4). The three L1 backgrounds were chosen based on how each of the four skills involved in spelling is “trained” in spellers of each of these three languages.

Participants of the study were young adults, more specifically university students. Participant groups were relatively homogeneous with regards to demographic characteristics, with the exception of gender distribution, which varied across groups. The EFL learners' English proficiency and the ways they acquired English were also comparable, although not identical, across groups. All participants had intermediate to high proficiency in English. Fair English proficiency was one of the prerequisites of participation since all the instructions were provided in English.

The approach to the analysis of the results was to first compare the groups on their performance in each of the four tasks, controlling for subjects' demographic and language proficiency characteristics. Then, participants' performance was compared across all tasks.

Overall, the evidence obtained in the study confirmed the prediction that the spelling performance of EFL learners depended on their native language and that the cross-linguistic differences were not the same across different tasks. However, not all the between-language differences conformed to the specific predictions of the study. The concluding chapter of the thesis discusses the results of the study starting with the ones that confirm the initial hypotheses, followed by the results that were not consistent with the predictions and the potential reasons for the discrepancies, and concluding with additional findings, placing them in the context of previous work on spelling. The chapter also assesses the strengths and weaknesses of the study and its theoretical and practical implications.

6.2. Confirmation of the Hypotheses

6.2.1. Cross-Linguistic Comparisons across Tasks

The strongest confirmation of the hypothesis that learners' native language has an influence on EFL spelling proficiency and that the influence is not the same across different components of spelling competence comes from the results of between-task comparisons discussed in the last section of the previous chapter (5.6).

These results demonstrated between-group differences in spelling performance and also showed that the size and nature of the differences was not the same across different tasks. Overall, Russians performed better than the other two EFL groups and Italians had the worst results, but neither the magnitude of these differences nor the pattern itself were consistent across the four tasks. The study also found that the effect of native language spelling proficiency was not the same across tasks.

These findings suggest that while native language spelling expertise in some L1 orthographies may be more beneficial for learning to spell in EFL than spelling expertise in other L1 orthographies, the positive cross-linguistic transfer only affects some, but not all components of spelling proficiency, such that the advantage of one L1 background over others is only seen for some, but not all skills that English spelling competence involves.

This conclusion, which implies that components of spelling proficiency are somewhat independent, is supported by other results of the study. Thus, while some predictors of English spelling proficiency had a consistent effect across all tasks, the study also identified predictors of spelling performance whose effect was task-specific. Further, the between task comparisons revealed that when participants' English proficiency, native language spelling skills and demographic characteristics were accounted for, the results of the four tasks were correlated, but only weakly so.

On one hand, the evidence of between-task correlations combined with the finding that the same predictors affected different aspects of spelling competence suggests that there exist underlying factors common to various skills related to spelling. This is consistent with the idea shared by the community of literacy researchers that all literacy-related skills are interdependent and that good readers and spellers tend to perform well in all reading and spelling tasks, while bad readers and spellers tend to perform badly in all such tasks (e.g., Treiman, 1984). On the other hand, the fact that between-task correlations were quite weak, that not all of the predictors were equally important in explaining the results of different tasks, and finally that the effect of participants' L1 background was different across tasks brings some qualifications to this idea.

These findings show that different aspects of spelling proficiency are somewhat independent from one another, that one can be good at one of them, but not as good at the others, and that training of one of the multiple skills involved in spelling proficiency may not necessarily improve the other skills. This finding has important implications for educational practices, which we will return to in 6.5.

6.2.2. Transfer of Morphological Awareness

Other findings confirming one of the hypotheses of the study come from the task testing the use of morphological cues in spelling (Task 2, 5.3.). The rationale behind the hypothesis that this task tested was based on the idea that learners of opaque orthographies develop the ability to consider sound-spelling correspondences not only on the phonemic level, but also in units larger than phonemes. It was hypothesized that this ability is transferred across languages and that the nature and size of the larger-than-phoneme units that spellers operate depends on the nature of L1 orthographic regularities. Task 2 in particular tested the ability to consider sound-spelling correspondences at the level of morphemes. The prediction for this task was that Russian and Danish participants, whose L1 orthography is opaque, would demonstrate a better ability to consider morphemes than Italian learners, whose L1 orthography is transparent. It was also predicted that Russians, who learned to spell in an orthography where most rules are morphology based and thus morphological analysis is the key skill in good spelling, would be the best at seeing morphologically motivated spelling regularities in L2 words and thus would outperform Danes and Italians on resolving spelling problems where morphology provides cues to the correct answer. These predictions were confirmed: Russians' results were better than both Italians' and Danes'; Danish speakers had an advantage over Italian speakers.

The study also found that Russian participants relied on morphological analysis to a larger extent than the two other groups, which partially explained their success in the task because the use of morphological strategies was associated with lower errors rates.

In addition to native language, the use of morphological strategies was predicted by how interested participants were in language and linguistics and how many foreign languages they knew. This association does not seem surprising and suggests that the use of morphological strategies in spelling, which involves the analysis of word structure and relationships between words, is to an extent determined by linguistic curiosity and the propensity to reflect on linguistic structures.

While using morphological cues was helpful in Task 2, it was not the only way for participants to achieve good results. In their comments following the completion of the morphological task many of them indicated that they tended to rely more on holistic visual strategies, even though some of them admitted that the format of the task disrupted those strategies to a degree. The fact that Russian participants scored as well as English native speakers, who, according to their self-reports, relied much more on whole-word memory than on morphological analysis, and that strategy use only partially explained the differences between EFL groups, shows that there can be multiple cognitive pathways to achieving the same result in spelling performance, given enough practice. The advantage of one way over others is then not necessarily the top level of performance, but rather how much it takes to reach that level. In the morphological task, Russian EFL learners scored as well as native English speakers, who presumably had significantly more practice spelling English words. Thus the advantage of the morphological strategies used by Russian spellers over the visual strategies used by the native speakers was not the number of correctly spelled words, but rather the amount of experience needed to achieve that level of proficiency.

The results of the study discussed in this section have an important theoretical implication for disambiguating the effect of the orthography on spellers' ability to rely on morphological cues from the effect of the morphological system of the language. Chapter 2 described the work by Gillis and Ravid (2006), who compared Dutch and Hebrew speakers on their ability to use morphological cues in L1 spelling and found that Hebrew speakers were better at this ability.

One explanation of this finding is the fact that in Hebrew orthography, morphological cues play a more important role than in Dutch and thus spellers are better trained to use the cues. As discussed in Chapter 2, an alternative explanation would attribute Hebrew speakers' greater attention to morphology to the structure of the language, rather than to its orthography, more specifically to the fact that Hebrew morphology is richer than Dutch. The results of the present study seem to refute this alternative explanation: as discussed in Chapter 3, both Russian and Italian are morphologically rich languages; however Russians were much better at using morphological cues when spelling in English than Italians. This seems to suggest that it is not the morphological structure per se, but rather its relation to orthographic rules that plays an important role in shaping cognitive mechanisms of spelling.

6.3. Results Inconsistent with Predictions

The study confirmed the predictions about cross-linguistic differences in the use of morphological cues in English spelling; however the predictions about cross-linguistic differences in other aspects of English proficiency were not fully supported. This section discusses possible reasons for why this was the case.

6.3.1. Whole-Word Memorization

One of the predictions for which no confirmation was found was that Danish and Russian spellers would do better at irregular English word spelling than Italians. The idea behind the prediction was that learning an opaque orthography, where there are a lot of irregularly spelled words, develops whole-word visual strategies in spellers and that they transfer these strategies to L2, where they are helpful in spelling irregular words. Learning a transparent orthography, on the other hand, promotes the use of sounding out strategies, which are mostly non-adaptive in English and often lead to errors. Because Danes and Russians need to memorize more irregularly spelled words in their native language than Italians, and because Italians learned to spell in a

transparent orthography, the latter were expected to be at a disadvantage for irregular English word spelling.

The results of the study did not follow the predicted pattern. Thus, in Task 1, Danes and Italians were equally likely to misspell words, and Russians had a slight advantage over both. At the same time, the idea that experience of spelling in an opaque orthography promotes whole word visual strategies, which are transferred to L2, was supported by the results from participants' observations on spelling strategy use. Thus, participants who reported relying the most on visual strategies were English speakers, followed by Danish speakers, followed by Russians, followed by Italians. This order parallels the degree of orthographic transparency of the four languages: from English with the most opaque orthography, to Italian, most transparent orthography. Learners of the transparent Italian orthography, on the other hand, were found to use phonetic strategies more than the other groups of spellers.

One possible reason why Italians did not score worse than Danes might have been that even though Italians rely less on whole-word visual skills but more on their phonological skills, the whole-word orthographic representation that they do form are more accurate than those of Danish speakers. This explanation finds support in research on L1 spelling. It has been shown that whole-word memorization is not correlated with non-verbal memory skills (e.g., Fischer et al., 1985) and that early phonological awareness skills in childhood predict irregular word spelling in adults (e.g., Allyn & Burt, 1998). The proposed mechanism of this relationship is that good early phonological skills ensure more accurate decoding of words during learning to read, resulting in more accurate orthographic representations of words stored in memory. People with poor early phonological skills learn to rely on partial information when reading, while guessing the rest, which results in weaker orthographic knowledge (see Allyn & Burt, 1998, for discussion). Considering the evidence discussed in Chapter 2 that readers in transparent orthographies tend to process words letter by letter and that readers in opaque orthographies rely on larger units (Ziegler & Goswami, 2005, 2006), the account of Italian speakers having stronger

orthographic representations than Danes seems plausible. The slight advantage of Russian spellers over Italians would then be explained by the fact that Russian orthography, on one hand, is opaque in sound-to-spelling directions, but is transparent in spelling-to-sound direction, thus helping the learners to develop both whole-word visual strategies and accurate orthographic representations.

In other words, while Danes and Russians might be better than Italians in relying on the whole-word visual strategies, found to be the most efficient for English spelling (e.g., Rittle-Johnson & Siegler, 1999), Russians and Italians might have stronger orthographic representations of English words than Danes. This would suggest that Italians tend to make errors because they rely on non-adaptive phonetic strategies and Danes make mistakes because their whole-word representations are not accurate; Russians have an advantage over both because they benefit from both the adaptive strategies and strong representations.

Some preliminary empirical results support this account. For instance, Ringbom (1987) compared Finnish- and Swedish-speaking children living in Finland on how they learn English as a second language. Finnish has an orthography that is very transparent in both directions, having almost perfect one-to-one correspondences between letters and sounds, whereas Swedish orthography is more opaque in the sound-to-spelling direction. Ringbom found that Finnish L1 children make significantly fewer spelling errors than Swedish L1 children. The author attributes these findings to the differences between the two orthographies.

Another piece of converging evidence comes from the study by D'Anguilli, Siegel, and Serra (2001), who tested Italian-English bilinguals and Italian and English speaking monolinguals (ages 9-13) on a number of literacy-related tasks. The authors found that bilingual children outperformed monolingual English speaking children on English tasks involving reading and spelling. This advantage could not be attributed to bilingualism per se since bilinguals performed worse than Italian monolinguals in all Italian reading and spelling tasks. The authors hypothesize that it is learning a transparent orthography that promote stronger English orthographic

representations in Italian-English bilinguals. Applying the same logic to the present study, Italians' experience with a transparent orthography would have provided them with the ability to form strong English orthographic representations, which would counterbalance the disadvantage of having spelling strategies that are often non-adaptive, e.g., sounding out.

To sum up, the results of the study, more specifically of Task 1, seem to indicate that having the experience with irregular word spelling in L1 does not alone make individuals better at irregular word spelling in L2. Even though, in line with the predictions of the study, L1 orthography shapes cognitive strategies with which spellers approach the task of L2 word spelling, these strategies do not always guarantee spellers' success. Despite the fact that spellers from different L1 backgrounds tend to use different strategies, they seem to achieve comparable results, given their amount of practice.

6.3.2. Context Sensitivity

Another prediction of the study was that experience in L1 orthography rich in context-driven orthographic patterns would be transferable from L1 and helpful in seeing similar context-driven orthographic regularities in L2. The study predicted that Danish EFL learners would be better at recognizing context-driven regularities in English than Russian and Italian EFL learners because out of the three languages, only in Danish context-based regularities are common and similar to those in English.

Sensitivity to context regularities is a relatively new topic in spelling research and only a few studies have been done investigating context sensitivity in English spellers. Therefore no universally accepted standard method of assessing this aspect of spelling proficiency has been developed. In previous studies in English, spellers' ability to consider rhyme context when spelling vowels of those rhymes was assessed as their inclination to choose the spelling of the vowel that was the most likely to occur in the context of that rhyme, even if it was not the most typical spelling of the vowel overall. The present study used the same logic, but adjusted the

design of the task to account for the facts that participants were not native English speakers and might not have native-like vowel discrimination skills. Unlike in previous studies, where participants were asked to spell words and pseudowords presented to them auditorily, in the present study, participants had to choose between two spellings already presented to them.

As discussed in section 5.4, the result show that after the design was changed to accommodate for EFL learners' vowel discrimination skills, the previously used method of assessing context sensitivity became unsuitable, leading to anomalous results. So instead, another measure was used, namely the number of times that participants indicated that both the most likely vowel spelling as measured across all words and the most likely vowel spelling in the context of the particular rhyme were possible.

As discussed in section 5.6, the number of *both possible* responses correlated with performance in other tasks. This suggests that seeing two competing spelling variants for the same phoneme is an ability that is useful to spellers, possibly because seeing that an ambiguity exists is an important step towards avoiding an error.

At the same time the mechanism behind choosing the *both possible* response is not quite certain. One possibility is that, such a response shows that participants are able to consider regularities at more than one grain-size level. An alternative interpretation of findings is possible, however. One could argue that participants chose the answer "both are equally possible" not because they considered spelling probabilities at both phoneme and rhyme level and could not choose, but because they did *not* consider spelling probabilities at either level. They simply saw two spellings of the vowel that occur in English and could not decide which of them is more likely.

Between-group comparisons showed that Danish spellers scored higher than Russian and Italian speakers on this measure and as high as English native speakers. Russian and Italian speakers' scores were similar. If sensitivity to spelling regularities at more than one grain-size level is the mechanism behind spellers' performance, the explanation of these between-group

differences can be found in the orthographic properties of participants' L1s. Because in Danish spelling regularities exist at both phoneme and rhyme level, Danish speakers learn to consider both levels in their L1 (Juul, 2005) and possibly this is what they do in English as well. In Italian and Russian, on the other hand, rhyme does not condition the spelling of the vowel the way it does in English and Danish, and therefore Italians and Russians do not have the same opportunity for transfer. This idea is consistent with Psycholinguistic Grain-Size Theory (Ziegler & Goswami, 2005, 2006) suggesting that in opaque orthographies where sound-letter correspondences are inconsistent, individuals learn to process words using units of multiple sizes. If the interpretation discussed here is correct, the results of the study provide evidence for the transfer of the unit sizes which spellers use from L1 to L2. This is a novel result -- while previous literature suggests that processing units in reading and spelling may vary in size across different orthographies, it has not been known whether the size of those units is transferred when L2 literacy is acquired.

To summarize, the results neither confirmed, nor disconfirmed the hypothesis of the study that Danish EFL learners would be more sensitive to English orthographic regularities at the level of rhyme than Russian and Italian EFL learners. However it was found that Danish EFL learners are more likely to consider more than one spelling possibility than Italian and Russian learners and that this ability seems to be useful to spellers and share underlying factors with other aspects of spelling proficiency, but whether or not this ability is promoted by sensitivity to probabilistic orthographic patterns at multiple levels of granularity is not possible to determine from the present results.

6.3.3. Phonological Awareness

The study also predicted that experience in an L1 orthography that is transparent in at least one direction (i.e., sound-to-spelling or spelling-to-sound) would affect phonological awareness skills in L2. Italian and Russian EFL learners were expected to have better English phonological

awareness skills than Danish participants.

This prediction was based on one hand on the previous finding that phonological skills are transferable across languages. Previous research described in Chapter 2 found that Chinese ESL learners, who do not have experience with an alphabet known to promote phonological awareness and who therefore lack overt phonological skills, perform worse on tasks requiring phonological skills in English than ESL learners whose L1 is alphabetic. On the other hand, it has also been shown that orthographies which are transparent in at least one direction promote phonological awareness better than opaque orthographies. Task 4 of the study was designed to test whether the benefits of learning a transparent L1 orthography would be carried over onto L2 phonological skills.

The study did not support this expectation. Italian EFL learners were worse at English pseudoword spelling than Russians and Danes. This difference was especially pronounced in the number of errors involving consonant clusters; the difference between Italians and Danes on the number of errors involving syllabic structures (e.g., missed syllables) was not significant.

The explanation of this result must probably be twofold. On one hand, the benefits of learning a transparent orthography for phonological skills development have been documented for beginning learners. Whether or not the differences in phonological awareness skills between speakers of languages with transparent and opaque orthographies continue to exist into adulthood is not clear. It is possible that by the time learners become proficient spellers, these cross-linguistic differences in phonological awareness skills disappear. Future studies with adults comparing phonological skills of users of transparent and opaque orthographies are needed to address this issue. If in fact cross-linguistic differences in phonological skills between learners of different alphabetic orthographies do not exist past early stages of literacy development, this would stand in contrast to the differences in phonological skills found between learners of alphabetic orthographies and learners of logographic orthographies, which exist not only in beginning readers and spellers, but also in adults (e.g., Holm and Dodd, 1996). The explanation

for such discrepancy would be that any alphabetic orthography trains phonological skills, but in opaque orthographies, this process takes longer than in transparent orthographies; therefore we can observe differences between beginning learners, but not in proficient spellers.

On the other hand, the performance on the English phonological awareness task might have been affected by properties of phonological systems of the three languages. Previous studies have shown that in addition to the properties of the writing system, phonotactic properties of language affect phonological awareness. For instance, Caravolas & Bruck (1993) demonstrated that Czech speaking preschoolers and first-graders are better at manipulating consonant clusters than their Anglophone peers. The authors suggest that one of the explanations of this finding lies in the differences between phonologies of the two languages: in Czech, initial consonant clusters are much more frequent and diverse than in English; therefore Czech children, who have more experience with onset consonant clusters and have more evidence for permutations between consonants within clusters, develop a better awareness of them.

Russian and Danish language have fewer phonotactic restrictions than Italian allowing for a larger number and higher complexity of consonant clusters – up to four segments in both languages. In Italian, strict phonotactic rules apply, the maximum number of segments in a cluster is 3 and the number of permitted consonant combinations is very limited. While the consonant clusters in the pseudowords in Task 4 were all legal combinations of consonants in all the three languages, it seems plausible that the richer syllable structures of Danish and Russian had allowed the speakers to develop better awareness of consonantal clusters and transfer this phonological competence to L2.

To summarize, based on the results of the present study, the advantages that beginning spellers of transparent orthographies might have over beginning spellers of opaque orthographies in phonological awareness do not seem to have a long-term effect resulting in a positive cross-linguistic transfer, when it comes to L2 phonological skills. Other factors, such as, for instance, phonotactic properties of L1 and L2 appear more important for L2 phonological competence.

Another important finding regarding L2 phonological skills was that they were very weakly correlated with the performance in tasks testing other aspects of spelling proficiency. This result is at odds with findings from L1 spelling research establishing a link between phonological skills and spelling skills, including irregular word spelling (Allyn & Burt, 1998; Burt, 2006; Burt & Butterworth, 1996). This suggests that in L2, spelling proficiency is less dependent on phonological skills than in L1. Indeed, as discussed earlier, phonological skills are necessary at beginning stages of spelling development in L1 in order to master the alphabetical principle of writing: being able to represent words in print using letters requires the ability to break words down into individual phonemes. The link between adult spelling skills and phonological awareness in L1 is explained by the fact that good phonological skills promote more efficient decoding of words during learning to read thus ensuring more accurate orthographic representations of words in memory (e.g., Allyn & Burt, 1998). Thus the effect of phonological skills on conventional spelling in adult L1 spellers is developmental rather than direct. The developmental nature of these effects has two implications. One is that if L2 phonological skills are being improved at a stage when L2 word decoding skills and spelling skills are already developed to some degree, this improvement will not affect spelling accuracy. The other implication is that L1 phonological skills are more important for L2 spelling than L2 phonological skills: it is L1 phonological skills that will create a strong foundation for alphabetic literacy development, including efficient word decoding strategies, which can further be used in both L1 and L2 literacy. Indeed, research discussed in Chapter 2 has shown that phonological awareness in L1 contributes significantly to L2 reading and spelling proficiency (Cardenas-Hagan, Carlson, & Pollard-Durodola, 2007; Durgunoglu, 2002; Sparks et al., 2008; Wang, Park, & Lee, 2006).

6.4. Additional Findings: Factors Affecting English Spelling Proficiency

The study controlled for multiple variables in order to insure that the groups of participants had similar demographic characteristics and linguistic background. The effects of these variables on English spelling performance were assessed. Some of the effects were consistent with expectations based on what is known about spelling and L2 proficiency, thus validating the results of the present study. Others were new findings of the study. This section discusses each of these variables and its impact on participants' performance in the study, as well as how it fits previous research on L2 spelling.

6.4.1. English Proficiency Variables

English Proficiency in the present study was a combined measure of oral proficiency, reading and vocabulary size. Not surprisingly, English proficiency was positively correlated with English spelling performance. In none of the tasks English proficiency interacted with language group, suggesting that the differences between speakers of different L1 did not depend of the overall English knowledge in this study. At the same time, it is important to remember that in the present study the range of English competence was limited: most of the participants were quite proficient in the language.

Age when participants started to learn English was another strong predictor of English spelling that had an effect in all tasks. The later participants started to learn English, the worse their results were. Although research on L2 literacy does not seem to have much data on the role of age when learners start acquiring L2, the results of the present study are consistent with more general work on bilingualism showing that early starters have better chances of achieving native-like L2 proficiency (e.g., Hyltenstam & Abrahamson, 2000). Two factors are likely to explain the relationship between age of acquisition of English and English spelling proficiency. One is the time factor: early starters have more time and exposure to the language and thus more opportunities to learn. The other factor is brain plasticity: language learning is supposed to be the

easier, the earlier one begins.

Contributors to English proficiency. Unlike previous studies looking at the effects of L2 proficiency on L2 spelling, the present study considered not only the level of proficiency itself, but also the factors contributing to L2 proficiency. The study assessed the effects of four contributors to English learning on English spelling competence: 1) learning English in school or in language courses as a foreign language, 2) reading in English, 3) watching TV, movies and listening to the radio in English and 4) using English for travel and communication with friends, colleagues and family. How much school and language courses contributed to English learning did not seem to affect English spelling performance, whereas the importance of the other three contributors affected spelling skills.

In Tasks 1 and 2, where spelling of real words was tested, the more communication with friends and colleagues contributed to English knowledge, the worse were spelling results and the more likely participants were to use phonetic strategies when they completed the morphological task. In Task 2, the morphological task, the impact of watching TV and movies and listening to the radio on English proficiency was also negatively associated with spelling performance; at the same time it was positively correlated with the number of correct answers in Task 4, which tested complex pseudoword spelling. These results suggest that learning English from exposure to the oral language benefits L2 phonological skills and the ability to perceive unfamiliar words, but does not benefit, in fact inhibits, learning conventional spelling, which is in line with the dissociation between L2 phonological skills and L2 spelling discussed earlier.

Despite the evidence that the amount of reading affects spelling proficiency in English as a first language (Burt, 1996), in the present study the importance of reading as a contributor to English knowledge did not predict the number of correct answers in any of the tasks, although it did affect the use of visual strategies and intuition in Task 2. This finding suggests that reading promotes the development of holistic visual processing in spelling as well as helps develop intuition about sublexical orthographic patterns.

6.4.2. Native Language Variables and General Linguistic Proficiency

Native language spelling. As an independently tested variable, native language spelling proficiency had an effect on English spelling in all tasks, but when other covariates were controlled for, it was only significant for Task 1, irregular word spelling, and Task 3, where the ability to see alternative spellings was tested. The effect of NL spelling was not the same for the two tasks. The effect was positive for irregular word spelling; in Task 3, the relationship between native spelling and the number of *both possible* responses was nonlinear: it was positive, but only for participants who rated their native language spelling as excellent or lower, i.e., not “perfect” (Figure 8). The fact that there was a positive effect of L1 spelling proficiency on L2 spelling is consistent with previous findings demonstrating cross-linguistic transfer of literacy-related skills and the idea of language-independent factors underlying reading and writing proficiency (e.g., Cummins, 1981; Dich, 2010; Durgunoğlu, 2002). At the same time, the fact that the effect of native language spelling proficiency was not the same for different aspects of L2 spelling speaks in favor of the idea that transfer of native language spelling skills may only affect some, but not all components of spelling proficiency, which are related, but to a certain degree independent from each other.

The age when participants started to read and write in their native language, when tested as an independent predictor, had an effect on English spelling in all tasks except Task 3, but when other covariates were controlled for, the effect was only significant in Task 4: better performance was associated with earlier native language literacy. Interestingly, the effect of NL literacy age was the strongest in the phonological awareness task. As discussed in Chapter 2, phonological skills are the basis for reading and writing in an alphabet. The earlier a child has the phonological prerequisites and the better his/her early phonological skills are, the earlier s/he will have the cognitive-linguistic basis necessary to start reading and writing. The association between L2 phonological skills and the age of L1 literacy acquisition is likely explained by the transfer of strong phonological knowledge of early spellers from L1 to L2.

This explanation may seem to contradict the finding that spellers who learned to read and write in a transparent orthography (Italians) did not outperform spellers who learned to read and write in an opaque orthography (Danes) in L2 phonological task, even though learning transparent orthographies are known to better promote the development of phonological skills in the beginning readers/spellers. Possibly, the cognitive and linguistic factors that influence the timing of the development of phonological awareness and the onset of reading are stronger and have a more long-term effect than orthographic transparency.

Linguistic curiosity. One of the consistent findings throughout the study was that the more interested individuals were in languages and linguistics, the better were their spelling results. The effects of linguistic curiosity on spelling have not been previously explored in literacy research, with the exception of one preliminary study preceding the one discussed in the thesis (Dich, in preparation), and thus represent a new result. One possible explanation for the relationship between linguistic curiosity and spelling, observed in the present study, as well as in the one preceding it, is that interest in language makes people think more about linguistic facts, helping to create and increase awareness of linguistic structures.

Because spelling research has now convincingly demonstrated that spelling goes way beyond memorization and recruits sophisticated linguistic skills, including the awareness of linguistic units and structures (e.g., phonemes and morphemes), it seems plausible that linguistic curiosity impacts spelling skills via increased linguistic awareness. This explanation is supported by the fact that in this study linguistic curiosity was associated with morphological awareness and the use of analytical morphological strategy in spelling, which in turn proved to be a productive strategy in one of the tasks. If it is in fact the case that the link between linguistic curiosity and spelling is causal, this finding has an important practical implication for literacy education: one of the ways to improve spelling skills is to make learners interested in linguistic matters and teach them the basics of linguistic analysis (e.g., morphemic analysis).

Another way to think about these results, however, is to hypothesize the existence of various

profiles of learners that differ on motivation for learning: while some people might learn English primarily for practical reasons, such as being able to travel, to communicate with friends, or for professional development, others might learn English primarily because they are interested in languages. The latter individuals are probably more likely to possess well-developed linguistic skills, including spelling.

Number of known foreign languages was positively associated with English spelling performance in all tasks except Task 3 when tested as an independent predictor. However it was not significant when other variables were accounted for, due to the fact that the number of known foreign languages was correlated with linguistic curiosity and native language spelling and did not have an effect on English spelling performance beyond and above those other variables.

Amount of reading in the native language. Previous research found that the amount of reading is one of the predictors of spelling proficiency in the native language (Burt, 1996). The present study was consistent with these previous findings showing that how much participants read for pleasure in their native language predicted native language spelling proficiency. However, native language reading habits did not seem to have an effect on L2 spelling.

6.4.3. Demographic Variables

Age did not affect performance of any of the tasks except Task 3, where the ability to consider multiple spellings was assessed. It is important to keep in mind, however, that the age range of participants in this study was quite narrow – they were all university students. Therefore there might have been not enough evidence to detect effects of age in Tasks 1, 2 and 4. At the same time, the effect of age in Task 3 calls for an explanation. In Task 3, older participants were more likely to choose both spelling options given for each pseudoword as valid answers. While any explanation of this finding would be speculative, one possibility is that this age effect is somehow related to the development of cognitive abilities in adolescence and young adulthood –

the age of the majority of the participants. Developmental studies show that cognitive changes beginning in late adolescence involve increases in the ability to approach a problem from multiple perspectives and to understand that there is not always one right and one wrong answer (e.g., Kuhn, 2009). However, the connection between cognitive development and Task 3 performance is just a conjecture – whether the changes in multidimensional and relativistic thinking in adolescence also apply to metalinguistic abilities remains to be seen.

Gender. In the present study female participants read more, were more interested in languages and knew more foreign languages, but at the same time tended to perform worse on English spelling tasks than male participants. Hardly any generalizations about gender can be made based on these findings, especially considering that the effect of gender was not the same across language groups in one of the tasks. The results are probably due to the characteristics of the present sample and possibly a self-selection bias. There were more women than men who volunteered to participate in the study, possibly suggesting that men needed a stronger motivation to participate than women. Confidence in own good spelling skills might have been a contributor to motivation.

6.5. Implications of the Findings

The results of the present study have both theoretical and practical implications. They contribute to our understanding of the development of cognitive underpinnings of literacy in both first and second language and they also inform educational practices.

One of the main findings of the present study was that multiple components of English spelling proficiency are related, but somewhat independent from one another and that a speller may be good at one aspect of spelling, but not as good at another. This finding presents an important contribution to the general area of literacy research. It shows that spelling is a much more complex phenomenon than it had been previously thought, and it is impossible to talk about spelling as one general skill. Particularly interesting from the developmental perspective is

the finding of the dissociation between L2 phonological and spelling skills, which stands in contrast with one of the most well-established links in L1 literacy research, namely the one between phonological awareness and alphabetic literacy in L1. The results of the present work suggest that early L1 phonological skills might benefit not only the development of reading and writing in the first language, but also the acquisition of literacy in the second language, while L2 phonological skills do not contribute to spelling skills beyond instances when the correct spelling depends on the perception of a non-native contrast.

Methodologically speaking, the finding of multiple components of spelling proficiency is important because it shows that multiple tasks are needed to get a comprehensive assessment of language users' spelling skills. In addition, this finding is important for educational practices because it suggests to us that spelling instruction methods that only emphasize one aspect (e.g., irregular word memorization) are not going to be the most successful and that a variety of exercises is needed in order to develop the linguistic expertise underlying different aspects of spelling competence.

The results of the present study suggest that the ways individuals approach the cognitive task of learning to spell in English are not the same across all learners. These differences in cognitive mechanisms of English spelling can be in part predicted from the characteristics of the L1 writing systems and explained by the transfer of native language literacy skills. This result is in line with the idea in cognitive psychology that experience plays an important role in shaping cognitive processes: the more one practices a task, the more proficient one becomes at it. The more one uses a particular cognitive strategy to do certain linguistic tasks in one's own language – the strategy that makes sense for that particular language, the more well-practiced that strategy is and the more likely one will be to exercise that strategy in a new language, even if it is not the most adaptive one. Importantly, however, native language is far from being the only factor determining the cognitive mechanisms of L2 spelling development. Just like language transfer does not explain *every* error made by L2 learners, it also does not fully explain which spelling

strategies learners use in L2. Consistent with previous research in L1 (e.g., Weekes, 1994), the results of the present study demonstrated considerable individual differences in spelling strategies, with learners' native language only creating a *bias* towards a particular strategy.

At the same time, in the task that imitated the real-life problem of spelling in English the best, namely the task where participants spelled irregular English words, the differences in spelling accuracy between the three EFL groups were minimal. This suggests that despite the differences in cognitive mechanisms determined by the differences in L1 orthographies, learners are able to arrive at comparable results in L2 spelling, given enough practice. This demonstrates the flexibility of the mind's learning capacities by showing that it can use multiple routes to achieving the same learning goal. In other words, given enough experience, language learners' minds can arrive at the same results via different routes, while native language orthography, alongside other factors, will influence which route is taken.

In addition, the present study also showed that in some components of English spelling proficiency EFL learners can achieve the same levels as native English speakers. This finding enriches our understanding of the cognitive prerequisites of English literacy. Most of the research on English reading and writing development available so far comes from studies of native English speakers. The present study adds to the existing body of work on English literacy development by showing that there can be multiple ways to fully master English spelling.

This finding also has implications for English as a second language instruction. The understanding of how an individual's first language experience may shape cognitive processes underlying literacy may help educators improve ESL literacy instruction methods. More specifically, the results of the present study suggest that a "one fits all" method of teaching English as a second language will not be the most efficient and that it can be beneficial for learners if the teaching method incorporates learners' strengths and weaknesses that result from literacy training in a particular native language. Such methodology would take into considerations which literacy-related skills students have developed in their native language and

which strategies they are likely to use to read and write in English. An efficient method of instruction would encourage the use of native language strategies that are helpful in English, such as whole word memorization or morphological analysis, but discourage the use of non-adaptive strategies, such as sounding out.

The results of the present study also underscore the importance of motivational factors for L2 spelling proficiency and suggest that fostering linguistic curiosity in students may be efficient in the development of their spelling skills. According to the findings, understanding of linguistic structures and connections is more beneficial for learning than memorization of linguistic facts, which adds to the body of evidence showing that linguistic awareness plays an important role in L2 learning.

Finally, the implications of the present study go beyond the domain of second language literacy, but bear on L2 learning more generally. More specifically, the results of the morphological task suggest that understanding of English word structure might also depend on the kinds of units that learners' L1 orthography reflects. Thus, Russian orthography is morphology based and Russian speakers need to develop morphological analysis skills in order to learn to spell correctly. This expertise seems to make the morphological structure of English words more salient for Russian EFL learners.

6.6. Strengths and Limitations of the Study

The present study was novel in many ways, with the novelty bringing about both strengths and limitations. This section discusses the strong points of the study and address potential criticisms.

6.6.1. Multiple L1 Backgrounds and Tasks

As mentioned in Chapter 2, the topic of cross-linguistic transfer in the acquisition of spelling in a second language is relatively new and the currently available evidence is quite limited. The

majority of the studies done on acquisition of ESL spelling each had participants from only one first language background. Only a very small number of studies included between-group comparisons of spelling skills of ESL learners from different first-language backgrounds (Figueredo, 2006). Without such cross-linguistic comparisons, where participants from various native language backgrounds perform the same tasks under the same conditions, it is difficult to assess the exact role of native language characteristics in L2 spelling acquisition and to understand which processes in L2 spelling development are universal and which are language-specific.

In addition, as Figueredo (2006) notes in her review, only a small number of first-language backgrounds have been studied so far with respect to cross-linguistic transfer in ESL spelling. The present study addresses these two limitations of previous work: it includes participants from three different language backgrounds simultaneously; moreover, the three native languages used in the present work have not been previously studied in cross-linguistic research on ESL spelling.

Another strength of the study was that it used multiple spelling tasks in order to assess multiple aspects of spelling proficiency. The majority of previous studies of English spelling, not only in ESL learners, but also in English native speakers, focused on irregular word spelling, in order to assess word-specific memory, and pseudoword spelling, in order to assess phonological skills and the knowledge of sublexical phonology-orthography correspondences. The present study extended previous research by adding more tasks and including morphological awareness and context sensitivity, which have not previously been investigated in ESL spelling research (see, however, Dich, 2010 on context sensitivity in ESL learners).

The results of the present study showed that using multiple tasks to assess cross-linguistic differences in L2 spelling skills is crucial because some of the components of L2 spelling competence are more sensitive to the differences between L1 backgrounds than others. Indeed, had this study only used one real word spelling task – spelling of irregular words – the cross-

linguistic differences in real word spelling would not have been detected.

6.6.2 Online Data Collection

The development of modern technology has brought about excellent possibilities for cross-linguistic studies that the previous generation of researchers did not have and provided an opportunity to look into cross-linguistic questions in the ways that would have been impossible before, due to being too time and labor consuming. The present study used a novel method of remote data collection, which has considerable advantages. First, collecting data over the Internet made it possible to create a relatively large pool of participants in a relatively short period of time. Having a larger sample of data is crucial for an exploratory study like the present one, the goal of which is to detect trends and patterns in the data. Second, the remote data collection method made it possible to test participants from four different countries simultaneously, allowing for various the cross-linguistic comparisons. However, alongside multiple benefits, this method of data collection also has a number of trade-offs.

One of such trade-offs is that the researchers do not have all control over the procedure, since they cannot observe participants directly. While the instructions of the present study did explain to the participants that it was important that they, for instance, use a quiet room, read the tasks carefully and not consult anyone or any sources as they complete the study, there is no way of telling whether all participants followed the instructions. While this might be regarded by some as a limitation, it may help to put things into perspective and consider the scenarios in which participants took advantage of not being observed and did not follow the instructions.

For instance, rather than participating in a quiet place without distractions, some people might have chosen to participate from a noisy airport to kill time during a layover and had to answer a couple of phone calls in the middle of completing a task. In a study collecting reaction times or looking at brain activity, this would have been a serious problem. In the present study, however, the participants did not have any strict timing constraints and the only results analyzed

were the products of their activity rather than the process itself. In all tasks, participants had an opportunity to revise their answers and to correct errors they might have made if they had been distracted. Therefore it seems that potential distractions do not present a serious problem in the study.

Another potential criticism of the online method of data collection is that there is no way of knowing if the participant completed the study on his/her own or if s/he consulted other people or sources for correct answers. While this possibility cannot be excluded, there are reasons to believe that participants were not very likely to do that. First of all, participants did not compete with anyone, nor was there a reward associated with the number of correct answers. The participants were offered an opportunity to check their own spelling skills. So it seems that there were no strong incentives for participants to “cheat”.

6.6.3. Use of Self-Reporting

Another potential criticism of the study was that some of the variables were assessed using self-reporting. As it was argued elsewhere in the text, the use of self-reporting was justified by evidence from previous studies that language learners’ estimate of their language proficiency correlates with the results of objective assessments (Marian et al., 2007; Schulte-Korne et al., 1997). The existence of this correlation was also confirmed by one result of the present study: self-rated English proficiency correlated with participants’ English vocabulary size assessed as the number of spelling items that they did not know.

6.6.4. Correlational Data

The discussion of the results offered some causal explanations of the present findings, however because the data in the present study were correlational, it is not always possible to rule out alternative explanations of observed relationships.

As authors of previous cross-linguistic studies on literacy (e.g., Caravolas, 2004; Juul &

Sigurdsson, 2005; Lundberg, 1999) note, when differences between speakers of different languages are found, it is sometimes difficult to give an unambiguous interpretation to such findings. Indeed, unless the participants are all raised in the same environment speaking different languages, language background is always confounded with other – cultural – variables. In the case of the present study, the between-group differences in spelling performance were to some extent consistent with what could be expected considering characteristics of their native languages, and an effort was made to control for variables that could potentially affect L2 spelling. And yet claiming that the study clearly proves that the observed differences in results are due exclusively to participants' first language would be unwarranted. Because participants came from different countries, it is not always possible to tease apart the influence of their first language from the potential influence of other cultural factors, such as, for instance differences in methods of teaching of both L1 and L2 in their home country.

However, it seems that because cross-linguistic studies of spelling are quite sparse and little is known about whether people from different backgrounds acquire literacy in the second language the same way, the fact that between-group differences exist is interesting in itself, while future studies might provide additional evidence to confirm or disprove that the explanation for these differences should be sought in the characteristics of participants' native language orthographies. Thus, while not providing definite answers to the question that informed the study, it provides potential answers and sets the ground for further research as it outlines directions in which the topic of cross-linguistic differences in spelling acquisition could be explored further.

6.7. Conclusions and Future Directions

The present work sought to shed more light on the mechanisms of cross-language transfer of literacy skills and cross-linguistic differences in L2 literacy acquisition. From previous research on L2 literacy, especially on spelling, it had been known that L2 learners transfer some skills and

knowledge from their native language when they learn to read and write in a second language, in particular the ability to manipulate individual sounds in words, known as phonological awareness, and the knowledge of letter-sound correspondences. Little was known about possible transfer of other skills involved in spelling, such as morphological awareness, sensitivity to context-driven orthographic patterns and whole word memorization, as well as about how particular characteristics of native language orthography, such as orthographic transparency and types of orthographic rules that the orthography uses, affect the processes of L2 spelling acquisition. The goal of the present study was to gain a better understanding of how the characteristics of native language orthographies shape the cognitive mechanisms of spelling in a second language via the transfer of skills and knowledge from the first language, as well as in what ways this transfer can be beneficial for learners.

The results of the present study suggest that characteristics of native language orthography may affect the cognitive procedures that L2 spellers employ: the study found that the strategies that participants reported using when completing spelling tasks depended on their first language and could be predicted to some degree from the characteristics of native language writing system, such as its transparency and the nature of orthographic rules. The results suggest that in addition to phonological skills and knowledge of letter-sound correspondences, morphological and whole-word processing skills are transferred when L2 spelling is learned. Importantly, however, learners' native language was far from being the only factor determining which spelling strategies learners used in L2. In each language group, individuals used a variety of strategies, while their native language only made the use of some strategies more likely. This result is consistent with L1 literacy research showing individual differences in cognitive mechanism of written language processing. While the present study shows that individuals' first language background contributes to individual differences in spelling strategies, future research will need to further explore the issues of interaction of native language with other factors shaping the individual differences in cognitive mechanisms of L2 spelling, such as the methods of

instruction, the distance between L1 and L2 writing systems, the age of L2 acquisition and L2 proficiency.

The study also found that in the task which best imitated the most typical English spelling problems, the difference between groups of EFL learners was minimal, suggesting that even if learners' cognitive procedures involved in spelling may be different, they are all able to achieve the same level of proficiency in spelling by the time their overall English proficiency reaches intermediate or upper-intermediate level. Because the effects of cross-linguistic transfer on spelling performance become weaker as L2 proficiency improves, it is possible that between-group differences in irregular English word spelling would be more pronounced if participants with lower English proficiency were tested. Developmental studies following learners' spelling skills improvement might help answer the question whether the effects of native language orthography on native spelling is stronger in beginning spellers and fades out as spellers become more proficient and acquire knowledge and strategies necessary to spell in L2, overcoming their native language biases.

As mentioned in the section on limitations, when a study compares participants from different countries speaking different languages, it is not always possible to disambiguate the effects of culture from the effects of language proper. One way to address this problem in future research might be to test the development of L2 skills in residents of a single country where multiple languages are spoken, but the methods of language instruction are similar across regions.

The present study employed a relatively simple design and was not technology-intensive. It analyzed the *product* of an activity (spelling) in order to make conclusions about the processes involved in that activity. Future research aimed at getting a better understanding of precisely what is going on in spellers' minds and brains, e.g., tapping into the *activity* itself, will need to employ more sophisticated research tools, e.g., chronometric and neuroscience methods.

A chronometric approach seems promising in studies of cross-linguistic differences in

spelling mechanisms. For instance, a study recording writing or typing speed and measuring times it takes individuals to move from one symbol to the next might give an insight into the size and type of units spellers operate.

Neuroimaging approach might also be used to study cross-linguistic differences in brain activity underlying spelling in L2. Showing that the neural network involved in L2 spelling depends on the spellers' native language would be a strong proof of the idea that the cognitive processes involved in L2 spelling are not the same across L2 learners.

Another question that it would be interesting to investigate further is the question of the role of script in L2 spelling acquisition. The present study was based on the assumption that in the situation when L1 and L2 do not share the same script (Russian and English in the present case), once the new alphabet is learned at the early stages of L2 acquisition, the differences between scripts per se should not put learners at a disadvantage. However, the question still remains whether the fact that L1 and L2 have different scripts might actually create an advantage for learners due to a lower amount of negative interference of L1 knowledge. As it was argued in the theoretical chapters of the thesis, cross-linguistic transfer of the knowledge of PGC rules seems possible even across scripts, but whether the amount of interference from L1 is the same regardless whether or not the scripts are shared between L1 and L2 is an open question.

Finally, the results of the present study give some insight into the relationship between L2 learning and precocious L1 literacy skills. The finding that individuals who were early readers in their first language had higher spelling proficiency in L2 puts forward many interesting issues for future developmental studies. In particular, future research will need to address the question whether factors promoting the development of literacy in L1 also facilitate second language acquisition and to test an intriguing hypothesis that some elements in early literacy training and the development of the linguistic skills necessary for the acquisition of reading and writing indirectly contribute to children's foreign language learning later in life.

To conclude, the study adds to the growing body of evidence that acquisition of spelling is a

complex cognitive task that requires sophisticated cognitive and linguistic knowledge and skills. It also demonstrates that there exist individual differences in cognitive procedures involved in spelling and shows how these differences may be shaped by prior experience. It is hoped that a better theoretical understanding of these differences will result in a better practical understanding of learners' needs and more efficient methods of language instruction.

APPENDIX

Task 1 Words

Achievement, acknowledgment, average, beautiful, believe, cabbage, choice, environment, forehead, foreign, forty, friend, fulfill, ghost, height, insurance, jewelry, kindergarten, leisure, neighbor, pigeon, raspberry, scissors, speech, surgeon, tomorrow, trouble, until, Wednesday, weird.

Task 2 Words (omitted letters given in bold)

Analog, **anonym**, **atom**, bar**ness**, base**less**, bureaucracy, cognition, **column**, **coolly**, **crazily**, **cruelly**, **ecstasy**, **emblem**, **evilly**, generate, grammar, **health**, **lazily**, **lioness**, **meant**, misapply, misspell, **oily**, overact, over**rrule**, **patroness**, **plainness**, **pleasant**, **policy**, **progression**, **solemn**, **stubbornness**, **suddenness**, **sultaness**, **suspicion**, **tailless**, **thinness**, **underrate**, **unearth**, **unnerve**.

Task 3 Pseudowords

<i>Vowel</i>	<i>Experimental</i>	<i>Control</i>
/ɔ/	splawk	splaunt
/ɔ/	trawk	traunch
/ɔ/	chawn	chaunt
/ɔ/	frawn	fraunch
/e/	flaint	flage
/e/	praint	prage
/e/	daith	dake
/e/	yaith	yake
/o/	foach	fope
/o/	noach	noke
/o/	joth	jope
/o/	doth	doke
/aʊ/	sowl	souch
/aʊ/	nowl	nouch
/aʊ/	chown	chout
/aʊ/	fown	fout

Taks 4 Pseudowords

Boodloodooboo, boogodooska, dembidibo, eboogrilon, geskitoody, gisinspostika, grumelarin, kiminilen , kreskornity, krestisoomun , melrilorren, messikrooplis, orgibrigly, salmelminly, siflislamby , skebilembra, sklabiskintar, skroolafilar , slunkensnookel, spinsistooty.

DIRECTIONS

In this task, you will be listening to a recording of 30 English words and typing them as you listen. Read the directions before you start.

- 1 Start the recording and type words in the box on the right.
 - The recording starts with 30 seconds of music.
 - While the music is playing, adjust the volume.
 - Start typing when you hear the speaker say English words.
 - Each word is said twice by two different American English speakers.
 - **Please do not stop the recording or play it a second time!**

2 Now revise your spellings.

1. If you notice **errors or typos**, correct them.
2. Put **question marks** next to all words that you've never seen or heard.
3. If you feel like **writing a comment** next to certain words, feel free to do so.

To start the recording, press this button: 
[OR click here to open the recording in your default player](#)

type here

Submit

Task 1 Screenshot

Task 2 Screenshot

Task 2 out of 4

DIRECTIONS

For each of the words below, supply the missing letters.

- In some words, only one letter is missing; in others two letters are missing.
- In order to listen to a word, click on the  icon next to it. If that does not work, click on the "play" link.
- **If you don't know a word, do not supply the missing letters, leave the space in that word blank.**

1)  [play](#) baro ess

2)  [play](#) (to) unde ate

3)  [play](#) ato

4)  [play](#) crazi y

5)  [play](#) thi ess

6)  [play](#) ove act

7)  [play](#) pl sant

Task 3 out of 4

DIRECTIONS

In this task, you will be choosing the best spelling for English names that you probably never heard before.

- You will hear 32 English last names.
- Two possible spellings are given for each name.
- Listen to each name and decide how it should be spelled in English.
- There are no right or wrong answers, just give your best guess!
- In order to listen to a name, click on the  icon next to it. If that does not work, click on the "play" link.
- You can play each name multiple times.

 [play](#) 1) Foché Foach both are equally possible

 [play](#) 2) Chaunt Chawnt both are equally possible

 [play](#) 3) Dathé Daith both are equally possible

 [play](#) 4) Nouch Nowch both are equally possible

 [play](#) 5) Prante Praint both are equally possible

 [play](#) 6) Soul Sowl both are equally possible

 [play](#) 7) Fraunch Frawnch both are equally possible

 [play](#) 8) Jope Jop both are equally possible

 [play](#) 9) Flaige Flaige both are equally possible

 [play](#) 10) Choun Chown both are equally possible

Task 3 Screenshot

Task 4 out of 4

DIRECTIONS

In this task, you will be listening to and spelling 20 last names, but this time they are going to be long and complicated, and no spelling options will be provided!

- The recording starts with 30 seconds of music.
- While the music is playing, adjust the volume.
- When the music is over, the speaker will start saying the names.
- Start typing right when you hear the speaker.
- **Each name will only be repeated once!**
- Try to spell each name exactly as you hear it.
- **Please do not stop the recording or play it a second time!**

To start the recording, press this button: 

[OR click here to open the recording in your default player](#)

type here

Done!

Task 4 Screenshot

EFL Survey Questions

- Were you born in Denmark/Italy/Russia¹¹? (*Yes/ No*)
 - If not, please comment:
- Have you ever lived outside Denmark/Italy/Russia¹¹? (*Yes/No*)
 - If yes, where?
 - When? From _____ until _____
- Have you ever had a hearing disability? Language disability? Learning disability? (*Yes/No*)
 - If yes, please explain:
- How interested are you in language/linguistics? (*Not interested at all; Somewhat interested; Very interested*)
- Is Danish/Italian/Russian¹¹ the only language that you have native-like proficiency in? (*Yes/No*)
 - If not, please comment:
- Approximately at what age did you start learning to read and write in Danish/Italian/Russian¹¹?
- How much do you read for pleasure in Danish/Italian/Russian¹¹? (*Rarely; From time to time; On a regular basis*)
- On a scale from 1 to 10, please estimate your spelling proficiency in Danish/Italian/Russian¹¹. (*1-very low; 2-low, 3-fair; 4-slightly less than adequate; 5-adequate; 6-slightl more than adequate; 7-good; 8-very good; 9-excellent; 10-perfect*).
- Please list languages that you know in the order of dominance, including Danish/Italian/Russian¹¹.
- At what age did you start acquiring English?

¹¹ The country and the language were inserted by the program based on which language the participant specified as his/her native at the onset of the study.

- On a scale from 0 to 10, please select how much the following factors contributed to your learning of English (*0-not a contributor; 1-minimal contributor; 5-moderate contributor; 10-most important contributor*).
 - Learning English as a foreign language in school/college/language courses
 - Living in an English speaking country
 - Traveling abroad
 - Interacting with friends/colleagues
 - Interacting with family
 - Reading
 - Watching movies and TV shows/Listening to the radio
- How regularly do you currently speak English? (*Do not speak English at all; Occasionally, e.g., when I go abroad or have foreign guests; Quite regularly; Every day/almost every day; Almost as much as I speak my native language*)
- How regularly do you hear spoken English? (*Do not hear spoken English at all; Occasionally, e.g., when I go abroad or have foreign guests; Quite regularly; Every day/almost every day; Almost as much as I hear my native language*)
- How much do you currently read in English? (*Do not read in English at all; Occasionally, e.g., when I go abroad, have to read labels or instructions, etc; I read books or articles; quite regularly; Every day/almost every day; As much as I read in my native language*)
- How much do you currently write in English? (*Do not write in English at all; Occasionally; Quite regularly; every day/almost every day; almost as much as I write in my native language*).
- On a scale from 0 to 10, please select the level of proficiency in speaking, understanding and reading in English (*1-very low; 2-low, 3-fair, 4-slightly less than adequate; 5-adequate; 6-slightl more than adequate; 7-good; 8-very good; 9-excellent; 10-perfect*).
 - Speaking
 - Understanding
 - Reading
- What's your age?
- Are you: Male/Female?

REFERENCES

- About.com (n.d.). *Using words correctly, effectively, and imaginatively*. Retrieved from http://grammar.about.com/od/words/a/misspelled_200C.htm
- Allyn, F. A., & Burt, J. S. (1998). Pinch my wig or winch my pig: Spelling, spoonerisms and other language skills. *Reading and Writing, 10*(1), 51–74.
- Ballard, N. (n.d.). *Commonly Misspelled Words*. Retrieved from <http://www.commonlymisspelledwords.org>.
- Bialystok, E. (2002). Acquisition of literacy in bilingual children: A framework for research. *Language Learning, 52*(1), 159–199.
- Bialystok, E. (2001). *Bilingualism in Development: Language, Literacy and Cognition*. Cambridge University Press.
- Bryant, P., Nunes, T., & Aidinis, A. (1999). Different morphemes, same spelling problems: cross-linguistic developmental studies. In M. Harris & G. Hatano (Eds.), *Learning to Read and Write: a Cross-linguistic Perspective* (pp. 112–133). Cambridge, U.K.; New York, NY, USA : Cambridge University Press.
- Burt, J. S. (2006). Spelling in adults: The combined influences of language skills and reading experience. *Journal of Psycholinguistic Research, 35*(5), 447–470.
- Burt, J. S., & Butterworth, P. (1996). Spelling in adults: Orthographic transparency, learning new letter strings and reading accuracy. *The European Journal of Cognitive Psychology, 8*(1), 3–43.
- Campbell, R., & Butterworth, B. (1985). Phonological dyslexia and dysgraphia in a highly literate subject: a developmental case with associated deficits of phonemic processing and awareness. *Quarterly Journal of Experimental Psychology, 37A*, 435–475.
- Caravolas, M. (2004). Spelling development in alphabetic writing systems: A cross-linguistic perspective. *European Psychologist, 9*(1), 3–14.
- Caravolas, M., & Bruck, M. (1993). The effect of oral and written language input on

children's phonological awareness: A cross-linguistic study. *Journal of Experimental Child Psychology*, 5(1), 1–30.

Caravolas, M., Hulme, C., & Snowling, M. J. (2001). The foundations of spelling ability: Evidence from a 3-year longitudinal study. *Journal of Memory and Language*, 45(4), 751–774.

Cardenas-Hagan, E., Carlson, C. D., & Pollard-Durodola, S. D. (2007). The cross-linguistic transfer of early literacy skills: The role of initial L1 and L2 skills and language of instruction. *Language, Speech, and Hearing Services in Schools*, 38(3), 249–259.

Carlisle, J. F. (1993). The influence of study of a second language on improvement in spelling: A longitudinal study. *Reading and Writing*, 5(4), 339–353.

Cheung, H., McBride-Chang, C., & Chow, B. Y.-W. (2006). Reading Chinese. In R.M. Joshi & P.G. Aaron (Eds.), *Handbook of Orthography and Literacy* (pp. 421 – 438). Lawrence Erlbaum.

Chikamatsu, N. (1996). The effects of L1 orthography on L2 word recognition: A study of American and Chinese learners of Japanese. *Studies in Second Language Acquisition*, 18(4), 403–432.

Chomsky, C. (1970). Reading, writing, and phonology. *Harvard Educational Review*, 40, 287–309.

Cook, V. J. (1997). L2 users and English spelling. *Journal of Multilingual and Multicultural Development*, 18(6), 474–488.

Cossu, G. (1999). The acquisition of Italian orthography. In M. Harris & G. Hatano (Eds.), *Learning to Read and Write: a Cross-linguistic Perspective* (pp. 10 – 33). Cambridge, U.K.; New York, NY, USA : Cambridge University Press.

Coulmas, F. (1996). *The Blackwell encyclopedia of writing systems*. Oxford: Blackwell.

Cummins, J. (1981). The role of primary language development in promoting educational success for language minority students. In California State Department of Education (Ed.), *Schooling and language minority students: A theoretical framework* (pp. 3–49). Los Angeles:

Evaluation, Dissemination, and Assessment Center, California State University, Los Angeles.

D'Anguilli, A., Siegel, L. S., & Serra, E. (2001). The development of reading in English and Italian in bilingual children. *Applied Psycholinguistics*, 22(4), 479–507.

Dhanesschaiyakupta, U. (2004). L1 orthography: The effects on L2 word recognition of Thai and Chinese ESL learners. *Dissertation Abstracts International, A: The Humanities and Social Sciences*, 64 (7), 2363–A. (Available from UMI, Ann Arbor, MI. Order No. DA3097607.)

Dich, N. (2002). Opiski na rusском jazyke. In T. Kuzovkina, K. Karu (Eds.), *Russkaja filologija 13. Sbornik naučnyx rabot molodyx filologov* (pp. 277–280). Tartu: Tartu Ülikooli Kirjastus.

Dich, N. (In Preparation). *Knowledge of Foreign Languages as a Factor in Native Language Spelling Proficiency*.

Dich, N. (2010). Sensitivity to phonological context in L2 spelling: evidence from Russian ESL speakers. *Written Language and Literacy*, 13 (1), 99–117.

Dich, N. & Cohn, A. (Submitted). *Spelling development as a source of psycholinguistic evidence for phonological theory*.

Durgunoğlu, A. Y. (2002). Cross-linguistic transfer in literacy development and implications for language learners. *Annals of Dyslexia*, 52, 189–204.

Dutcher, N., Tucker, G.R. (1994). *The use of first and second languages in education: A review of educational experience*. Washington, DC: World Bank, East Asia and the Pacific Region, Country Department III.

Fashola, O. S., Drum, P. A., Mayer, R. E., & Kang, J.-S. (1996). A cognitive theory of orthographic transition: Predictable errors in how Spanish-speaking children spell English words. *American Educational Research Journal*, 33, 825–843.

Fender, M. (2008). Spelling knowledge and reading development: Insights from Arab ESL learners. *Reading in a Foreign Language*, 20(1), 19–42.

Ferrolì, L.J. (1991). *Developmental spelling and the transfer of literacy skills among primary*

grade bilinguals. Ph.D. Dissertation, University of Illinois, Chicago.

Figueredo, L. (2006). Using the known to chart the unknown: A review of first-language influence on the development of English-as-a-second-language spelling skill. *Reading and Writing, 19*(8), 873–905.

Figueredo, L., & Varnhagen, C. K. (2004). Detecting a problem is half the battle: The relation between error type and spelling performance. *Scientific Studies of Reading, 8*(4), 337–356.

Fischer, F. W., Shankweiler, D., & Liberman, I. Y. (1985). Spelling proficiency and sensitivity to word structure. *Journal of Memory and Language, 24*(4), 423–441.

Geva, E. (2006). Learning to read in a second language: Research, implications and recommendations for services. In E. Tremblay, R. V. Peters, M. Boivin & R. G. Barr (Eds.), *Encyclopedia on early childhood development*. Retrieved from <http://www.enfant-encyclopedie.com/Pages/PDF/GevaANGxp.pdf>

Gillis, S., & Ravid, D. (2006). Typological effects on spelling development: A crosslinguistic study of Hebrew and Dutch. *Journal of Child Language, 33*(3), 621–659.

Hanley, J.R., Tzeng, O., & Huang, H.–S. (1999). Learning to read in Chinese. In M. Harris & G. Hatano (Eds.), *Learning to Read and Write: a Cross-linguistic Perspective* (pp.173 – 195). Cambridge, U.K.; New York, NY, USA : Cambridge University Press.

Harris, M., & Giannouli, V., (1999). Learning to read and spell in Greek: the importance of letter knowledge and morphological awareness. In M. Harris & G. Hatano (Eds.), *Learning to Read and Write: a Cross-linguistic Perspective* (pp. 51 – 70). Cambridge, U.K.; New York, NY, USA : Cambridge University Press.

Holm, A., & Dodd, B. (1996). The effect of first written language on the acquisition of English literacy. *Cognition, 59*(2), 119–147.

Holmes, V. M., & Malone, N. (2004). Adult spelling strategies. *Reading and Writing, 17*(6), 537–566.

Hoosain., R. (1986). Language, orthography, and cognitive processes: Chinese perspectives for the Sapir–Whorf hypothesis. *International Journal of Behavioral Development*, 9, 507–525.

Hyltenstam, K. & Abrahamson, N. (2000). Who can become native–like in a second language? All, some, or none?: On the maturational constraints controversy in second language acquisition. *Studia Linguistica*, 54, 150 – 166.

James, C., Scholfield, P., Garrett, P., & Griffiths, Y. (1993). Welsh bilinguals' English spelling: An error analysis. *Journal of Multilingual and Multicultural Development*, 14(4), 287–306.

Job, R., Peressotti, F., & Mulatti, C. (2006). The acquisition of literacy in Italian. In R.M. Joshi & P.G. Aaron (Eds.), *Handbook of Orthography and Literacy* (pp. 105 – 119). Lawrence Erlbaum.

Juul, H. (2005a). Grammatical awareness and the spelling of inflectional morphemes in Danish. *International Journal of Applied Linguistics*, 15(1), 87–112.

Juul, H. (2005b). Knowledge of context sensitive spellings as a component of spelling competence: Evidence from Danish. *Applied Psycholinguistics*, 26(2), 249–265.

Juul, H., & Elbro, C. (2004). The links between grammar and spelling: A cognitive hurdle in deep orthographies? *Reading and Writing*, 17(9), 915–942.

Juul, H., & Sigurdsson, B. (2005). Orthography as a handicap? A direct comparison of spelling acquisition in Danish and Icelandic. *Scandinavian Journal of Psychology*, 46(3), 263–272.

Katz, L., & Frost, R. (1992). The reading process is different for different orthographies: the orthographic depth hypothesis. In R. Frost & L. Katz (Eds.), *Orthography, phonology, morphology, and meaning: Advances in psychology*, Vol. 94 (pp. 67–84). Oxford: North–Holland.

Kessler, B. & Treiman, R. (2001). Relationships between Sounds and Letters in English Monosyllables. *Journal of Memory and Language*, 44, 592–617.

- Kodzasov, S.V., Krivnona, O.F. (2001). *Obschaja Fonetika*. Moskva: RGGU.
- Kuhn, D. (2009). Adolescent thinking. In R. Lerner & L. Steinberg (Eds.), *Handbook of adolescent psychology* (3rd ed., Vol. 1, pp. 152–186). New York: Wiley.
- Landerl, K., & Wimmer, H. (2008). Development of word reading fluency and spelling in a consistent orthography: An 8–year follow–up. *Journal of Educational Psychology*, *100*(1), 150–161.
- Lefrancois, P. (2001). Transfer in second–language writing. [Le Point sur les transferts dans l'écriture en langue seconde] *The Canadian Modern Language Review/La Revue Canadienne Des Langues Vivantes*, *58*(2), 223–245.
- LoveToKnow, Corp. (n. d.). *100 Most Often Misspelled Misspelled Words in English*. Retrieved from <http://www.yourdictionary.com/library/misspelled.html>.
- Luelsdorff, P.A. (1990). Processing strategies in bilingual spellers. In J. Fisiak (Ed.), *Further Insights Into Contrastive Analysis* (pp. 187 – 205). Amsterdam; Philadelphia: John Benjamins.
- Lundberg, I. (1999). Learning to read in Scandinavia. In M. Harris & G. Hatano (Eds.), *Learning to Read and Write: a Cross–linguistic Perspective* (pp. 157 – 172). Cambridge, U.K.; New York, NY, USA : Cambridge University Press.
- Marian, V., Blumenfeld, H. K., & Kaushanskaya, M. (2007). The language experience and proficiency questionnaire (LEAP–Q): assessing language profiles in bilinguals and multilinguals. *Journal of Speech, Language and Hearing Research*, *50*, 940 – 967.
- Marsh, G., Friedman, M.P., Desberg, P., & Saterdahl, K. (1981). Comparison of reading and spelling strategies in normal and reading disabled children. In M.P. Friedman, J.P. Das, & N. O'Connor (Eds.), *Intelligence and learning* (pp. 363–367). New York: Plenum.
- Miyawaki, K., W. Strange, R. R. Verbrugge, A. M. Liberman, J. J. Jenkins & O. Fujimura (1975). An effect of linguistic experience: the discrimination of [r] and [l] by native speakers of Japanese and English. *Perception & Psychophysics*, *18*, 331-340.
- Muller, K., & Brady, S. (2001). Correlates of early reading performance in a transparent

orthography. *Reading and Writing*, 14(7–8), 757–799.

Nusbaum, H. C., Pisoni, D. B., & Davis, C. K. (1984). *Sizing up the Hoosier mental lexicon: Measuring the familiarity of 20,000 words* (Research on Speech Perception Progress Report No. 10). Bloomington: Indiana University, Psychology Department, Speech Research Laboratory.

Perry, C. & Ziegler, J.C. (2004). Beyond the two–strategy model of skilled spelling: Effects of consistency, grain size, and orthographic redundancy. *The Quarterly Journal of Experimental Psychology Section A*, 57, 325–356.

Rickard Liow, S. J., & Lau, L. H. –. (2006). The development of bilingual children's early spelling in English. *Journal of Educational Psychology*, 98(4), 868–878.

Ringbom, H. (1987). *The role of the first language in foreign language learning*. Clevedon, Philadelphia: Multilingual Matters.

Rispens, J. E., McBride–Chang, C., & Reitsma, P. (2008). Morphological awareness and early and advanced word recognition and spelling in Dutch. *Reading and Writing*, 21(6), Aug–607.

Rittle–Johnson, B., & Siegler, R. S. (1999). Learning to spell: Variability, choice, and change in children's strategy use. *Child Development*, 70(2), 332–348.

Sasaki, M. (2005). The Effect of L1 Reading Processes on L2: A Crosslinguistic Comparison of Italian and Japanese Users of English. In V, Cook & B. Bassetti (Eds.), *Second language writing systems* (pp. 289 – 308). Clevedon; Buffalo: Multilingual Matters.

Schulte–Korne, G., Deimel, W., & Remschmidt, H. (1997). Can self–report data on deficits in reading and spelling predict spelling disability as defined by psychometric tests? *Reading and Writing*, 9(1), 55–63.

Schwartz, M., Geva, E., Share, D. L., & Leikin, M. (2007). Learning to read in English as third language: The cross–linguistic transfer of phonological processing skills. *Written Language and Literacy*, 10(1), 25–52.

Seeff-Gabriel, B. (2003). Phonological processing: A platform for assisting second-language

learners with English spelling. *Child Language Teaching and Therapy*, 19(3), 291-310.

Seymour, P.H.K., Aro, M., & Erskine, J.M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94, 143–174.

Share, D. L. (2008). On the anglocentricities of current reading research and practice: The perils of overreliance on an “outlier” orthography. *Psychological Bulletin*, 134(4), 584–615.

Shankweiler, D., Lundquist, E., Dreyer, L.G., & Dickinson, C.C. (1996). Reading and spelling difficulties in high school students: Causes and consequences. *Reading and Writing*, 8, 267-294.

Sharp, A. C., Sinatra, G. M., & Reynolds, R. E. (2008). The development of children's orthographic knowledge: A microgenetic perspective. *Reading Research Quarterly*, 43(3), 206–226.

Siegel, L. S. (2008). Morphological awareness skills of English language learners and children with dyslexia. *Topics in Language Disorders*, 28(1), 15–27.

Sparks, R. L., Ganschow, L., Fluharty, K. & Little, S. (1995). An Exploratory Study on the Effects of Latin on the Native Language Skills and Foreign Language Aptitude of Students with and without Learning Disabilities. *The Classical Journal*, 91.2, pp. 165–184.

Sparks, R. L., Patton, J., Ganschow, L., Humbach, N., & Javorsky, J. (2008). Early first–language reading and spelling skills predict later second–language reading and spelling skills. *Journal of Educational Psychology*, 100(1), 162–174.

Treiman, R. (1984). Individual differences among children in reading and spelling styles. *Journal of Experimental Child Psychology*, 37, 463–477.

Treiman, R. (1993). *Beginning to spell: A study of first–grade children*. New York: Oxford University Press.

Treiman, R., & Kessler, B. (2006). Spelling as statistical learning: Using consonantal context to spell vowels. *Journal of Educational Psychology*, 98, 642–652.

Treiman, R., Cassar, M., & Zukowski, A. (1994). What types of linguistic information do

children use in spelling? The case of flaps. *Child Development*, 65, 1318–1337.

Treiman, R., Kessler, B., & Bick, S. (2002). Context sensitivity in the spelling of English vowels. *Journal of Memory and Language*, 47, 448–468.

Tucker, G.R. (1999). *A Global Perspective on Bilingualism and Bilingual Education*. Retrieved from <http://www.cal.org/resources/Digest/digestglobal.html>

Van Berkel, A., (2005). The role of phonological strategy in learning to spell in English as a second language. In V, Cook & B. Bassetti (Eds.), *Second language writing systems* (pp. 97 – 121). Clevedon; Buffalo: Multilingual Matters.

Van de Gaer, E., Pustjens, H., Van Damme, J., & De Munter, A. (2009). School engagement and language achievement: A longitudinal study of gender differences across secondary school. *Merrill–Palmer Quarterly: Journal of Developmental Psychology*, 55(4), 373–405.

Venezky, R.L. (1999). *The American way of spelling: The structure and origins of American English orthography*. New York: Guilford Press.

Wade–Woolley, L. (1999). First language influences on second language word reading: All roads lead to Rome. *Language Learning*, 49(3), 447–471.

Wang, M., & Geva, E. (2003). Spelling performance of Chinese children using English as a second language: Lexical and visual–orthographic processes. *Applied Psycholinguistics*, 24(1), 1–25.

Wang, M., Park, Y., & Lee, K. R. (2006). Korean–English biliteracy acquisition: Cross–language phonological and orthographic transfer. *Journal of Educational Psychology*, 98(1), 148–158.

Weekes, B. S. (1994). Spelling skills of lexical readers. *British Journal of Psychology*, 85, 245–257. Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, 131, 3–29.

Wimmer, H., & Landerl, K. (1997). How learning to spell German differs from learning to

spell English. In Perfetti, C. A., L. Rieben & M. Fayol (Eds.), *Learning to spell: Research, theory, and practice across languages* (pp. 81–96). Mahwah, NJ: Lawrence Erlbaum.

World Bank. (1995). *Priorities and strategies for education*. Washington, DC: The International Bank for Reconstruction and Development.

WWW.ESLDesk.com (n.d.). *Commonly Misspelled English Words*. Retrieved from <http://www.esldesk.com/esl-quizzes/misspelled-words/misspelled-words.htm>.

Ziegler J.C., Stone, G.O., & Jacobs, A.M. (1997). What is the pronunciation for –ough and the spelling for/u/? A database for computing feedforward and feedback consistency in English. *Behavior Research Methods, Instruments & Computers*, 29, 600–618.

Ziegler, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, 131(1), 3–29.

Ziegler, J.C., & Goswami, U. (2006). Becoming literate in different languages: similar problems, different solutions. *Developmental Science*, 9, 429–453.