Measuring L2 (Russian) Reading Proficiency Across Various Levels Using Eye Tracking

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Measuring L2 (Russian) Reading Proficiency
Across Various Levels Using Eye Tracking

Anastasia Rybakova

A thesis submitted to the faculty of
Brigham Young University
in partial fulfillment of the requirements for the degree of

Master of Arts

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ABSTRACT

Measuring L2 (Russian) Reading Proficiency Across Various Levels Using Eye Tracking

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Master of Arts

In recent years interest in L2 reading research has focused largely on word frequency, sentence level, word recognition, and several researchers have begun to use eye tracking to better study reading behaviors. Parshina et al. (under review) have found that high proficiency heritage speakers of Russian read faster in terms of gaze duration and total time and had fewer regressions than low proficiency heritage speakers. The current study focuses on the establishment of benchmarks for L2 Russian readers in terms of first fixation duration, gaze duration, and total time when reading a complete passage, and compares these variables among different proficiency levels. Thirty-two students participated in the study with proficiency levels ranging from Novice to Superior. Subjects completed eye tracking and reading comprehension passages with the use on an eye tracker to asses reading abilities. Results show that all participants read L1 significantly faster than L2 in terms of first fixation duration. Additionally, all proficiency levels read Intermediate passages faster than Advanced passages. These results help establish the first benchmarks for eye tracking in Russian as an L2.

Keywords: language acquisition, eye movement benchmarks, eye tracking, second-language reading, Russian, reading behavior
ACKNOWLEDGMENTS

I would like to express my deep and sincere gratitude to everyone who contributed to this process. First, I would like to acknowledge my chair, Dr. Jennifer Bown, for guiding, teaching, supporting, and believing in me and my capacities to do this project. She showed support from the first day of graduate school by kindly guiding and helping me to grow professionally, academically, and personally. I am grateful for all the advice, feedback, support and time from other committee members. I am also thankful for every member of the ICAMRA research group (professors and other graduate students) for their example of diligent work and support. I am grateful to Kathy and Bob Carter for their trust in me and seeing my potential to receive a Master’s degree in a second language. I am especially grateful to my mom, and the lessons of hard work, diligence, and perseverance that she taught me by her example. I am grateful for my family’s endless love, support, and belief in achieving dreams and goals in my life.
# TABLE OF CONTENTS

ACKNOWLEDGMENTS .......................................................................................................................... iii
LIST OF TABLES .................................................................................................................................. vi
LIST OF FIGURES .............................................................................................................................. vii
PREFACE ........................................................................................................................................ viii

Chapter 1: Introduction ...................................................................................................................... 1

Chapter 2: Review of Literature ........................................................................................................ 5
  What is Reading? ............................................................................................................................... 5
  Assessing Reading Comprehension ................................................................................................. 6
  Assessing Reading Through Eye Tracking .................................................................................... 7
  Eye Movement Benchmarks in Monolingual Reading ................................................................. 9
  Eye Movement Benchmarks in Children ...................................................................................... 11
  Eye Movement Benchmarks in Bilingual/L2 Reading ............................................................ 11
  Eye Movement Benchmarks in Russian ....................................................................................... 12
  Research Questions ..................................................................................................................... 15

Chapter 3: Research Design ............................................................................................................. 16
  Participants .................................................................................................................................. 16
  Materials ..................................................................................................................................... 17
  Apparatus ..................................................................................................................................... 21
  Procedures ................................................................................................................................... 21
  Cleaning Data ............................................................................................................................... 24
  Data Measurements Measures .................................................................................................... 25
  Data Analysis ............................................................................................................................... 25

Chapter 4: Results ............................................................................................................................. 27
  Average benchmarks for first fixation duration, gaze duration, and total time .................... 28
  Differences of L2 readers for first fixation duration, gaze duration, and total time ............. 30
  Affect of text difficulty for first fixation ..................................................................................... 31
  Differences between L1 and L2 readers for first fixation duration, gaze duration, and total time ............................................................................................................................................. 32

Chapter 5: Discussion ....................................................................................................................... 42
  Proficiency Level Effect ............................................................................................................... 42
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Fixation Duration</td>
<td>42</td>
</tr>
<tr>
<td>Gaze Duration</td>
<td>43</td>
</tr>
<tr>
<td>Chapter 6: Conclusion</td>
<td>46</td>
</tr>
<tr>
<td>Summary</td>
<td>46</td>
</tr>
<tr>
<td>Limitations</td>
<td>47</td>
</tr>
<tr>
<td>Future Research</td>
<td>48</td>
</tr>
<tr>
<td>References</td>
<td>49</td>
</tr>
<tr>
<td>Appendix A</td>
<td>58</td>
</tr>
<tr>
<td>Appendix B</td>
<td>74</td>
</tr>
<tr>
<td>Appendix C</td>
<td>81</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 1. Means (and standard deviation) for reading variables as a function of Experiment and Preview Condition, in milliseconds/proportions .......................................................... 29
Table 2. Experiment parameters .................................................................................. 28
Table 3. First Fixation Duration for English and Russian words ................................. 34
Table 4. Gaze Duration for English and Russian words .............................................. 36
Table 5. Total Dwell Time between languages in a trial ............................................. 39
LIST OF FIGURES

Figure 1. Example of a Russian Intermediate level reading passage ........................................ 19
Figure 2. Example of an English Intermediate level reading passage .................................... 19
Figure 3. Example of a question in Russian ................................................................................. 20
Figure 4. Example of a question in English .................................................................................. 20
Figure 5. First Fixation Duration in English and Russian passages ........................................... 35
Figure 6. First Fixation Duration in English and Russian passages by proficiency levels .......... 36
Figure 7. Gaze Duration in English and Russian passages ......................................................... 38
Figure 8. Gaze Duration in English and Russian passages by proficiency levels .................... 38
Figure 9. Total time in English and Russian passages ............................................................... 40
Figure 10. Total time in English and Russian passages by proficiency levels ........................... 41
PREFACE

This thesis was written with the purpose of being submitted as a manuscript to be published in a journal. The following journals were chosen as options for publication: *Reading in a Foreign Language, Journal of Eye Movement Research, Studies in Second Language Acquisition, Second Language Research, and International Multilingual Research Journal.*
Chapter 1

Introduction

Reading is a complex process that combines perceptual, psycholinguistic, and cognitive abilities in any language regardless if it is a first language (L1) or a second language (Adams, 1990; Grabe, 2009). Reading in a first language (L1) may seem like a somewhat natural process, similar to breathing. How often do people pay attention to the way they are breathing or what they are breathing with? On the other hand, reading in a second language (L2) requires more attention from the reader. When people read in their L1, they rarely pay attention to any morphological structures; however, that rapidly changes when they start reading in L2, especially if the L2 varies dramatically from the L1, where script, reading direction, and/or alphabet may differ.

Despite the amount of research available on English literacy development, relatively little research on literacy development in a second (L2) language has been conducted (Grabe, 2009). One of the reasons why the question of literacy development has not been researched widely may stem from an assumption that the skills learned in one language will automatically transfer to another language as long as the reader has a large vocabulary. However, the fact that the L1 differs from L2 is inevitable. It is important to state that not all transfer from L1 to L2 can be successful. Many have learned to read in their L1 more or less successfully from a very young age, and the reading strategies developed in the L1 can either accelerate the transfer of reading skills to the L2 or become obstacles for L2 readers, as the reading processes do not transfer from an L1 to an L2.

Nevertheless, a reader can generally become more proficient and fluent in L1 and L2 reading. Understanding the development of reading comprehension and reading fluency among
L2 readers has become an important focus of research in the last decade. Scholars define reading fluency as “the ability to read rapidly with ease and accuracy, and to read with appropriate expression and phrasing. It involves a long incremental process and text comprehension is the expected outcome” (Grabe, 2009). According to Grabe (2010), fluency requires the development of a large passive vocabulary, as well as the development of automaticity. Scholars generally agree that such automaticity requires extensive exposure to large amounts of text. Research on L1 reading indicates that reading fluency is strongly correlated with reading comprehension for children (Grabe, 2009; Gorsuch, & Taguchi, 2008; Gorsuch, & Taguchi, 2010; Kuperman, & Van Dyke, 2011).

Evaluating reading fluency mostly for children is typically accomplished by asking readers to read a graded passage aloud within a certain amount of time while marking any errors in reading or prosody, counting the total number of words read in the passage, subtracting the number of errors from the total number of words, and then calculating words per minute. Adults’ comprehension of the passage is evaluated through silent reading followed by comprehension questions. The reader’s comprehension is also considered and is assessed indirectly as students answer comprehension questions. In recent years, however, eye tracking technology has allowed researchers to better understand reading fluency, as well as other factors involved in comprehension. Eye tracking allows researchers to focus on the reading process rather than on reading results. Scholars use eye trackers to measure what readers’ eyes fixate upon, assuming that the fixations of the eye reflect areas of attention. The eye-mind link hypothesis assumes that (1) what a reader looks at (fixates their eye on) is what they are paying attention to and (2) fixation duration reflects the required cognitive effort in order to process what is being viewed (Rayner et al., 2007; Rayner, 2009; Reichle, Pollatsek, & Rayner, 2012). Eye tracking makes it
possible for researchers to measure and distinguish between early and late reading processes (defined below) and enable them to look closely at word recognition, comprehension, fluency, etc.

Eye tracking has been used extensively to investigate L1 reading and establish a variety of benchmarks related to fluent reading in L1 readers, including reading rate (words read per minute), first fixation duration (a time in milliseconds when the eyes remain stationary on a word in order to recognize the word), saccade length (rapid eye movements made from one fixation point to another), and number of regressions (eye movements back to a previous word or phrase) (Rayner, 1998, 2009; Robert, & Siyanova-Chanturia, 2013). These benchmarks were established for English, a language with a deep orthography and a Latin alphabet. However, in the 1990s scholars began to turn their attention to other languages, with different orthographies and morphological characteristics. Cross-linguistic research on reading in typologically diverse languages demonstrates the need to establish language-specific benchmarks. For example, it was found that the average saccade length for L1 readers of Chinese, a language with a non-spaced logographic script, is much shorter than those of readers of spaced scripts (Yan, Kliegl, Richer, Nuthmann, & Shu, 2010).

Though benchmarks have been established for L1 reading, relatively little research has investigated natural L2 reading processes, and even less has been done for L2 reading in Russian. Only recently have benchmarks been established for L1 reading in Russian, among adults and 8-year old children (Korneev, Akhutina & Matveeva, 2017; Laurinavichyute, Sekerina, Alexeeva, Bagdasaryan, & Kliegl, 2019). A recent, as yet unpublished study has examined reading among bilingual heritage speakers of Russian (Parshina, Laurinavichyute, & Sekerina, under review). However, Parshina et al. (under review) used sentence-level reading to
track eye movements, rather than having learners read actual texts. Moreover, Parshina et al. (under review) examined only two proficiency levels, deemed “high” and “low,” and thus can say very little about the development of reading proficiency over time. Finally, the study focused on heritage speakers of Russian, rather than on L2 readers.

The purpose of this study is to establish benchmarks for natural L2 reading in Russian at various levels of proficiency. The participants for this study will be L2 learners of Russian, who began their study of the language as young adults. Most of them are L1 speakers of English, a language that is typologically quite different from Russian.

The results of this study will establish benchmarks for natural L2 reading of Russian at various proficiency levels established by the American Council on the Teaching of Foreign Languages. This study is part of a larger project to establish reading benchmarks in a variety of typologically and orthographically diverse languages, allowing scholars to better understand how linguistic features affect the development of proficiency over time.
Chapter 2

Review of Literature

What is Reading?

Reading is a common skill in most languages, and often begins at a relatively young age in a child’s first language (L1); nevertheless, reading does not come naturally even in L1. Reading generally requires instruction, and reading ability becomes stronger with practice over the years. Children start by reading separate graphemes, linking the graphemes to sounds, connecting sounds into syllables, combining syllables into words and collocations, and finally forming full sentences. Therefore, reading ability is mainly influenced by various experiences within a language, as well as readers’ development in languages.

Snow (2002) defined reading comprehension “as the process of simultaneously extracting and constructing meaning through interaction and involvement with written language” (p. 11). In this study, he emphasized both the importance and the insufficiency of the text as a determinant of reading comprehension. Snow (2002) emphasized three elements of comprehension:

• “The reader who is doing the comprehending

• The text that is to be comprehended

• The activity in which comprehension is a part” (p.11).

The National Reading Panel report focuses on text and reader as sources of variability of reading development and comprehension (NRP, 2000). Many authors also identify the importance of such factors as the reader’s purpose, interest in the topic, background knowledge, strategy use, etc. Gaskins together with his colleagues (e.g., Gaskins, 1998; Gaskins et al., 1993; Gaskins & Elliot, 1991) has described that part of reading comprehension requires awareness of the implicit and explicit information presented in the text.
For a fluent reader of L1, reading is often viewed as a smooth process of decoding words (linking graphemes to sounds) and integrating each newly recognized word into the broader schematic of the text. Fluent reading in an L1 is automatic, and readers rarely notice what they are doing. However, reading in an L2 may not be so automatic. However, little is known about the process of decoding the information during reading.

Assessing Reading Comprehension

For decades measuring reading comprehension was limited to indirect measures, such as: multiple-choice questions, think aloud protocols, interviews, surveys, cloze tests, inference questions, self-reports, etc., where only products of the process of comprehension are perceived (Caldwell, 2008; Cutting & Scarborough, 2006; Fletcher, 2009; Francis et al., 2006; Gorsuch, & Taguchi, 2008; Grabe, 2009). Caldwell (2008) pointed out that “comprehension is something that can be examined only indirectly. We cannot actually see what is occurring in a student’s head as he or she comprehends” (p. 34). It is inferred that a student comprehends a text if he or she answers a question correctly. These methods can, at best, help researchers infer how well reader comprehends a text. In addition to being indirect measures of assessment, many of the methods used to determine reading comprehension may not actually measure comprehension. For example, multiple choice questions may assess test taking strategies, rather than actual comprehension. Cloze tests, which can provide results comparable to standard comprehension questions in terms of validity and reliability (Gelbert & Elbro, 2013; Williams, Ari, & Santamaria, 2011), may also assess something beyond reading ability. For example, a study conducted by Baghaei and Ravand (2016) among L2 English speakers from the Iranian National University found that cloze test items generated higher levels of local item dependency (LID, where items tested in cloze test depended on each other) than reading comprehension items,
which might mean that this method may require certain abilities above the reader’s language proficiency. Think-aloud protocols are used by teachers and researchers to evaluate unseen cognitive processes in a reader’s head while reading a text. However, in a study of L2 (English) learners, Jahandar et al. (2012) confirmed that the think-aloud method has a positive effect on improving reading comprehension, suggesting that this method may influence the very process it is intended to study. On the other hand, eye tracking can serve as a direct measure of L2 reading proficiency, further evidenced by the discovery that subjects adopt eye movements with longer durations and shorter saccades while reading a second language (Cop, Drieghe, et al., 2015a; Cop, Keuleers, et al., 2015b).

Assessing Reading Through Eye Tracking

Eye tracking has become a promising method to more directly measure the reading process. Eye trackers can record readers’ eye movements as they read texts. Scholars who employ eye tracking technology assume that eye gaze denotes overt attention, relating to ongoing processing in the mind, known as the eye mind link hypothesis (Rayner et al., 2007; Rayner, 2009; Reichle, Pollatsek, & Rayner, 2012).

Rayner (1998) reviewed the development of eye movement studies over the years. He separated them into three eras, where the first era goes back to the 1879 – 1920s and primarily states facts about an eye movement in reading and later research added that eye movement can reflect the cognitive process of reading. According to Rayner (1998), many basic facts about eye movements were discovered during the first period, such as the length of saccades, the size of perceptual span (an interest zone), etc. The second era focused on eye movements as a reflection of behavior in experimental psychology without trying to uncover underlying cognitive
processes. Lastly, the third era marked the time of improvements in more accurately and easily obtaining measurements by the technological advancements that were made.

Though eye tracking has been successfully used to study L2 processing (Rayner, 2009; Roberts, & Siyanova-Chanturia, 2013), relatively few studies have focused on L2 reading (Cop et al., 2015a; Gollan, Montoya, Cera, & Sandoval, 2008). Only recently have scholars turned their attention to L2 reading, though the methods and focus of the studies have varied considerably. For instance, scholars have focused on such diverse areas as word recognition (Cop et al., 2015), processing of simple sentences and strings of words (Dussias, 2010; Parshina et al., under review; Roberts & Siyanova-Chanturia, 2013), validity of reading tests (Bax & Chan, 2019), or differences between successful and unsuccessful L2 readers (Bax, 2013).

Dussias (2010) used eye-tracking technology to analyze comprehension of short sentences and passages in both the L1 and the L2. She found that reading processing among L2 speakers is affected by linguistic variables, such as proficiency and type of linguistic experience. Bax and Chan (2019) used eye tracking along with interviews to examine the relationship between reading item types and students' reading processes in test conditions. They provided compelling evidence that eye tracking adds significant value as a method for researching cognitive validity in reading tests.

There is compelling evidence that the use of eye tracking together with other methods such as answering comprehension questions and think aloud protocols add significant value to the study of reading comprehension. Moreover, eye tracking allows researchers to look at participants’ reading behavior closer.
Eye Movement Benchmarks in Monolingual Reading

Although the pool of literature on eye tracking in L2 reading is relatively small, several researchers have used eye tracking to establish benchmarks in L1 monolingual reading, and even a few have looked at L2 bilingual reading (Blythe, Häikiö, Bertam, Liversedge, & Hyönä, 2011; Engbert, Nuthmann, Richter, & Kliegl, 2005; Fernández, Shalom, Kliegl, & Sigman, 2014; Kuperman, Bertram, & Baayen, 2010; Kennedy, & Pynthe, 2005; Laurinavichyute et al., 2019; Reichle, Pollatsek, & Rayner, 2006; Reichle, Warren, & McConnell, 2009).

The first eye movement benchmarks in English were established in the 1980s, as scholars put forth the first models of eye movement control (Radach & Kennedy 2004; Rayner, 2009). Today, eye movements are actively used to investigate cognitive processes during reading, scene perceptions, and visual search (Rayner, 2009). During the last few decades, technological developments have allowed scholars to measure precisely where and when a reader is looking while reading (Rayner, 1998, 2009; Roberts, & Siyanova-Chanturia, 2013). Developing technology to record eye movements allows researchers to distinguish measurements as early or late (Clifton, Staub, & Rayner, 2007; Kuperman & Van Dyke, 2011; Roberts & Siyanova-Chanturia, 2013), depending on what stages of the reading process they are thought to reflect. Early measures are those that involve lexical access, syntactic parsing, and semantic proposition formation; late measures indicate later stages of the reading process, whereby new information is integrated into what is already known or readers employ metacognitive strategies to compensate for difficulties understanding (Boston, Hale, Kliegl, Patil & Vasishth, 2008; Vasishth, Malsburg, & Engelmann, 2013). Early measures include first fixation duration, single fixation duration, gaze duration, and probability of skipping words. Among the late measures are sum of all fixation durations on the word and saccades regressions.
Among the benchmarks established for reading across languages are the mean fixation durations (FD) in monolingual adults, ranging from 220-250 milliseconds, depending on a word’s length, frequency, and predictability. Moreover, research shows that approximately one-third of all words are skipped and that the likelihood a word will be skipped is dependent upon the word length (i.e., shorter words are skipped more frequently than longer words) or function (function words are skipped more often than content words). The probability of regression is about 20% (Parshina et al., under review).

Other factors that influence eye movements include such lexical properties as word frequency, predictability, and length. Typically, the mean fixation on a word decreases as its frequency and predictability increase. Moreover, the more frequent or predictable a word, the more likely it is to be skipped during the reading process (Inhoff & Rayner, 1986; Rayner, 1998).

The features listed above have been found across a variety of languages (Fernández et al., 2014; Kuperman et al., 2010 Laurinavichyute et al., 2019; Liversedge & Hyönä, 2011; Reichle et al., 2009). However, other features that affect eye movements are language dependent. Kennedy and Pynthe (2005) found that gaze duration among readers of French is affected by readers’ familiarity with the parafoveal word (the following word). Word position in sentences in Dutch and Spanish affects eye movements (Fernández et al., 2014; Kuperman et al., 2010a), as does complex morphology in Finnish (Hyönä, Laine, & Niemi, 1995). Other studies find an effect for language scripts. For example, a study of native Chinese speakers found that average saccade length is shorter compared to saccade lengths in readers of spaced scripts. Nevertheless, readers of unspaced scripts are still able to move their gaze to the preferred viewing location (close to the middle of the word) as easily as readers of spaced scripts, where spaces may allow readers to estimate word length (Yan, Kliegl, Richer, Nuthmann, and Shu, 2009).
Eye Movement Benchmarks in Children

Research on the eye movements of monolingual children reflects the developmental nature of reading. Children demonstrate longer mean fixation durations (280-300 milliseconds), lower skipping rate (ranging from 9-13% of total words), and more regressions (30%). Overall, these findings suggest that children are slower at decoding words compared to adults and that they tend to have a smaller visual span. The differences in reading skill disappear with age as the children gain more automaticity through practice (Blythe, Häikiö, Bertam, Liversedge & Hyönä, 2011; Häikiö, Bertram, Hyönä & Niemi, 2009; Mancheva et al., 2015).

Eye Movement Benchmarks in Bilingual/L2 Reading

Only recently have scholars employed eye tracking technology to study bilingual reading, assuming that bilinguals, due to decreased contact with the target language, will demonstrate weakened links between word forms and their mental representations (Gollan et al., 2008). As a result of these weaker links, lexical access is slowed down, as reflected in longer reading times and larger frequency effects. In their study of eye movement patterns of L1 and L2 readers (among Dutch – English readers), Cop et al (2015b) found that bilingual L2 readers had 20% longer sentence reading times, more fixations, shorter saccades and less word skipping; regressions were very similar between L1 and L2 readers.

Parshina et al. (under review) summarize the findings on bilingual and L2 readers

“[E]ye movements in lower-proficient L2 readers are characterized by longer fixation durations, lower likelihood of skipping the words, higher probabilities of regressive saccades, and larger FEs making unbalanced L2 bilinguals similar to monolingual children or monolingual adults with poor reading skills. Such empirical findings support the weaker links account that puts exposure to non-
dominant language as the bottleneck factor affecting acquisition of literacy skills in bilingual L2 speakers” (pp. 7-8).

However, it is assumed that proficiency may modulate these effects. Much as children’s eye movements become more similar to those of adult readers as they gain proficiency, so should L2 readers’ eye movements become more similar to adult L1 readers. Proficient reading can be defined as “the active, automatic far-transfer process of using one’s internalized language and culture expectancy system to efficiently comprehend an authentic text for the purpose for which it was written” (Clifford & Cox, 2013, p. 50). In fact, Parshina et al. (under review) found that proficiency indeed increases lexical access, while decreasing frequency effects. On the other hand, another study on L2 eye movements and reading proficiency provided contradictory findings (Grahl, 2019). Grahl (2019) focused on the reading behaviors of L2 readers of Portuguese. In her study, Grahl did not find significant differences between the reading behavior of L2 (Portuguese) readers and L1 (English) readers. Additionally, proficiency level had no effect on reading performance in the L2, except that readers read more slowly in their L2 then in their L1 when reading a text. It is important to note that English and Portuguese have a similar writing system (as alphabetic language), whereas the Russian alphabet is more distinguished from the English alphabet, which might lead to different findings.

**Eye Movement Benchmarks in Russian**

In recent years, scholars have expanded their focus from languages with Roman scripts, such as French, German, Dutch, and Finnish to languages with non-Roman orthographies, including Chinese, Japanese, Korean, Hebrew, Hindi, Arabic, and Urdu (Fernández et al., 2014; Hyönnä et al., 1995; Kennedy, & Pynthe, 2005; Laurinavichyute et al., 2019). However, there has been little research done on L2 reading in Russian, which uses a script that has been
underexplored in eye-tracking research. In addition to using the Cyrillic alphabet, the Russian language has a very complex grammar and morphological structure, nonsystematic stress patterns, long polymorphemic words, and a high degree of syncretism, in which functionally distinct occurrences of a single morpheme are identical in form (see Rakhlin, Kornilov, & Grigorenko, 2017 for a discussion of the difficulties associated with learning to read Russian). All of these make Russian an interesting case for eye-tracking studies.

Only recently were eye-movement benchmarks established for Russian. Laurinavichyute and colleagues (2019) conducted eye movement studies among monolingual speakers of Russian. Participants were asked to read sentences on a computer where the machine was recording their eye movements. Ninety-six participants read a set of 13 sentences, 33% of which were followed by a comprehension question to ensure they were reading for comprehension. Among the other measures studied, the scholars examined fixation duration, gaze time, and total time. With the existing data, they were later able to compare the eye movements of native Russian speakers with those of native German speakers in Kliegl et al.’s (2006) study, on whose corpus Laurinavichyute and colleagues (2019) based their instrument. They found that the probability that a Russian reader will fixate their eye on a word only once increases with increased word length or predictability, whereas in German the opposite is true. The authors posit that this difference may suggest simply that in their study they were comparing words that were fixated once rather than words that were skipped, and longer words are more likely to be fixated on than skipped.

Laurinavichyute et al.’s (2019) study was the first to establish benchmarks for reading Russian in terms of fixation duration measures, average saccade length, probabilities of skipping and fixating on words, and the number of regressions in the reading of natural sentences.
Moreover, their study demonstrated the effects of various morphosyntactic features on eye movement behaviors. For example, the authors found that verbs required longer reading times, as did morphosyntactically ambiguous word forms and inflected word forms. In addition to these important findings, Laurinavichyute et al. (2019) introduced the freely available Russian Sentence Corpus, which includes full morphological annotation.

The eye movements of monolingual Russian 8-year-old children were also only recently investigated, using a design parallel to the Russian Sentence Corpus (Korneev et al., 2017). Overall, it was found that Russian children read more slowly and with less automaticity than adult readers of Russian. For example, the children demonstrated multiple fixations per word with longer mean durations in early and late measures, less word skipping, and more regressive saccades to the currently fixated words.

Parshina et al. (under review) extended the study of reading benchmarks in Russian to heritage speakers (HSs) of Russian. They examined 50 heritage speakers of both high and low proficiency and compared their eye movements to those of monolingual Russian native speakers, both adults and children, as well as to L2 learners of Russian. Findings reveal longer fixations, lower skipping probabilities, and higher regressions than in L1 speakers (adults). High proficiency HSs’ results were closer to the results found in monolingual children, whereas low-proficient HSs’ results were more similar to L2 learners.

The studies cited above represent an important breakthrough in understanding reading behaviors in Russian, both by L1 and bilingual readers. However, their studies rely on sentence-level reading and one short passage only for high proficient HSs (Parshina et al., under review); rather than reading a complete text. Also, Parshina et al. (under review) considered only two proficiency levels (high and low). An additional limitation is that the baseline for “high
proficiency” readers in this study represented a 2nd grade reading level for monolingual Russians. Moreover, their primary focus is on Russian heritage speakers, rather than on L2 learners, with the L2 learners serving more as comparison group than as the focus of study. A study that focuses on L2 learners at various levels of proficiency and using complete texts rather than individual sentences would thus provide additional benchmarks for L2 reading in Russian. That is precisely what this study intends to do.

Research Questions

For the first phase of the larger study, our research questions will focus on:

- What are average benchmarks for readers at various levels of proficiency in terms of first fixation duration, gaze duration, and total time?
- How do L2 readers of Russian at Intermediate, Advanced, and Superior levels of proficiency differ in terms of first fixation duration, gaze duration, and total time?
- How does text difficulty affect the first fixation duration, gaze duration, and total time of readers at Intermediate, Advanced, and Superior?
- How do first fixation duration, gaze duration, and total time differ when readers read in their L1 (English) versus their L2 (Russian)?
Chapter 3

Research Design

Participants

A total of forty-eight students studying Russian as a second language at BYU participated in the study, though data from 16 participants could not be used for various reasons: the eye tracking machine read their eye movements incorrectly, the machine not could not calibrate their eyes, or the participants did not complete all phases of the research study. Data from the remaining 32 participants were used in this study. All participants were compensated fully or partly depending on their level of participation.

All participants were students of Brigham Young University (BYU) studying Russian at different levels. They were recruited from all levels of Russian taught at BYU during the Winter 2019 and Fall 2019 semesters. Of the remaining 32 participants, there were 16 males and 16 females, with ages ranging from 18 to 25 years old (with 22.06 average age). All participants were born in the United States except two. The other two participants were born in Japan and the United Kingdom. Nevertheless, all participants spoke English as their first and dominant language, as noted in the background questionnaire. Participant language levels in Russian varied from first year through fourth year.

Most of the participants started studying Russian at the age of 18 or later. There were 22 participants who spent time in Russia or Russian-speaking countries (13 in various regions of Russia, five in Ukraine (both Ukrainian and Russian speaking), two in Lithuania, one in Latvia, and one in the Baltic States), where they spent from 12 to 24 months living abroad in Russian or Slavic language countries. Others reported that they did not spend any time in Russia. Thirteen students reported that they were exposed to Russian in college, and two participants did a study
abroad in Latvia for one semester (four months in length) in addition to their experience living in Russian-speaking country.

**Materials**

1) *A Background Questionnaire* was adopted from a background questionnaire for Portuguese (Grahl, 2019). The survey was adapted from several demographic and language background surveys used for previous L2 eye-tracking studies. Researchers selected questions for a pilot survey that was administered to 8 faculty members and 2 graduate students. Based upon the feedback from the pilot participants, the questionnaire was revised. The background questionnaire was used only to pre-screen participants and to ensure that participants had the necessary language background and that they were capable of reading on the screen (T. Cox, personal communication, November 19, 2019) (Appendix A).

2) *Reading Proficiency test in English*. The ACTFL Reading Proficiency test is a standardized test for the global assessment of reading ability in a language. The test consists of reading passages representing specific targeted proficiency levels. Each passage is followed by one multiple-choice question with four possible answers and only one correct. The test targets a specific range of proficiency and is computer adaptive. The test is divided into “testlets” in which 5 items of similar difficulty level are grouped together. If students perform well on one testlet, they are given another testlet at the next level. If the results from the first testlet are inconclusive, students receive another testlet at the same level. However, if they perform poorly on the testlet, they receive no more tests. Students receive ratings of Novice, Intermediate, Advanced, and Superior, with sub-levels of low, mid, and high on all but the Superior-levels of proficiency. This test allowed researchers to determine the literacy level of the participants in their L1.
3) *Reading Proficiency test in Russian* was administered to determine the reading proficiency level of the L2 readers. This test parallels the Reading Proficiency Test in English.

4) *Eye Tracking Corpus* – The reading passages were developed by the Center for Language Studies at BYU, based on the principles upon which the Reading Proficiency Tests were designed. A group of trained raters selected texts and evaluated them for author purpose, text type, and text features. Three reading proficiency levels were represented: Intermediate, Advanced, and Superior. There were thirty-four reading passages, seventeen in each language (English and Russian) split between fifty-four screens. There were twelve Intermediate passages of approximately 50 to 70 words, four Advanced passages of approximately 150-180 words, and one Superior passage containing 300 to 500 words—such that the word count for passages at each level was approximately 500 words. Each passage was immediately followed by one multiple-choice comprehension question, with five possible options: three distractors, one “I don’t know” option, and one correct answer. However, it is important to note that answers to comprehension questions were not taken into account when data was analyzed; they were used to ensure that participants read the texts for comprehension, rather than skimming them. The Intermediate passages consisted of announcements, signs, notes, and advertisements. The Advanced-level passages included tutorial instructions (from WikiHow) (Appendix B and C).
Нам нужны волонтеры!

В Парке Горького 7 мая будет проходить благотворительное мероприятие, посвященное празднованию Дня Победы.

Организаторам необходима помощь в подготовке праздничного концерта.

Если вы заинтересованы в участии, пожалуйста, обратитесь к Екатерине Веселовой по телефону 873-562-09-03.

Figure 1. Example of a Russian Intermediate level reading passage.

Ross School Election Day Bake Sale

Tuesday, March 1st 8 a.m. – 7 p.m.

We need donations!

Baked goods: cakes, pies, breads, cupcakes, pastries, cookies

Individually wrapped please!

Items can be dropped off on Monday all day or call us to arrange a drop off or pick up.

As always, thank you for supporting Ross School!

Rita Stones 555-825-2147

Figure 2. Example of an English Intermediate level reading passage.
Figure 3. Example of a question in Russian

This ad is for ________.

dance classes

singing rock

piano teaching

guitar lessons

I don’t know.

Figure 4. Example of a question in English.
**Apparatus**

To evaluate eye movements, we used the EyeLink 1000 PLUS eye tracker with a 35mm lens and a sampling rate of 100hz (which means it provides information 1000 times every second and allows researchers to look precisely at the areas of interest). Participants were asked to place their head on a chin rest while they read the passages, which was located 63 cm away from a 21-inch monitor. Eye calibration was performed for each participant before the beginning of each section. Additional calibration occurred every time a participant needed a break or when it was necessary to ensure that data was accurate. In order to navigate between screens, participants used a space bar, and they answered questions with a mouse.

**Procedures**

The data collection process consisted of three parts: Pre-Visit intake (Language Background Questionnaire), In-Person Eye Tracking visit, and In-Person Proficiency test. During the first step of the data collection process, participants were asked to take an online Qualtrics Background Survey, which also asked for demographic information and language background. Participants with visual incompetency were excluded from the study at this stage. Participants with normal or assisted vision (such as soft contact lenses) were able to continue the study. After completing the survey, they were contacted by the researcher to schedule an In-Person Eye Tracking visit. Before the experiment started, they were asked to sign a Consent form for future use of the data.

Before each experiment, the researcher or a lab assistant would provide instructions about the experiment including information about what participants would see on the screen, how to navigate between screens, how to answer a comprehension question with the mouse, and when to take a designated break. All participants were informed that there were two parts to the
experiment and that the first part of the experiment (the eye tracking portion) would take approximately fifty to seventy minutes. The second part of the experiment was the Reading proficiency test in Russian and English, which they completed separately in the Humanities testing lab and took approximately 60-85 minutes.

Before the eye tracking portion of the experiment, a lab assistant or the researcher asked each participant to read and sign a consent form. Then a lab assistant or researcher asked other related questions, such as their BYU ID number, their email and on-campus employment status in order to provide compensation for time they participated in the research. All information was saved on Google-Sheets, where access was only available to lab assistants and the researcher. The files also had additional information, such as when each participant took the eye tracking portion of the research as well as the ACTFL Reading Proficiency test (English and Russian) and comments. Lab assistants were able to leave any necessary comments related to the experiment, such as “Calibration went well, but on trial 22 student had a hard time reading bottom line”. Each comment gave the researcher more information after the experiment was over. It allowed the researcher to remember information that otherwise would be forgotten. If each participant completed both parts of the research, they received $25 in Cougar Cash. If they only completed a part of the experiment, their compensation varied from $5 to $10 depending on how much time they invested in the experiment. Each participant was reminded how long each part would take at the beginning of the experiment and were informed that they could stop the experiment at any time.

Students were asked to sit on a chair and get into a comfortable position, where their chin was on the chin rest and their forehead against the forehead line. Lab assistants or the researcher would remind them to stay still and try not to move during the experiment after their eyes were
calibrated and validated. It is important to note that the chair used in the eye tracking lab has advantages and disadvantages. The height was easily adjusted for students to be more comfortable, but it was easily moved and therefore posed a problem if participants did not stay still. A separate file was created for each separate participant with their code name. All code names were saved in a separate file that only lab assistants and the researchers had access to.

After the file was created, the experiment began. In order to calibrate participants’ eyes, first we asked them to look in four corners to make sure that their cornea was clear and that the eye tracker does not read it as a pupil. For calibration students were asked to follow a dot without trying to predict where it was going to go. After a participant was ready, a lab assistant or a researcher would start calibration. EyeLink 1000 PLUS has ten-point calibration with a possible one-degree of error. If participants were out of the one-degree error, they would not be able to proceed with the experiment. After calibration students were asked to do the same thing for validation – to follow the dot without trying to predict where it was going to go. If both calibration and validation were acceptable, a lab assistant or a researcher started the experiment.

Each experiment began with an instruction screen. Since the program would randomize the language used first, participants saw an instruction screen in the language that was presented first. If English was presented first, then participants saw instructions in English and vice versa for Russian. Since the experiment was run with the help of lab assistants who were trained prior to the experiment and the researcher was not present in the room at all times, all instructions before the experiment and after were done in English. All participant questions regarding any part of the experiment were answered in English as well for consistency of the experiment.

The program is built in a way that the language it started with was randomized as well as the order of passages, so that neither the lab assistants/researcher nor the participant could
predict it. The only passage that the test would not start with was the Superior passage.

Participants were also advised that they could take a break at any time if they felt they were tired, after they answered the question and before they started a new passage. After each break, a lab assistant or a researcher would calibrate and validate their eyes before starting the second part of the experiment.

After completing the test, participants saw a screen that said, “THANK YOU”, and the program closed, after which students were told that the first part of the experiment was over, and they could go home. Each participant was reminded that they needed to finish the second part of the experiment in order to complete the requirements for monetary compensation.

In order to complete the second part of the study, students were asked to go to the Humanities testing lab, which is located in the basement of Joseph Fielding Smith Building on campus. Students were told in advance what the lab’s office hours were and when they could take the test. Since the experiment was split between two semesters, students were also reminded via email to take the Reading Proficiency test in English and Russian.

Cleaning Data

In order to keep all information straight, we created a document on Google Drive that was shared between the researcher and lab assistants. The Google-sheet had the following columns: Name, Name of the file, BYU ID number, email, if they work on campus, Notes, Eye tracking experiment date, Reading Proficiency test date, cleaning data (date), and Reading Proficiency level. Some of the columns were necessary for providing compensation for participation in the study, others for convenience to work with information, and still others for research purposes.
Cleaning the data was done mostly by the lab assistants. They were asked to record any notes or comments, including the date when they started to work on cleaning the file and when they finished working on it. Cleaning data included moving fixations inside the area of interest it belonged to only up or down (along the y axis). If they were not sure where it belonged, they were asked not to move it, but leave it how it was.

**Data Measurements Measures**

The purpose of the study was to measure reading proficiency across various proficiency levels of Russian. The following measurements were used in this study: *first fixation duration, gaze duration, and total time*. *First fixation duration* is the length of the first time when the readers looks at a word or an area of interest (AOI); in this case, each word is considered its own AOI. *Gaze duration* is defined as the sum of all fixations combined that were made by the reader on a word or an AOI before the reader exits AOI in any directions (right or left) (Conklin, Pellicer-Sánchez, & Carrol, 2018). Both *first fixation duration* and *gaze duration* are considered early measures and thus involve lexical access processes, word recognition, syntactic parsing, and semantic proposition formation (Clifton et al., 2007; Kuperman & Van Dyke, 2011; Parshina et al., under review; Roberts & Siyanova-Chanturia, 2013). These measures allow researchers to make an assumption about how much time it takes a reader to recognize and decode the word and to understand what the meaning of the word is. *Total reading time* is among the late measures and represents the sum of all fixation durations on the word or AOI and saccade regressions.

**Data Analysis**

To answer the research questions for this study, a Linear Mixed Effect Model (LME) model was run using R statistical software (2016 Version), using the lme4 package and lmerTest
package to get $p$ values. LME modelling is a type of linear regression modelling that takes into account fixed and random effects, where fixed effects are language, proficiency, and text level, and random effects in this study are words and participants. Three dependent variables were chosen for this study: (1) first fixation duration, (2) gaze duration, and (3) total time. All findings are relative to these base lines.
Chapter 4

Results

The purpose of this study was to establish benchmarks for natural L2 reading of Russian at various proficiency levels with Russian as the baseline language. Russian was chosen as the baseline language for this study because it allowed the researcher to fulfill the purposes of this study and examine whether there was a difference, as a function of proficiency, in L2 readers. The findings provide information about reading behavior in first and second languages (English and Russian, respectively), not only in regard to the word level but also to the text as a whole. We ran a linear mixed effect model (LME) with the following variables: language, proficiency, and text level, and used the lmerTest and lme4 packages (Bates, Mächler, Bolker, & Walker, 2016) in R 3.6.0. (R Core Team, 2019) with random by-participant and by-word intercepts. Random by-participant slopes for language were also included. Russian was chosen as a base line; Advanced level of proficiency and Advanced level texts were chosen as the comparison groups.

Figures 5-7 represent descriptive statistics for each of the dependent variables and include the mean and the standard error for the time (in milliseconds) readers read the passages in their L1 and L2.
Table 1. Experiment parameters

<table>
<thead>
<tr>
<th>Language</th>
<th>Proficiency Levels</th>
<th>Passage Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Intermediate Reader</td>
<td>Intermediate Passage</td>
</tr>
<tr>
<td></td>
<td>Advanced Reader</td>
<td>Advanced Passage</td>
</tr>
<tr>
<td>Russian</td>
<td>Superior Reader</td>
<td>Superior Passage</td>
</tr>
</tbody>
</table>

The research questions focused on: (1) What are average benchmarks for readers at various levels of proficiency in terms of first fixation duration, gaze duration, and total time? (2) How do L2 readers of Russian at Intermediate, Advanced, and Superior levels of proficiency differ in terms of first fixation duration, gaze duration, and total time? (3) How does text difficulty affect the first fixation duration, gaze duration, and total time of readers at Intermediate, Advanced, and Superior? (4) How do first fixation duration, gaze duration, and total time differ when readers read in their L1 (English) versus their L2 (Russian)? In this study we not only focused on their reading behaviors at the word level, but also on the text as a whole.

One consistent finding throughout the study was that English was read faster than Russian, overall, in terms of first fixation duration, gaze duration, and total time.

**Average benchmarks for first fixation duration, gaze duration, and total time**

The following results were found in response to the research question one: How do L2 readers of Russian at Intermediate, Advanced, and Superior levels of proficiency differ in terms of first fixation duration, gaze duration, and total time?

Because this study is one of few eye tracking studies focused on Russian learners studying Russian as a second language, it allowed us to establish preliminary benchmarks for Intermediate, Advanced and Superior level L2 readers of Russian. It needs to be noted that
Superior level L2 readers of Russian could not be considered as a final result, since we only had five Superior level L2 readers presented in this study; nevertheless, we chose to consider them as a separate comparison group in order to see interactions between different proficiency level readers and text difficulty in terms of first fixation duration, gaze duration, and total time. The average benchmarks are summarized in Table 2 below.

Table 2. Means (and standard deviation) for reading variables as a function of Experiment and Preview Condition, in milliseconds/proportions.

<table>
<thead>
<tr>
<th></th>
<th>Intermediate Readers</th>
<th>Advanced Readers</th>
<th>Superior Readers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Russian</td>
<td>English</td>
<td>Russian</td>
</tr>
<tr>
<td>Skipping Probability</td>
<td>0.34</td>
<td>0.5</td>
<td>0.36</td>
</tr>
<tr>
<td></td>
<td>(0.47)</td>
<td>(0.5)</td>
<td>(0.48)</td>
</tr>
<tr>
<td>First Fixation Duration(^1)</td>
<td>330</td>
<td>210</td>
<td>259</td>
</tr>
<tr>
<td></td>
<td>(205)</td>
<td>(84)</td>
<td>(136)</td>
</tr>
<tr>
<td>Refixation Probability</td>
<td>0.52</td>
<td>0.12</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>(0.5)</td>
<td>(0.32)</td>
<td>(0.49)</td>
</tr>
<tr>
<td>Gaze Duration(^1)</td>
<td>800</td>
<td>237</td>
<td>447</td>
</tr>
<tr>
<td></td>
<td>(861)</td>
<td>(141)</td>
<td>(394)</td>
</tr>
<tr>
<td>Regression Probability</td>
<td>0.19</td>
<td>0.19</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.39)</td>
<td>(0.41)</td>
</tr>
<tr>
<td>Total Time(^1)</td>
<td>1153</td>
<td>306</td>
<td>682</td>
</tr>
<tr>
<td></td>
<td>(1173)</td>
<td>(231)</td>
<td>(630)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Intermediate Text</th>
<th>Advanced Text</th>
<th>Superior Text</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Russian</td>
<td>English</td>
<td>Russian</td>
</tr>
<tr>
<td>Skipping Probability</td>
<td>0.47</td>
<td>0.58</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>(0.5)</td>
<td>(0.49)</td>
<td>(0.5)</td>
</tr>
<tr>
<td>First Fixation Duration(^1)</td>
<td>317</td>
<td>206</td>
<td>198</td>
</tr>
<tr>
<td></td>
<td>(198)</td>
<td>(80)</td>
<td>(80)</td>
</tr>
<tr>
<td>Refixation Probability</td>
<td>0.57</td>
<td>0.11</td>
<td>0.41</td>
</tr>
<tr>
<td></td>
<td>(0.5)</td>
<td>(0.32)</td>
<td>(0.49)</td>
</tr>
<tr>
<td>Gaze Duration(^1)</td>
<td>799</td>
<td>230</td>
<td>422</td>
</tr>
<tr>
<td></td>
<td>(875)</td>
<td>(121)</td>
<td>(398)</td>
</tr>
<tr>
<td>Regression Probability</td>
<td>0.17</td>
<td>0.16</td>
<td>0.17</td>
</tr>
<tr>
<td></td>
<td>(0.38)</td>
<td>(0.37)</td>
<td>(0.38)</td>
</tr>
<tr>
<td>Total Time(^1)</td>
<td>1329</td>
<td>332</td>
<td>692</td>
</tr>
<tr>
<td></td>
<td>(1363)</td>
<td>(259)</td>
<td>(672)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Superior Text</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Russian</td>
</tr>
<tr>
<td>Skipping Probability</td>
<td>0.57</td>
</tr>
<tr>
<td></td>
<td>(0.5)</td>
</tr>
<tr>
<td>First Fixation Duration(^1)</td>
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<td></td>
<td>(198)</td>
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<tr>
<td>Refixation Probability</td>
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<tr>
<td>Gaze Duration(^1)</td>
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<tr>
<td></td>
<td>(787)</td>
</tr>
<tr>
<td>Regression Probability</td>
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</tr>
<tr>
<td></td>
<td>(0.39)</td>
</tr>
<tr>
<td>Total Time(^1)</td>
<td>1075</td>
</tr>
<tr>
<td></td>
<td>(1051)</td>
</tr>
</tbody>
</table>

\(^1\) Analyzed variable.
Differences of L2 readers for first fixation duration, gaze duration, and total time.

The results below were found in response to the research question two: How do L2 readers of Russian at Intermediate, Advanced, and Superior levels of proficiency differ in terms of first fixation duration, gaze duration, and total time?

**First fixation duration.** We investigated how long it took participants to recognize and identify a word when they were first looking at it in their first or second language (English and Russian). The findings show that Intermediate readers were slower than Advanced readers in Russian, while there was no significant difference between the speed of Superior and Advanced readers in Russian. Superior readers were not faster than Advanced readers in Russian. The main findings are summarized in Table 3. See Figure 5 and Figure 6 for first fixation duration across these conditions. In contrast, Parshina et al. (under review) found only a weak effect of proficiency level on heritage learner (HL) reading, emphasizing that proficiency affected only some eye movement benchmarks, for instance, that high proficient HSs read faster in terms of gaze duration and total time, skipped more words, and had fewer fixations than low-proficient HSs. They conclude that these findings could be explained by the fact that high-proficient HLs and monolingual participants read harder sentences, whereas low-proficient HSs and L2 read simpler sets of sentences. However, in this study, all readers read the same texts, allowing us to better compare the effects of proficiency eye movements.

**Gaze duration.** These findings provide evidence of a proficiency effect on the time spent by readers looking at a word before moving to the next. In terms of gaze duration as well as first fixation duration, Intermediate readers were slower than Advanced readers in their L2 (Russian), whereas Superior readers were not faster than Advanced readers in Russian. However, it is hard to know for sure, since there were only five Superior-level readers of Russian. These results
might change if the sample of Superior-level readers were larger. For a summary of these results, see Table 4 and Figure 7 and Figure 8 below.

**Total time.** We also explored how much time each participant spent on a text per word. We found that, in Russian, Intermediate readers were slower than Advanced, while Superior readers were not faster than Advanced readers in Russian. Once again, the results cannot be considered final since the sample was limited by five Superior-level readers. It must be noted that, in Russian, Intermediate readers re-read Intermediate texts more than Advanced texts. For a summary of these results, see Table 5 and Figure 9 and Figure 10 below.

**Affect of text difficulty for first fixation**

To answer the third research question “How does text difficulty affect the first fixation duration, gaze duration, and total time of readers at Intermediate, Advanced, and Superior?”, we looked at the same characteristics (first fixation duration, gaze duration, and total time) as the previous one. To answer the second research question, we looked at the same characteristics (first fixation duration, gaze duration, and total time) as the previous one. The findings are summarized below.

**First fixations.** The first fixation duration time was similar when readers read Advanced and Superior passages for the first time. Intermediate texts were read faster in Russian, while Superior texts were not read faster in terms of first fixation duration. This provides evidence that reading in a second language (in this case Russian) necessitates more time decoding higher-level text difficulty and less decoding lower proficiency. For a summary of these results, see Table 3 and Figure 5 and Figure 6 below.

**Gaze duration.** Readers of various (Intermediate, Advanced, and Superior) proficiency levels of Russian read texts differently. The findings show that Intermediate texts were read
faster in Russian than Advanced texts by Intermediate readers, while Superior texts were read slower than Advanced texts in Russian by Intermediate readers. Also, findings reveal that in Russian, Intermediate texts were not completed faster by Superior readers. For a summary of these results, see Table 4 and Figure 7 and Figure 8 below.

**Total time.** In terms of total time and text level, the results revealed that in Russian, Intermediate readers did not read Intermediate texts faster, but had to re-read Intermediate and Advanced texts more, which suggests that the text difficulty affects readers at Intermediate level of reading proficiency, whereas the results also revealed that Intermediate readers were faster for Superior texts. This counterintuitive result may result from Intermediate level readers not have finishing the passage, but rather moving on to the next task. However, significant differences between Advanced and Superior level were found, though this may be due to the inadequate sampling of the Superior level of Russian. For a summary of these results, see Table 5 and Figure 9 and Figure 10 below.

**Differences between L1 and L2 readers for first fixation duration, gaze duration, and total time**

The findings summarized below respond to the last research question “How do first fixation duration, gaze duration, and total time differ when readers read in their L1 (English) versus their L2 (Russian)?”

**First fixation duration.** In Russian, Intermediate readers were faster for Superior texts than for Advanced texts, while in English Intermediate readers were not faster for Superior texts. This may be because Intermediate readers of Russian were giving up on reading Superior level texts because of a lack of vocabulary, difficulty comprehending meaning, or simply being tired. These findings revealed that Intermediate texts in Russian were read faster, thus readers spent
less time on recognizing words. The different proficiency levels in Russian appeared to affect the way readers read passages in their L1 (English) and L2 (Russian) in terms of first fixation duration. The other interactions represented in Table 3 were not significant. For a summary of these results, see Table 3 and Figure 5 and Figure 6 below.

**Gaze duration.** In terms of gaze duration, English was read faster than Russian, which means that readers spent less time fixating on a word before they moved to the next one. Likewise, Intermediate readers were faster for Intermediate texts in English. This is likely because readers are more familiar with the writing system of their native language and they have a better knowledge of word meaning and a richer vocabulary. On the other side, the findings revealed that in English, Intermediate readers were not slower than Advanced readers, compared to Russian, where Intermediate readers did not read Intermediate texts faster. For a summary of these results, see Table 4 and Figure 7 and Figure 8 below.

**Total time.** Intermediate level L2 readers when reading in English were not slower than Advanced, as opposed to reading in Russian. No significant difference in Advanced and Superior readers were found in terms of total time. Also, the results revealed that in English, Superior readers re-read Intermediate texts less than Advanced, whereas readers of Advanced and Superior levels of proficiency in Russian did not differ in terms of the total time spent reading at each level. For a summary of these results, see Table 5 and Figure 9 and Figure 10 below.
Table 3. First Fixation Duration for English and Russian words

<table>
<thead>
<tr>
<th></th>
<th>b</th>
<th>SE</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>English Language</strong></td>
<td>-0.217</td>
<td>0.025</td>
<td>-8.572</td>
<td>&lt;0.000001</td>
</tr>
<tr>
<td><strong>Int. Russian Reader</strong></td>
<td>0.176</td>
<td>0.044</td>
<td>4.000</td>
<td>0.00039</td>
</tr>
<tr>
<td><strong>Sup. Russian Reader</strong></td>
<td>0.069</td>
<td>0.058</td>
<td>1.184</td>
<td>0.24631</td>
</tr>
<tr>
<td><strong>Intermediate Passage</strong></td>
<td>-0.034</td>
<td>0.008</td>
<td>-4.285</td>
<td>0.00001</td>
</tr>
<tr>
<td><strong>Superior Passage</strong></td>
<td>-0.012</td>
<td>0.010</td>
<td>-1.214</td>
<td>0.22482</td>
</tr>
<tr>
<td><strong>English Language x Int. Russian Reader</strong></td>
<td>-0.130</td>
<td>0.035</td>
<td>-3.693</td>
<td>0.00084</td>
</tr>
<tr>
<td><strong>English Language x Sup. Russian Reader</strong></td>
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<td>0.046</td>
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English Language x Int. Russian

Reader x Superior Passage

<p>| | | | |</p>
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<td>0.042</td>
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English Language x Sup. Russian

Reader x Superior Passage

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<td>0.010</td>
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*Note.* Int = Intermediate. Sup = Superior

**Figure 5.** First Fixation Duration in English and Russian passages.
Figure 6. First Fixation Duration in English and Russian passages by proficiency levels.

Table 4. Gaze Duration for English and Russian words.

<table>
<thead>
<tr>
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<tr>
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<tr>
<td>Passage</td>
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<td>2.164</td>
<td>0.0304</td>
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<tr>
<td>Passage</td>
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<tr>
<td>Passage</td>
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*Note.* Int = Intermediate. Sup = Superior.
Figure 7. Gaze Duration in English and Russian passages.

Figure 8. Gaze Duration in English and Russian passages by proficiency levels.
Table 5. Total Dwell Time between languages in a trial.

<table>
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<tr>
<td>Passage</td>
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<td>0.017</td>
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<tr>
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<td>0.19340</td>
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<td><strong>English Language x Int. Russian Reader x Intermediate</strong></td>
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<td>Reader x Intermediate Passage</td>
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<td>0.019</td>
<td>-8.236</td>
<td>&lt; 2e-16</td>
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<td><strong>English Language x Sup. Russian Reader x Intermediate</strong></td>
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<tr>
<td>Reader x Intermediate Passage</td>
<td>0.078</td>
<td>0.024</td>
<td>3.148</td>
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</table>
English Language x Int. Russian

Reader x Superior Passage  0.024  0.025  0.956  0.33883

English Language x Sup. Russian

Reader x Superior Passage  -0.056  0.032  -1.745  0.08099

Note. Int = Intermediate. Sup = Superior

Figure 9. Total time in English and Russian passages
In sum, readers showed slower reading rates than in their L2 (Russian) than they did in their L1 (English) in terms of first fixation durations, gaze duration, and total time. This was likely related to different reading proficiency levels, since the proficiency level interactions were significant in all three characteristics. It is expected that readers read slower in the second language, and this study confirmed that reading in Russian, which has different writing system (Cyrillic alphabet), led less proficient readers to fixate longer on less familiar words and to re-read words and the whole text in their second language more than in their first language (English). In the present study, an Intermediate Russian reader demonstrated much slower reading behavior and speed than Advanced or Superior readers in all three terms (first fixation duration, gaze duration, and total time). Therefore, it was found that there is a significant difference between three reading proficiency groups (Intermediate, Advanced and Superior).
Chapter 5
Discussion

Proficiency Level Effect

One of the purposes of this study was to explore the differences among participants at various levels of reading proficiency in L2 reading (Russian). The results from this study are relevant and contribute to the development of research in establishing benchmarks for eye movements of L2 readers in non-Latin alphabet languages.

First, participants represented proficiency levels from Novice High to Superior. There were 2 Novice High readers of Russian, 14 Intermediate (Low, Mid, High) readers, 13 Advanced (Low, Mid, High) readers, and 5 Superior. Since there were only two participants who received Novice High level score on Russian Reading Proficiency Test by ACTFL, they were combined with the Intermediate-level L2 readers (since Intermediate Low is considered the sealing of Novice High). The results revealed that there was a significant difference between Intermediate-level readers of Russian and Advanced-level readers, but there was not a significant difference in terms of first fixation duration, gaze duration and total time between Superior-level readers of L2 (Russian) and Advanced readers. This effect may be due to the fact that there were not enough participants of the Superior level in Russian, so it is difficult to make an assumption that there were no differences between Advanced and Superior-level readers of Russian.

First Fixation Duration

In terms of first fixation duration (i.e., letter and word decoding), Intermediate- and Superior-level readers read Intermediate-level texts more slowly than they read Advanced or Superior-level texts. It might be because they focused on the task of answering comprehension question afterwards or they were unfamiliar with the topics of the texts. Moreover, the findings
were consistent, revealing that Intermediate readers were slower for all three level of texts, fixations of the Intermediate readers were longer, saccades were shorter, and there were more regressions during the reading process. The results also revealed that Advanced readers read Intermediate-level passages faster than the Advanced passages. Readers spent more time decoding the word by looking at a word for longer periods of time as text difficulty increased. This supports Juhasz and Rayner’s (2006) findings that suggest that first fixation duration is affected by the word frequency, as we presume that the lexicon in more difficult texts are less frequent.

**Gaze Duration**

The results revealed that, in Russian, Intermediate readers were slower than Advanced readers, whereas there was no significant difference between Superior readers and Advanced readers. L2 Intermediate readers were not slower than L2 Advanced readers in English, confirming that participants were proficient in their L1 (English).

Results for gaze duration also indicated that all readers took more time to comprehend words in Russian Intermediate passages than Advanced passages. This may be due to the unfamiliarity with the topic in L2 Intermediate passages for Intermediate-level readers and, in the case of L2 Superior readers, because were reading the text in order to answer a comprehension question. Intermediate-level texts by their very nature lack cohesion; they represent strings of sentences that can be placed in any order. The lack of cohesion in the texts could necessitate longer gaze duration to be certain of comprehension. Indeed, Canale & Swain (1980) assert that cohesion is an essential element for L2 interactive and communicative competence. Early research by Vuchinich (1977) likewise finds that, at least in conversational exchanges, learners are “systematically and measurably sensitive to cohesion” (p. 255) and demonstrated lack of
comprehension in non-cohesive turns. Thus, this finding may be related to a variety of factors, including lack of cohesion, word frequency effects, lexical effects, word length effects, part-of-speech effects, or word predictability effects.

**Total time**

Overall, English was read faster than Russian in terms of first fixation duration, total time, independent of their proficiency level. The faster overall time in the L1 is an expected outcome, seeming to confirm the weaker links account of bilingualism (Gollan et al., 2008). Similar patterns were found by Cop et. al (2015b), who found that bilingual L2 readers had 20% longer sentence reading times, more fixations, shorter saccades and less word skipping.

One interesting result is that Intermediate and Superior-level readers spent more time reading Intermediate-level passages in Russian in terms of total time, whereas Advanced and Superior readers read Advanced passages faster, and Superior passages were read faster by readers of all proficiency levels. This might be happening because Intermediate level passages have less cohesion, or more specific information is provided, which would require a reader to really understand and remember it in order to answer the comprehension question that followed.

In answer to the research questions, it was found that native speakers of English took significantly longer to read in the L2 (Russian) in terms of fixation duration, gaze duration, and total time than in their L1, and Intermediate-level readers reread texts more than Advanced or Superior-level readers of Russian. We also found that L2 readers of Russian at Intermediate level of proficiency were slower across all variables compared to Advanced-level readers of Russian. However, there were no significant differences found between Superior and Advanced-level readers of Russian. In terms of gaze duration only Advanced-level readers of Russian were significantly faster for Intermediate passages. Lastly, in this research it was also found that the
text difficulty affected total time, where the results showed that Intermediate readers were slower on Intermediate passages; on the other hand, there was not enough evidence to reveal whether Superior L2 proficiency resulted in any differences for first fixation duration, gaze duration, or total time for Advanced or Superior passages. It is evident that the total time spent on Superior passage is shorter than time spent on Intermediate-level passage or Advanced suggesting that Intermediate-level readers of Russian gave up reading Russian Superior passages for various reasons, one of which potentially could be that they gave up in the middle of the passage because it was beyond their comprehension, what reflects in the results of the study (see figure 10).

Our research confirms previous research on the development of L1 English literacy, which has found that L1 readers have longer saccades, shorter first fixation durations, fewer regressions, and shorter total time (Gorsuch, & Taguchi, 2010, Rayner et al., 2007; Reichle, Pollatsek, & Rayner, 2012;). Prior research on L2 reading emphasizes the opposite effect overall in terms of first fixation duration, gaze time, regressions, and total time. Parshina et al. (under review) found that lower-proficiency L2 reading was characterized by longer fixation duration, lower possibility of skipping words, and higher likelihood of rereading the sentence. Results revealed that high proficiency HS were closer to monolingual children in their reading abilities, whereas low-proficient HS were more similar to L2 learners. This research focused on L2 learners of Russian and confirmed findings of previous research adding more information about readers of L2 at various proficiency levels (Novice High – Superior).
Chapter 6

Conclusion

Summary

The purpose of this study was to investigate reading behavior of L1 (English) and L2 (Russian) readers and the effect of proficiency level (Intermediate, Advanced, Superior) on their reading performance in the L2 (Russian) in terms of first fixation duration, gaze time, and total time. We used eye tracking technology to analyze natural reading patterns of 32 native English speakers who also speak Russian as their second language. Results revealed that proficiency level did show significant interaction in the performance of L2 readers (Russian) in terms of first fixation durations, gaze duration, and total time. Readers of Russian as L2 read much slower in Russian than in English, which possibly was caused by an alphabetic system that is very distinct from the English-based alphabet. Participants fixated longer on words in general, and lower level readers of Russian had longer gaze duration on the word and longer total time, suggesting that they re-read each text a few times before they were able to comprehend it.

This study is one of the first studies to establish benchmarks in Russian. It demonstrates that there are differences in fluency measures between L1 and L2 reading. This study followed the study of eye movements in Portuguese readers (Grahl, 2019) and took a similar approach. However, Grahl (2019) did not find significant differences between L2 Portuguese readers in terms of first fixation durations, gaze duration, and total time, except that L2 readers of Portuguese read slower in their L2 compared to their L1 (English). In that study, results revealed that readers of various proficiency levels (Intermediate and Advanced levels) read similarly.
Limitations

One limitation of this study could be a lack of participants of lower level (Novice) and higher level (Superior) proficiency. Having a wider sample of participants might lead to discovering more information about the effect of proficiency level in reading performance. Second, the Russian Reading Proficiency Test is still in the process of being validated; thus reported reading proficiency levels in Russian may only partly represent participants’ true proficiency level. Also, it is hard to predict whether or not Superior readers guessed on comprehension questions on the Russian Reading Proficiency Test; therefore, it is hard to say if they really had Superior level reading proficiency in Russian. Another limitation of this study could be potential text difficulty because the chosen texts for the eye tracking part of the study were not analyzed prior to the experiment. We also did not use monolingual speakers as the baseline that was used for previous research of eye movement in reading in Russian (Laurinavichyute et al., 2019; Parshina et al., under review), but the comparison was rather made with L2 speakers of Russian. Topic familiarity also plays an important role, and it was not controlled in this study. According to Paul Nation, 95% of the words need to be familiar in order to comprehend the text, thus some of it could be guessing (Grabe, 2009). We did not look at the comprehension questions, and the answers on comprehension questions were not considered in the results section.

Finally, in this study we did not look at the part-of-speech effect or lexical characteristics of words, such as length and frequency, on eye movements. Parshina et al. (under review) and Laurinavichyute et al. (2019) found that part-of-speech and lexical characteristics play a role in reading comprehension and fluency of HL (heritage learners), monolingual speakers, and L2 learners of Russian; in this study, we did not focus on those characteristics. We also did not
compare L2 readers to monolingual readers of Russian (L1 Russian). All of the above may explain why we could not find a significant difference between Advanced and Superior readers of Russian.

**Future Research**

First, future research could benefit from representing a wider sample of proficiency levels, including more low- and high-level participants to assure a variety of data. Further studies would also be enlightened by even further languages that differ in writing system, grammar structure, and the direction of the text (right to left, top to bottom). Since we did not focus our study on how participants answered comprehension to see how proficiency levels are affected by it, proficiency could predict how fast and accurate they answer questions. In this study, we found that proficiency levels interact with the way they read the passages with a significant difference.
References


http://dx.doi.org/10.1017/S026719051000005X

https://doi.org/10.1080/01690965.2012.760745


Appendix A

Eye Tracking Language Background Questionnaire

ICAMRA: Mapping the Path to Advanced Second Language Literacy in Adults Using Eye-Tracking

You are invited to participate in a research project sponsored by the Interdisciplinary Cohort for the Assessment of Multilingual Reading Ability (ICAMRA). This study investigates characteristics that distinguish L1 readers of English who are also L2 readers of Portuguese as a Foreign Language (PFL) and how those characteristics differ across those languages in various proficiency levels through the use of eye-tracking.

Do you agree to take the background survey to see if you are eligible to participate?

☐ Yes

☐ No

Eye Health
The following questions will ask you about your eye health to see if current eye-tracking technology will work with any conditions you might have.
Please select any that apply.

☐ I have glaucoma

☐ I have cataracts

☐ I have eye implants

☐ I have permanently dilated pupils

☐ I need assistive technology (screen reader, magnifier, etc.) to read a computer screen

☐ I need contacts/glasses to read a computer screen

☐ None apply-I can read a computer screen without glasses or contacts.

Sorry, since you have glaucoma, you are not eligible to participate in this study. We thank you for your time.
Sorry, since you have cataracts, you are not eligible to participate in this study. We thank you for your time.

Sorry, since you have eye implants, you are not eligible to participate in this study. We thank you for your time.

Sorry, since your pupils are permanently dilated, you are not eligible to participate in this study. We thank you for your time.

Sorry, since you need assistive technology to use the computer and the Web, you are not eligible to participate in this study. We thank you for your time.

Are your glasses/contacts__________?

- single lens for reading
- single lens for distance
- no line bifocals
- lined bifocals/trifocals, layered lens, or regression lens

These glasses/contacts will not work with current eye-tracking technology. Do you have a pair of single lens glasses/contacts you can wear for the study?

- Yes
- No

Can you read a computer screen and the Web without difficulty?

- Yes
- No
Sorry, since you can't read a computer screen and the Web without difficulty with your contacts and/or eyeglasses on, you are not eligible to participate in this study. We thank you for your time.

How old are you?

▼ 17 or younger (1) ... 60 or older (44)

Sorry, since you are not at least 18 years old, you are not eligible to participate in this study. We thank you for your time.

What is your given name?

________________________________________________________________

What is your surname?

________________________________________________________________

How many years of formal education do you have?

☐ Less than High School

☐ High school graduate

☐ Some college

☐ 2 year degree

☐ 4 year degree

☐ Professional degree

☐ Doctorate
Choose one of the following:

- Male
- Female
- Prefer not to answer

In which country were you born?

▼ Please select below... (1) ... Other (195)

Please indicate when you'd be available for the next step of the study.

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</tbody>
</table>
How can we contact you to set up an appointment? (Select all that apply)

☐ Email _______________________________________

☐ Text Message/Phone Call _________________________

☐ Other _________________________________________

The following questions will ask you about the languages you speak.

----------------------------------------------------------------------------------------------------------------------------------
What language(s) do you speak or read?
Select all the languages speak natively or non-natively and/or have studied either formally or informally to any degree.

☐ English
☐ ASL
☐ Arabic
☐ Chinese (Mandarin)
☐ Chinese (Cantonese)
☐ Dutch
☐ Finnish
☐ French
☐ German
☐ Haitian Creole
☐ Hindi
☐ Italian
☐ Japanese
☐ Korean
☐ Norwegian
☐ Persian
☐ Polish
☐ Portuguese
☐ Russian
Please rank the languages you know in order of dominance (1= Most Dominant/Strongest):
Drag and Drop.

<table>
<thead>
<tr>
<th>Dominance</th>
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</thead>
<tbody>
<tr>
<td>_____ English</td>
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<tr>
<td>_____ ASL</td>
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<tr>
<td>_____ Arabic</td>
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<td>_____ Chinese (Mandarin)</td>
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<td>_____ Chinese (Cantonese)</td>
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<td>Tagalog</td>
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<td>Urdu</td>
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<tr>
<td>Vietnamese</td>
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<tr>
<td>Other:</td>
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</tbody>
</table>
How old were you when you started to learn the language?

<table>
<thead>
<tr>
<th>Language</th>
<th>0 (1) ... 25 or older</th>
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</thead>
<tbody>
<tr>
<td>English</td>
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<tr>
<td>ASL</td>
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<tr>
<td>Arabic</td>
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<tr>
<td>Chinese (Mandarin)</td>
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<tr>
<td>Chinese (Cantonese)</td>
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<tr>
<td>Dutch</td>
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<td>Finnish</td>
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<td>French</td>
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<td>German</td>
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<td>Haitian Creole</td>
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<td>Hindi</td>
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<td>Persian</td>
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<td>Urdu</td>
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<tr>
<td>Vietnamese</td>
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<tr>
<td>Other:</td>
<td>▼</td>
</tr>
</tbody>
</table>
What do you consider to be your native language(s)?

- English
- ASL
- Arabic
- Chinese (Mandarin)
- Chinese (Cantonese)
- Dutch
- Finnish
- French
- German
- Haitian Creole
- Hindi
- Italian
- Japanese
- Korean
- Norwegian
- Persian
- Polish
- Portuguese
- Russian
The following question(s) will gather more information about how you learned ________.

How did you learn ________? Check all that apply.

☐ Informally (native language, from family, living abroad, friends, independent study, etc.)
☐ School
☐ Mission
☐ Study Abroad
☐ Other, please specify how and for how long:

Informal Language Learning

Please list the years and months you spent in each INFORMAL ________ language environment.

<table>
<thead>
<tr>
<th>Language</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
A family/home in which __________ is spoken.

A country where __________ is spoken.

A work environment in which __________ is spoken.

With friends who spoke __________

Through the independent study of __________

Other, specify:

▼ 0 to 6 months (1 ... 11 or more

▼ 0 to 6 months (1 ... 11 or more

▼ 0 to 6 months (1 ... 11 or more

▼ 0 to 6 months (1 ... 11 or more

▼ 0 to 6 months (1 ... 11 or more

Please provide any other comments on how you learned __________ if the previous questions did not cover it:

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

__________________________________________________________________________

School (formal education, language classes, etc.):

Please list the years and months you spent in each __________ language learning environment.

<table>
<thead>
<tr>
<th>Years</th>
<th>Months</th>
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</thead>
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<tr>
<td>Level</td>
<td>Min - Max</td>
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<td>------------------------</td>
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</tr>
<tr>
<td>Elementary school</td>
<td>▼ 0 (1 ... 6 or more</td>
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<tr>
<td>Middle School/Junior High</td>
<td>▼ 0 (1 ... 6 or more</td>
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<tr>
<td>Highschool</td>
<td>▼ 0 (1 ... 6 or more</td>
</tr>
<tr>
<td>Undergraduate</td>
<td>▼ 0 (1 ... 6 or more</td>
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<tr>
<td>Graduate</td>
<td>▼ 0 (1 ... 6 or more</td>
</tr>
<tr>
<td>Postgraduate</td>
<td>▼ 0 (1 ... 6 or more</td>
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<tr>
<td>Other, specify:</td>
<td>▼ 0 (1 ... 6 or more</td>
</tr>
<tr>
<td>Other, specify:</td>
<td>▼ 0 (1 ... 6 or more</td>
</tr>
</tbody>
</table>

Please provide comments on your study of [__________] in schools (if any).

________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
________________________________________________________________
Mission information:

Where did you serve your ______-speaking mission?

__________________________________________________________________________________

How many months did you speak ________ on your mission?

0 2 5 7 10 12 14 17 19 22 24

Months ()

__________________________________________________________________________________

Please provide comments on your mission in ________ (if any).

__________________________________________________________________________________

Study abroad

Which country did you go to study ________?

__________________________________________________________________________________

How long did you stay in the country where you studied ________

- Term (Spring/Summer)
- Semester (Fall/Winter)
- Other ____________________________________________

Please provide comments on your study abroad in ________ (if any).

__________________________________________________________________________________
What is your level of speaking proficiency in _________

- 10 — I can interact and negotiate to resolve abstract and complex matters on a wide variety of topics in a variety of situations with NO PATTERN of linguistic errors.
- 9
- 8 — I can hold complex conversations and tell detailed stories in the past, present and future time frames accurately with both my pronunciation and grammar.
- 7
- 6
- 5 — I can hold simple conversations through asking and answering questions related to my daily life.
- 4
- 3
- 2 — I can produce memorized words & phrases and formulaic utterances about personal topics.
- 1 — Very Little
What is your level of reading proficiency in __________?

- **10** — I can follow the flow of ideas and infer meaning from unfamiliar, abstract topics in complex language in informational texts.

- **9**

- **8** — I can identify the underlying message and MOST supporting details across major time frames in texts.

- **7**

- **6**

- **5** — I can understand the main idea and key information short straightforward texts.

- **4**

- **3**

- **2** — I can recognize letters and understand lists of words & phrases by general topic.

- **1** — Very Little
Appendix B

Russian Reading Passages

1) Правила безопасности по использованию водной горки: Всегда спускайтесь ногами вперёд после того, как предыдущий человек полностью спустился. Запрещено играть в бассейне у водной горки. Запрещено прыгать или нырять с водной горки. На водную горку допускается только один человек. Запрещено пользоваться игрушками на водной горке.

2) Внимание! Нам нужны добровольцы! Нам нужны 4 добровольца, чтобы помочь нашим сотрудникам на информационной стойке на ярмарке и в выставочном центре. Доступные смены: суббота, 19 марта, с 8:00 до 12:00 и воскресенье, 20 марта, с 12:00 до 16:00. Волонтеры должны достигнуть, как минимум 18 лет. Волонтерам нужно будет заплатить за парковку.

3) Осторожно! ЯД Опасная зона! Вход в рабочую зону без разрешения запрещен. Использование респиратора и защитной одежды обязательно. Еда, питьё или курение в этой области запрещены.

4) Уважаемая Екатерина Камнева, Мы хотим подтвердить вашу встречу с нашим менеджером. Барбарой Стокетт 14 апреля в 10:00 в главном офисе нашей компании для консультации. Если вы не можете присутствовать на этой встрече, пожалуйста, сообщите нам, чтобы мы могли перенести встречу. С уважением, Барбара Стокетт.

Консалтинг социальных агентов.

5) Идеальное место для репетиций! Отличная музыкальная репетиционная комната с ежемесячными окнами для аренды, большим количеством места для хранения и отличной творческой энергией. Чтобы полностью оценить комнату, её нужно увидеть вживую. Всё ещё доступно время, если вы хотите прийти посмотреть (отправьте электронное письмо для получения информации о ценах и наличии). + Круглосуточный доступ семь дней в неделю + 2 лифта + ванная комната +
парковка + 2 охранных замка + система видеонаблюдения. Место для репетиций расположено недалеко от линии метро Таймс-сквер, администрации порта и вокзала Пенн. Свяжитесь с нами для получения дополнительной информации или для посещения студии.

6) Первоклассные уроки рока: начинающие приветствуются (Ист-Виллидж) Я – профессиональный гитарист и преподаватель с 8-летним опытом. Я специализируюсь на техниках рока, блюза, фьюжна, неоклассики, джаза и т.д … Электрическая или акустическая гитара. Все уровни приветствуются. Мои занятия для тех, кто хочет: Изучить основы Слушать песни ваших любимых групп. Стать профессиональным гитаристом.

7) Открытие выставочного зала! Приходите и найдите идеи для своей кухни и ванной! Шкафы стандартных или нестандартных размеров. Все породы деревьев, цветов и размеров. Бесплатные замеры и бюджет. Сантехника, краны, раковины, ванные, туалеты и душевые двери на заказ. Столешницы, керамическая плитка и деревянные полы на заказ. Приходите и посетите наш новый выставочный зал! С понедельника по пятницу с 7:00 до 17:00. Суббота с 7:30 до 13:00.

8) Ваш ребенок в средней школе и любит науку? Государственный университет рад предложить летнюю программу Академии наук для будущих 6 и 8 классов, продолжительностью 5 дней. Присоединяйтесь сейчас! С понедельника по четверг 8:30-14:30: занятия Пятница 14:30-16:00: финальные презентации!

10) Разыскивается немецкая овчарка / смесь с хаски. Моя собака сбежала из моего двора, и я не могу его найти. Он смесь немецкой овчарки и хаски. Он чёрно-белого окраса. Собака среднего размера и его зовут Макс. Если вы его найдете, свяжитесь со мной по телефону 888-888-8888. Спасибо!

11) Мы ищем дом для аренды или покупки. Должно быть 4 спальни или более и гараж. Желательно в Лейтоне или округе Дэвис, с отличной историей аренды. Готовы переехать прямо сейчас. У нас уже есть деньги для депозита и арендной платы за первый месяц. Хороший ежемесячный доход. Пожалуйста, свяжитесь с Пэтти по телефону 888-777-6666. Владелец продает свой дом.

12) Приходите и посмотрите на прекрасные леса парка Ледников, высокие Альпы, скалистые горы и живописные озера. Ледник, протянувшийся на тысячу миль дорог, является райским местом для любителей приключений, ищущих уединения и пустыни. Насладжайтесь историческими сельскими домиками, гостиницами, транспортом и историями о коренных индейцах. Исследуйте Национальный парк Ледников и узнайте, что вас ждет.

13) Атака на причины плесени. 1. Основная причина плесени - влажность. Плесень является проблемой влаги. Если вы убрали плесень, но не решили проблему влаги, вы сохранили условия для возврата плесени. Чистите и сушите влажные участки в течении 24 часов, чтобы избежать появления плесени. 2. Обратитесь к профессионалам, если плесень распространялась на площади более 3 кв. м. Если вы имеете дело с серьезной плесенью – более 3 квадратных метром – лучше вызвать профессионалов для ее удаления и очистки. Профессионалы используют высокоэффективные моющие средства и имеют надлежащую защиту против вдыхания спор плесени. 3. Удалите абсорбирующие или пористые материалы. Впитывающие или пористые материалы, такие как гипсокартон или потолочная плитка, возможно должны быть выброшены, если плесень является достаточно серьезной проблемой. Плесень может заполнить крошечные трещины и поры этих материалов, и может оказаться трудно полностью удалить плесень. Очистка в
данном случае будет только временно подавлять рост плесени; если вы не уберете эти поверхности из вашего дома полностью, плесень будет продолжать возвращаться. 4. Не закрашивайте заплесневелую поверхность. Это лечение «пластырем» совсем не эффективно. На поверхностях, таких как стены или плитка, которые были окрашены по плесени, краска не ляжет очень хорошо; краска просто отстанет, потому что не было чистой поверхности. 5. Носите соответствующую защиту при чистке. Поскольку плесень содержит споры, которые находятся в воздухе очень важно применять надлежащую защиту при очистке заплесневелых поверхностей. В большинстве случаев плесень безвредна, но существует много различных видов плесени, некоторые из которых могут представлять опасность для здоровья.

14) «Как обвязать подвернутую лодыжку Способ 1: подготовка к обвязке голеностопного сустава 1. Выберите повязку. Для большинства людей лучший выбор компрессионной повязки – это эластичная ткань. • Подойдет повязка любой марки. Однако более широкие обычно проще в использовании. • Эластичные тканевые повязки удобны из-за своего материала. Кроме того, их также можно использовать многократно. 2. Подготовьте повязку. Если эластичная повязка еще не скручена, плотно скатайте ее. • Компрессионные ленты должны быть хорошо обмотаны вокруг стопы и голеностопного сустава, поэтому может быть полезно, если повязка плотно скручена в начале процесса, уменьшая необходимость растягивать ее и заново регулировать во время движения. 3. Начните перевязывать лодыжку, разместив бинт с внутренней стороны стопы. Если вы перевязываете лодыжку кому-то, удобнее всего начать бинтовать с наружной стороны стопы. • Важно, чтобы бинт оставался с внешней стороны стопы, когда вы обвязываете её, чтобы избежать прокручивания бинта. • Например, если мы сравним свернутый бинт с рулоном туалетной бумаги, а ногу со стеной, тогда свернутый бинт должен обращён лентой от себя 4. При необходимости увеличьте фиксацию. Для дополнительной поддержки вы можете поместить бинт по обе стороны от лодыжки, прежде чем перевязать ее. Также можно использовать подушечки в
форме подковы и пеноматериалы или фетровые материи для придания большей стабильности при перевязке.

15) Как поджарить миндаль. Метод 2. 1. Разогрейте сотейник на среднем-умеренном огне. Лучше всего использовать кастрюлю с тяжелым дном, не смазывая ее жиrom. Хотя для большего аромата можно использовать и немного сливочного масла. 2. Высыпьте миндаль в кастрюлю. Когда кастрюля разогреется, разложите в ней миндаль ровным слоем. - Размешивайте или встряхивайте содержимое кастрюли очень часто (каждые 30 секунд), чтобы орехи не подгорели. - Несмотря на то, что это быстрый способ приготовления, однако, миндаль имеет свойство не дожариваться, поэтому важно все время перемешивать его. 3. Извлеките из сотейника, когда миндаль поджарится. Жарка миндаля на плите занимает 3-5 минут. - Поджаренный миндаль достаньте из кастрюли до того, как появится запах жареных орехов, а края миндаля начнут подрумяниваться. - Для охлаждения сразу же переложите миндаль на блюдо.

16) Как ездить верхом. 1. Научитесь управлять при помощи вожжей. В западном стиле управление лошадью немного отличается от английского. При езде по-западному используется особая техника, называемая “обузданием шеи”. - При этом вожжи держатся довольно свободно, и сигналы подаются путем легких прикосновений к шее животного. Большинство сигналов при езде по-западному подается именно таким способом. - Чтобы повернуть направо, сдвиньте вожжи на шее лошади в правую сторону. И наоборот, для поворота налево сдвиньте вожжи влево. - Всегда держите вожжи в левой руке. Правую руку можете положить на переднюю луку седла. - Как и в английском стиле, при управлении следует использовать все тело. Кроме рук, подключайте к управлению ноги и кости таза. 2. При необходимости направляйте лошадь вожжами. Если возникла потребность быстро изменить направление, рекомендуется немедленно перейти к английскому стилю. Если животное не реагирует на мягкие сигналы в западном стиле, возьмите вожжи обеими руками. Мягко потяните на себя или подберите левую вожжу, чтобы повернуть налево, и правую для поворота направо. 3. Пустите лошадь
шагом. Начните с неспешного шага. В западном стиле для начала движения также слегка сжимают бока лошади или подталкивают их пятками. Как и в английском стиле, ваши руки должны следовать за движениями головы коня, но поскольку в западном стиле вожжи держатся свободнее, достаточно менее интенсивных движений рук, чем при езде по-английски. 4. Пустите лошадь трусцой. Слегка сожмите бока идущего животного, переводя его в легкую рысь, называемую в западном стиле трусцой. Средняя и быстрая рысь не характерна для западного стиля. - Трусца — это медленный, равномерный аллюр. Она немного быстрее шага, но медленнее рыси в английском стиле. - При легкой рыси в западном стиле держаться в седле не составляет труда. При этом приподниматься в седле не обязательно.

17) Два года назад в России приняли закон о запрете игорных заведений по всей стране. Этим российское правительство пытается уменьшить оборот «грязных денег», уничтожить центры криминальной деятельности и спасти «игроманов» от разорения. Конечно, казино не запретили совсем. Согласно закону, для азартных игр в России выделено четыре зоны: в Калининградской области, Алтайском и Приморском краях, а также на границе Ростовской области и Краснодарского края. Спустя год в «Азов-Сити» появилось первое в России легальное казино. Также в «Азов-Сити» планируется построить отели и рестораны, вокзал и аэропорт, спортивные и курортные корпуса, а также милицийский участок. Дело-то в том, что правительство разрешило строительствоказино только в менее людных частях России, рассчитывая, что у людей не будет ни желания, ни возможности туда ездить, а инвесторы не захотят вкладывать огромные суммы в такие сомнительные проекты, поскольку для функционирования казино требуется построить целый город. Казалось, правительство всем угодило — в азартные игры в Москве никто не играет, и места под казино нашли для желающих поиграть. Да и строительство в зонах не движется: "Азов-сити" единственное место, где имеются игорные заведения. Остальные российские "Лас-Вегасы" только проектируются. Кажется, страсти по азартным играм поутихли, но так ли это в действительности? С момента принятия запрета на азартные игры, было проверено 40 тысяч объектов.
Правоохранительные органы пресекли деятельность тысяч незаконных игорных заведений. Хоть игорные заведения и запретили, они перешли в подполье. А это хуже, потому что игры превратились по-настоящему в "азартные". Ставки в подпольном казино выше: ведь на кону не только деньги, но и имя, статус и даже срок в тюрьме. Очевидно, что правительство никого не уберегло – люди разоряются, криминальные центры стали криминальнее, а имеющие "грязные" деньги могут их отмывать в "Азов-сити". Вопрос о легальности азартных игр не решен –наоборот, теперь он становится остree.
Appendix C

English Reading Passages

1) We need volunteer walkers!
   Our Sunset Park Shelter is in need of people who will walk and exercise our dogs. Come by and meet our lovable pups! You’ll be guaranteed lots of kisses. All dogs have been vaccinated.
   Contact us at 555-845-6325.

2) Ross School Election Day Bake Sale
   Tuesday, March 1st 8 a.m. – 7 p.m.
   We need donations!
   Baked goods: cakes, pies, breads, cupcakes, pastries, cookies.
   Individually wrapped please!
   Items can be dropped off on Monday all day or call us to arrange a drop off or pick up.
   As always, thank you for supporting Ross School!
   Rita Stones 555-825-2147.

3) Daniel, your appointment has been confirmed.
   Please review the details of your appointment and contact us if you need assistance.
   You are scheduled for your annual physical exam with Dr. Stephen Holmes. Remember to bring a form of payment and/or your proof of insurance.
   May 26 at 2:00 p.m.
   1100 Montimar
   Mobile, Al 2345
   Phone: 555-896-1287

4) Just a reminder that your appointment is scheduled for Monday, May 26 at 2:00 p.m.
   Please confirm your meeting by clicking the button below. If you are unable to make this appointment, please call us to reschedule. Please come prepared with your form of payment or insurance card.
Thanks!

5) Become a School Crossing Guard!
   Help Your Community While Earning Pay and Benefits!
   School Crossing Guards help their children safely cross busy intersections on their way to and from school. They control traffic flow around schools in the morning, at lunch time, and at the end of the school day.
   PART TIME JOBS ARE AVAILABLE NOW!
   PAY - $9.88/HOUR TO START, $12.90/HOUR AFTER 3 YEARS.

6) Monday Arts & Crafts
   Come and join in the fun of making simple Arts & Crafts each Monday afternoon. Paper crafts, beading, clay modeling, cartooning and more! Stimulate your creativity, explore new techniques, and help develop your fine motor skills. All ages welcome.
   June 6 – August 31, 4:30pm
   Brookfield Branch Library

7) The South End Community Health Center is seeking volunteers for their upcoming fundraising event being held Thursday, April 21, from 6-8 p.m. at the Central Square House. Volunteers are needed for two-hour time slots to assist with various activities. Please contact the manager if interested.

8) Stuck inside the snow? Bake a delicious chocolate treat for the Valentine’s Day Bake-off on Friday, February 12! Entries are judged and prizes awarded. Send your name, email, and what you are cooking to our manager, and she will send you the details.

9) Want to spread Thanksgiving cheer? The Student Council is looking for 10 volunteers to help the Salvation Army give out hundreds of turkeys and food items to Boston area families. Share the holiday spirit by donating an afternoon to your community!
   When: Saturday, November 21, 10:30 am – 3:30 pm.
   Where: The Salvation Army Community Center.
10) I lost my wedding ring in Laughlin, Nevada on May 22. It’s white gold, and it has 3 diamonds. The diamond in the middle is a princess cut and a little bit bigger than the other two diamonds. It’s a size 5 and a half. If you find it, please call me at 801-777-8888. Thank you.

11) Whitney Piano, super condition, fantastic price. It was purchased for my elderly mother who used to be a concert pianist, but she no longer needs it. Plays well, could use fine tuning. One wobbly front leg, does not affect piano. Buyer must pick up at Abby Manor, 222 Center St., Central City.
CALL 1st FOR APPOINTMENT: Keith at 555-444-7777.

12) This Apple Watch comes with the white silicone band and another band in the smaller size. I only used it for a few days, but I like my old watch best, and now I need money ASAP. 1st come 1st served! I’ll drive to you. Price is negotiable, but please be realistic. This retails for over $550, so it’s already a steal. Please message me with questions. Thanks!

13) How to Meet a Celebrity
Method 1: Locating the Celebrity From Afar
1. Read tabloid magazines and websites. Gossip magazines and blogs regularly post paparazzi photos of celebrities out and about. Look in the background of the photo. If there is a hotel, it's likely that is where they are staying while they're in town. If it's a specific coffee shop or store, that might be a regular hang-out of theirs.
   • Set a Google alert for your favorite celebrity's name. News articles will appear, but so will information about their whereabouts, based on recent paparazzi photos and fan updates.
   • Celebrity sighting is a popular hobby. Many people maintain blogs they update regularly with information.
2. Follow Twitter. Many celebrities tweet regularly throughout their day. Following their twitter feed may lead to information on where they regularly go to the gym, go for dinner, or shop. Visiting these places will increase your chances of meeting them.

  • Many fans post sightings of celebrities on their twitter feed. Setting an alert to the celebrity's handle may inundate your feed, but could let you know if someone is in your immediate area.

3. Follow Instagram. Uploaded photos from celebrities may produce clues as to where they spend their time. Look in the background of the photo for street signs, shop names, and other identifying characteristics of their location.

  • Most celebrity Facebook accounts are run by their publicist, and not updated with information regarding their day-to-day life, but you may find information from comments left by fans.

4. Search through online databases. Many websites exist that provide information on when and where celebrities will be coming for film and television filmings, book signings, public appearances, and speaking arrangements.

14) How to Clean the Oven

Method 2: Cleaning a Non-Self-Cleaning Oven

1. Remove the oven racks. Place them in a sink full of warm water mixed with a few drops of dishwashing liquid to soak.

2. Make a cleaning solution. Load a 1-liter spray bottle with 4 tablespoons of baking soda and fill the rest with water. Shake the spray bottle to moisten and dissolve the baking soda.

3. Spray down the oven. Spray the interior of a cold oven, focusing on the charred and stained areas, until the carbon is completely saturated.

  • For particularly dirty ovens, increase the ratio of baking powder to water so that you have more of a paste than a liquid. Spread the paste all over the charred areas.

4. Allow the solution or paste to soak in for at least an hour. After an hour, test to area to see if the charred part has loosened.

  • If it's still hard as a rock, douse it again with baking soda solution and allow it to sit for another hour.
• If it's loose enough to chip off, proceed to the next step.
5. Use a scraper to remove the loosened carbon. The type of scraper you would use to chip ice and snow off your windshield works well. Keep scraping until most of the carbon is gone.
• Wear rubber gloves if you don't want your hands to get black from the soot.
• Spray the area with more baking soda solution as you go to make the loosening process easier.
• Sweep out the debris you chipped off. Use a small brush and dustpan.
6. Spray the oven interior with the baking soda solution again. Allow it to soak in for an additional hour, then use a scrubber to remove the remaining carbon.
7. Wipe down the oven once more with a solution of half vinegar, half water. At this point the interior of your oven should be clean. If caked-on carbon remains, try the following alternative methods:
• Use an industrial-strength oven cleaner. These contain chemicals that may be harmful to breathe, so use with caution. They typically instruct you to let the solution soak into the charred sections and then scrub out the oven.
• Use ammonia. Pour it on the caked-on areas and let it sit for thirty minutes before scrubbing it off with a scrubber and then wiping with a damp sponge.
8. Clean the oven racks. Scrub the oven racks in the soapy water. Rinse them off and dry them, then replace them in the oven.

15) How to Get Rid of Acne Cysts Fast
Method 2: Developing a Daily Skincare Routine
1. Wash your face twice a day with benzoyl peroxide cleanser. Benzoyl peroxide helps fight acne by reducing oil and bacteria. Wash your face in the morning and evening by dampening your face and applying the cleanser. Rinse off thoroughly and pat your face dry with a clean towel.
• If you wear makeup, be sure to remove it completely before washing your face. Use makeup removing wipes or solution to help remove all of your makeup.
• You can buy cleansers containing benzoyl peroxide at grocery stores, beauty stores, and pharmacies.
2. Apply a toner with salicylic acid after you wash your face. Your toner will help remove any last particles of dirt while fighting the acne. Dampen a cotton pad with the toner and gently wipe across your face to apply the toner.

- Salicylic acid can help unplug pores and may prevent clogged hair follicles.
- If you’re pregnant, you might try products that contain azelaic acid instead. These may be safer for pregnant women, though salicylic acid is unlikely to be a risk.

3. Apply a spot treatment with benzoyl peroxide. Once your face is clean, dab some benzoyl peroxide cream or gel onto your acne. This can help reduce the acne more quickly. You can get spot treatments from your dermatologist or over the counter at pharmacies and grocery stores.

4. Moisturize after each wash with a non-comedogenic moisturizer. Your skin needs moisture after you strip it of oil and water. Use non-comedogenic moisturizers that won't block your pores. These should be marked as “non-comedogenic” on the label.

- Common ingredients in non-comedogenic moisturizers include hyaluronic acid, glycerin, and aloe vera.

5. Avoid touching or picking your acne. As hard as it is, try not to touch your face or feel your pimples. Cystic acne can get inflamed when touched, producing more redness and irritation. It may also increase scarring.

- Try sitting on your hands if you feel the urge to touch your face. Distract yourself by chewing gum, taking a walk, or squeezing a stress ball.
- Cystic acne is much harder to pop than normal acne, and doing so will possibly make it worse. Trying to pop cystic acne will also be more painful and more likely to leave a scar.

16) How to Make Curly Fries

Method 2: Using a Deep Fryer

1. Wash and rinse your cut fries in advance. Allowing them to completely air dry will keep the oil from sputtering if you choose to deep fry them. Water can be very dangerous when introduced into oil so the less water you add to the frying oil, the better.

2. Blanch the fries in oil. Blanching is a technique that uses lower-temperature oil for a long duration during frying. This ensures that the potato will be cooked all the way
through. To blanch, heat the oil on a medium-low setting. Add your fries and cook for approximately eight minutes. When the fries make a “screaming” noise, they are ready to come out. The screeching is the sound of air whistling out of the inside as they cook. The fries shouldn’t be browned, but will be edible. Upon removing, allow the fries to drain on a paper towel to remove excess oil.

- When deep frying, use a deep pot or wok with a thick bottom. Fill it halfway with vegetable oil and allow to heat completely before using.
- Frying can be made much easier with the use of a frying thermometer. This will allow you to control the temperature more accurately. When blanching, ideal oil temperature should be 250 degrees Fahrenheit.

3. Allow the fries to rest. Give the fries time to cool before frying a second time. For a quick turnaround, put them on a pan in a single layer inside the freezer. Otherwise, allow them to rest in the fridge overnight in a paper-towel lined sheet.
- No matter the method, allow the fries to come back to room temperature before the second frying. This allows even cooking.

4. Quick-fry the blanched fries. Heat the oil to 325-350 degrees Fahrenheit. Add the blanched fries to the oil in small batches to prevent overcrowding. Cook for three to five minutes or until the fries are golden brown in color. Remove and pat excess oil off using paper towel. Serve immediately.
- Season with kosher salt, garlic salt, or seasoning salt.

17) At different times in our history, different cities have been the focal point of a radiating American spirit. In the late eighteenth century, for example, Boston was the center of a political radicalism that ignited a shot heard round the world — a shot that could not have been fired any other place but the suburbs of Boston. At its report, all Americans, including Virginians, became Bostonians at heart.

In the mid-nineteenth century, New York became the symbol of the idea of a melting-pot America — or at least a non-English one — as the wretched refuse from all over the world disembarked at Ellis Island and spread over the land their strange languages and even stranger ways. In the early twentieth century, Chicago, the city of big shoulders and heavy winds, came to symbolize the industrial energy and dynamism of
America. If there is a statue of a hog butcher somewhere in Chicago, then it stands as a reminder of the time when America was railroads, cattle, steel mills and entrepreneurial adventures. If there is no such statue, there ought to be, just as there is a statue of a Minute Man to recall the Age of Boston, as the Statue of Liberty recalls the Age of New York.

Today, we must look to the city of Las Vegas, Nevada, as a metaphor of our national character and aspiration, its symbol a thirty-foot-high cardboard picture of a slot machine and a chorus girl. For Las Vegas is a city entirely devoted to the idea of entertainment, and as such proclaims the spirit of a culture in which all public discourse increasingly takes the form of entertainment. Our politics, religion, news, athletics, education and commerce have been transformed into congenial adjuncts of show business, largely without protest or even much popular notice. The result is that we are a people on the verge of amusing ourselves to death.