Influence of L1 Norwegian and L2 English on Vowel Reduction and Stress Position in Loanwords in L3 Russian

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Abstract

This study focused on the phonological features of the pronunciation of loanwords from English by Norwegian speakers (L1) when learning Russian as a third language (L3). The main goal was to determine the influence of L1 Norwegian and L2 English on the processes of vowel reduction and stress placement in loanwords in L3 Russian. For this purpose, a list of words was compiled, including target (loanwords) and control words corresponding to these target words. Nine Norwegian speakers were audio recorded when they were reading the carrier phrases that included target and control words, and the audio files were annotated and analyzed. The results of the analysis showed that the reduction was influenced by whether the word was target or control since, according to the statistics, vowels were reduced more often in target words. The study confirmed that matching stress in L1 or L2 with stress in Russian promotes accurate pronunciation, especially in high-frequency words. The findings expand our understanding of the dynamics of language acquisition and highlight the importance of the relationship between the first (native) and second languages in the acquisition of a third.

Sammendrag

Denne studien satte søkelys på de fonologiske trekkene ved uttalen av engelske lånord i russisk av norsktalende (L1) når de lærer russisk som tredjespråk (L3). Hovedmålet var å bestemme innflytelsen av L1 norsk og L2 engelsk på prosessene vokalreduksjon og stressplassering i lånord i L3 russisk. Til dette formålet ble det utarbeidet en liste av ord, inkludert målord (låneord) og kontrollord som tilsvarer målordene. Det ble gjort lydopptak av ni norsktalende mens de leste frasene som inkluderte mål- og kontrollordene, og lydfilene ble kommentert og analysert. Resultatene av analysen viste at reduksjonen var påvirket av om ordet var mål- eller kontrollord siden vokaler, ifølge statistikken, ble redusert oftere i mållord enn i kontrollord. Studien bekreftet at å matche stress i L1 eller L2 med stress på russisk fremmer nøyaktig uttale, spesielt i høyfrekvente ord. Funnene utvider vår forståelse av dynamikken i språktilegnelse og fremhever viktigheten av forholdet mellom første- (morsmål) og andrespråk i tilegnelsen av et tredjespråk.

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1. Introduction

Loanwords are an integral part of any language, and the Russian language is no exception to it. New words of different origins were coming into the language depending on the time period. The 13th-16th centuries are characterized by the massive arrival of borrowings from the German language, or Middle Low German (Thomas, 1978). The French language's influence on Russian vocabulary has also been notably substantial. The initial wave of French borrowings seeped into the language during the Petrine era (1682-1725). This trend continued through the late 18th to early 19th century. The fascination with French culture among the upper society class led to the extreme popularity of incorporating French words into Russian (Mikheeva & Petrova, 2020). However, due to the fact that English has become a lingua franca and enabled global communication, the modern Russian language is saturated with English words. One category of these words joined the ranks of the old ones adding new concepts to the language (*попкорн* [pɐpˈkorn] 'popcorn'), another one has replaced the old Russian words partially or completely (*кардиган* [kərdʲɪˈgan]← *жакет* [ʒɐˈkɛt] 'cardigan'), and the third category is going along with the Russian words becoming just one of the variations of the concept with the same meaning, or synonyms (*бойфренд* [bojˈfrɛnt] = *парень* [ˈparʲɪnʲ] 'boyfriend').

Even though the borrowings come to the language from English, it does not mean that it borrows every aspect from the original language. It is undergoing some changes to conform to the properties of Russian grammar and phonology. When it comes to pronunciation, some sounds are pronounced differently compared to English for many reasons. One of the reasons is a widespread phenomenon in Russian as a stress-timed language (a language in which stressed syllables are spoken at approximately equal intervals and unstressed syllables are

shortened to match this rhythm) called vowel reduction, which is “a process that neutralizes phonological contrasts between vowels in unstressed syllables” (Jaworski, 2010, p.51).

Another reason is a stress position, as the stress could also differ from the original English word (English *deadline* [ˈdɛdˌlaɪn] – Russian *дедлайн* [dɛˈdlaɪ̯n]). Both Russian and English have variable stress and it is not always clear why stress placement in certain loanwords differs from that of the source language. “The English system does occasionally and fortuitously predict correct Russian stress; however, this may have the unintentional effect of reinforcing the use of English parameters while speaking Russian. On the other hand, moving from Russian to English appears to be less complex since the Russian system accommodates the facts of the English” (Hart, 1998, p.269).

Borrowings from other languages are an important part of linguistic evolution, and the Russian language does not remain outside of this process. As we can see, it actively interacts with various languages at different historical stages. From the time borrowings from German and French entered the language in different periods to the modern influence of English, the Russian language demonstrates its ability to adapt and perceive new lexical elements. This process, on the one hand, testifies to globalization and cultural enrichment, and on the other, emphasizes the importance of preserving and developing linguistic identity. Thus, language borrowings not only enrich the vocabulary but also serve as a mirror of sociocultural transformations, making language a living and relevant tool of communication in the modern world.

At the same time, it is important to understand that when Anglicisms are introduced into the Russian language, changes occur in both pronunciation and stress. These adaptations are due to differences in grammar and phonology between languages, as well as features of the language system. Studying these changes allows us to better understand how language contacts shape lexical and phonetic changes in the Russian language.

It is important to understand that language changes under the influence of external factors. This makes it alive and dynamic, and studying the processes of borrowing and adapting words from other languages helps us better understand its evolution and development.

1.1. Research Questions and Hypotheses

It is always a challenging process to acquire a foreign language at any age, especially in terms of accurate pronunciation of the sounds of that language. People try to compare the phonetic and phonological features of the language being studied with their native language in the early stages of learning, and most of the time they encounter difficulties in correctly pronouncing certain sounds due to many reasons (phonological and articulatory differences, phonotactics, prosodic features, muscle memory, auditory perception, etc.). That, in turn, can form specific phonological cues, which could relate to individual speech sounds (segmental) or include broader speech attributes (suprasegmental), that may reveal the person as a non-native speaker of the language. Therefore, some phonological features of the native language may transfer into the second or the third language, where the pronunciation may not reach the target.

The overall purpose of this study is to define what phonological difficulties non-native speakers go through while learning Russian as L1 Norwegian speakers. However, the more specific aim is to see how the loanwords that were borrowed to L1 (Norwegian) from the English language influence the pronunciation of the same words, in L3 (Russian) – that is, whether familiarity with a loanword/cognate influences its pronunciation in a second language. Moreover, it is interesting to observe whether approximate knowledge of words that are similar in the native language helps to pronounce these words correctly compared to words that are completely different from the first language, or whether this familiarity has no effect. One of the examples of the negative interference study is the research done by Burakova &

Permyakova (2021). They studied the errors and deviations in the pronunciation of L1 Russian speakers whose L2 is English, and they studied Japanese as L3. The task was to read a text in Japanese that contained loanwords from English. With regard to stress, the Russian and Japanese systems are different, as in standard literary Russian pronunciation, the sound [o] in unstressed syllables is usually absent, and the sound [a] is often used instead. However, due to the distinctive stress pattern of the Japanese language, its vowels do not have an unstressed position, and therefore the open sounds [a], [e], and [o] must be clearly pronounced without changes in their acoustic characteristics. Thus, the study reports that due to the negative interference 4 out of 30 students pronounced the second syllable in the word パソコン /pasokon/ 'personal computer' as [sa]. Also, 36% of students pronounced the word パスワード /pasuwa:do/ 'password' as /pasuwo:do/, which is likely due to the English pronunciation of the word /ˈpæswɜːrd/.

This study will focus on Russian vowels and their pronunciation and stress both in English loanwords in Russian and Russian words that have no relation to English or Norwegian. The aspects that will be taken into consideration are the aforementioned vowel reduction and stress position. That accordingly poses the following research questions:

1. What phonological difficulties do Norwegian speakers encounter when learning Russian as L3 with regard to accuracy of vowel pronunciation and stress placement?

2. How does familiarity with words (e.g. cognates or shared loanwords) affect the accuracy of vowel pronunciation and stress placement? (e.g. the word *deadline* would be more likely to be pronounced with initial stress in Russian because of the influence from Norwegian; *компетенция* kompʲetʲent͡sia would likely not be reduced because the Norwegian *kompetanse* have /o/ in them)

These research questions will help to better understand the process of Russian language acquisition by Norwegians, the peculiarities and difficulties of pronunciation, as well as the

influence of the similarities between the Norwegian and English languages on the learning of the Russian language.

The hypotheses for the study are the following:

1. L3 speakers of Russian are less likely to neutralize cognate words compared to non-cognate words (based on the assumed influence by their L1/other languages);

2. L3 Russian speakers tend to align stress with their L1 which may be congruent or incongruent from that of the Russian target.

1.2. Thesis outline

The previous section has presented a brief introduction to the potential pronunciation challenges when learning Russian as L3 and the significance of studying the influence of the Norwegian and English languages on the pronunciation of Russian words.

We will take a closer look at the phenomenon of vowel reduction (neutralization) and stress position in Section 2. Further in this section, we will examine the studies that have already been conducted on this topic.

Furthermore, the thesis relies on manually collected and annotated data and a self-designed experiment (both are described in detail in Section 3) aimed at investigating how much influence and/or interference native Norwegian speakers, who are L3 Russian learners, experience from the knowledge of Norwegian and English and how prompted they are to pronounce Russian words in a Norwegian/English manner. The goals and the hypotheses of the experiment are tested in this study.

When the pronunciation patterns are identified and analyzed, they will be discussed in Sections 4 and 5, addressing the findings and outlining the potential steps to improve the pronunciation of L3 Russian speakers in terms of language acquisition.

2. Literature review

In this section, we delve into the phenomenon of vowel reduction, exploring its various types, approaches and specifics that cover two distinct languages, Russian and Norwegian. We also observe the patterns of the vowel reduction of the loanwords, primarily focusing on the Russian language.

Additionally, the topic of stress placement in these two languages shall be considered in detail encompassing not only the inherited native words of these languages but also the stress patterns of the borrowed words that were adapted to these languages' systems and that affect stress position and the pronunciation of these words in general.

The examination sheds light on how the loanwords undergo changes in vowel pronunciation and stress placement, a process that is essential to their integration into the phonological structure of the host language. By exploring these aspects, we gain some valuable insights into the phonological processes that shape the pronunciation and rhythm of language in the context of linguistic adaptation.

2.1. Vowel reduction

In phonetics, if the vowel is not stressed, then it gets its own level of reduction depending on its position and the position of the stress in the word. Yet what does exactly the vowel reduction mean? What happens when the vowel is neutralized or reduced? What are the characteristics that should be considered when the reduced vowels are analyzed? Are the stressed vowels pronounced longer than the unstressed or prestressed ones?

The term "vowel reduction" refers to many linguistic phenomena. On the one hand, vowel reduction can be defined as the complete deletion of unstressed vowels. On the other hand, it could be also applied to non-neutralization in the pronunciation of both stressed and unstressed vowels. However, most of the time the vowel reduction links to the phenomena that

are defined somewhat in between these two interpretations that "involves categorical quality change that is conditioned by phonological categories such as stress and/or phonemic vowel length" (Crosswhite, 2001, p. 3).

Vowel reduction can usually be understood in two primary ways: phonetic and phonological vowel reduction. The phonetic vowel reduction implies that the vowel targets get undershot as a consequence of such factors as coarticulation and/or centralization, which also depends on speech rate and register, stress, and segmental context. The result of this process is described as gradual overall vowel space shrinkage. Lindblom (1963) states that the phonetic vowel reduction takes place due to a decrease in duration. It involves target undershoot, where the formants are influenced in the direction of neighbouring consonants and vowels, their formants specifically. That incidentally can lead to centralization, but not necessarily. Fourakis (1991) and Van Bergem (1993) support the idea of formant undershooting, however, they also agree that phonetic vowel reduction assumes the overall vowel space reduction. Padget & Tabain (2005, p.3) suggests that "the shrinkage of the overall vowel space under decreased duration is a common feature of all phonetic vowel reduction phenomena. It is this, rather than schwa-like realizations, that justifies the term "reduction".

Conversely, the phonological vowel reduction can be defined as the neutralization of the vowel phoneme contrasts that result in the categorical substitution of vowels (e.g. [ə]-like pronunciation in English in some certain contexts). It is neither characterized as a gradient undershoot nor does it depend on speech rate or register (e.g. *explanation – explain*, [eɪ] cannot occur in the first example no matter how thoroughly you pronounce it). Fleming (2005) claims that the phenomenon of the neutralization of vowel contrasts in unstressed syllables is noticed across various languages. Nevertheless, it is important to understand that the relevant correlates are not stress, but the short vowel duration and reduction in articulatory effort. In addition, it is more common to eliminate vowel height contrasts before taking backness and rounding

contrasts into account. The author states that languages like Italian, Brazilian Portuguese and Slovene follow the same reduction pattern, where the contrasts between higher and lower mid vowels vanish in unstressed syllables. Another common pattern encompasses reduction from a five-vowel system in stressed syllables to the three-vowel system in unstressed syllables, which erases the contrast between high and mid vowels (Standard Russian, Southern Italian dialects, Catalan dialects). Thus, it causes an overall elevation of the vowel "space floor". The vowel space compresses the distance between vowel pairs, and maintaining this minimal distance leads to neutralization (Fleming, 1995). To sum up, different languages demonstrate different vowel reduction patterns that can include eliminating certain vowel contrasts and changing and adapting the qualities of unstressed vowels.

In the following sections, we will take a closer look at the phenomenon of vowel reduction applicable to certain languages, such as Russian and Norwegian, as well as different views on vowel reduction in these languages, and reduction in borrowed words.

2.1.1. Vowel reduction in Russian

There are different approaches towards the systematization of reduction/neutralization of the Russian stressed vowels. The Russian vowel stressed system consists of five phonemes /i, e, a, o, u/ (Avanesov & Sidorov 1970; Kniazev & Pozaritskaya 2005; Kasatkin 2006). Padgett (2004) argues that the system can overgo the reduction and result in 2- or 3-vowel systems (it depends if we consider palatalization of the preceding consonants or not) when the vowels are unstressed. If the analyzed neutralized vowel comes after non-palatalized consonants, the neutralization is based on whether the vowel is in the first pretonic syllable (1a) or in other unstressed syllables (1b) (the examples of the vowel neutralization after non-palatalized consonants are shown below):

(1)

a. /i/ /u/

/e/ /o/

ɐ

/a/

b. /i/ /u/

/e/ /o/

ə

/a/

a. 'dᵛim 'smoke'
'sudnə 'ship'
'tsᵛex '(factory) shop'
'got 'year'
'praf 'law'

b. dᵛi̲mɐˈvoj 'smoke' (adj.)
su̲dɐˈvoj 'ship' (adj.)
tsᵛi̲xɐˈvoj '(factory) shop' (adj.)
gə̲dɐˈvoj 'annual'
prə̲vɐˈvoj 'legal'

In case the preceding consonant is palatalized, the vowel neutralization has the following form (2) and its examples (a, b):

(2)

/i/ /u/

/e/ /o/

/a/

a. vʲit 'species'
'klʲutʃ 'key'
'dʲelə 'business'
'slʲos 'tears (gen.pl.)'
'rʲat 'row, file'

b. vʲidɐˈvoj 'specific'
klʲutʃiˈvoj 'key' (adj.)
dʲilɐˈvoj 'business' (adj.)
slʲizətɐˈtʃivᵛij 'tear (gas) (adj.)'
rʲidɐˈvoj 'average'

Another perspective on vowel reduction was outlined by Crosswhite (2000, 2001) where the author provides the reduction pattern of Modern Standard Russian and differentiates "moderate" and "radical" reduction based on moraic (a heavy stressed syllable containing a short vowel and moraic coda are related to two moras; the coda is competitively selected relative to the vocalic gesture) and non-moraic (a light stressed syllable containing a short vowel and moraic coda are associated with one mora; the coda is coselected with the vocalic gesture) position (Tilsen, 2014, p.50) accordingly. The reduction is also distinguished whether the unstressed vowel is after a non-palatalized or palatalized consonant. Besides the palatalization factor, the outcome of the vowel reduction is determined by other two independent variables as well: the identity of the underlying segment and its placement within the word. In the case of consonants being non-palatalized, the moderate reduction looks the following way:

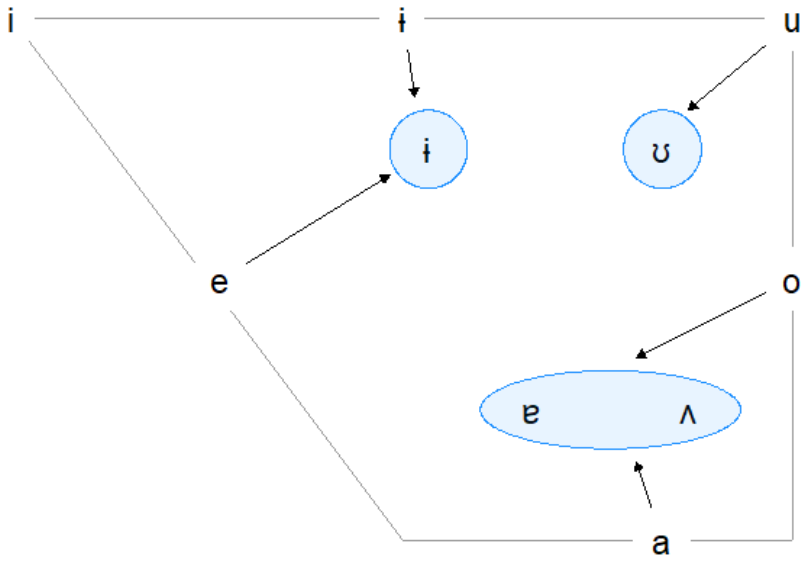


Figure 1. The moderate reduction in the non-palatalized context (based on Iosad, 2012, p.5).

The scheme of the reduction after non-palatalized consonants is relatively different from the one proposed by Padgett (2004), as it includes such phonemes as [ʌ], [ɐ], [ɨ] and [ʊ]. All the sounds aim to be significantly centralized, even the vowel /u/ which generally does not

neutralize. For many languages, the neutralization leads to the schwa-like sound occurrence. Even in Russian /a/ and /o/ could be reduced to [ə], but it is not always the case. Both of these vowels have an [a]-like sound when they are in an unstressed position, e.g. [ʌ] or [ɐ]. Russian /e/, if unstressed, could not be found after non-palatalized consonants, with the occasional exception of [ʂʷ], [zʯʷ] and [ts] ([ˈzʯʷemʧʲʊk] ‘pearl’ - [zʯʷɨmˈʧʲuzʯʷnəj] ‘pearl (adj.)’; [ˈzʯʷoni] ‘wives’ – [zʯʷɨˈna] ‘wife’): which lack a palatalized aspect in them. Although according to modern norms /e/ neutralizes with /i/ to produce [ɨ̞], essentially, there's no distinction in how /e/ behaves across non-palatalized and palatalized contexts.

In a palatalized context, the reduction seems to be simpler, and the contrasts are neutralized:

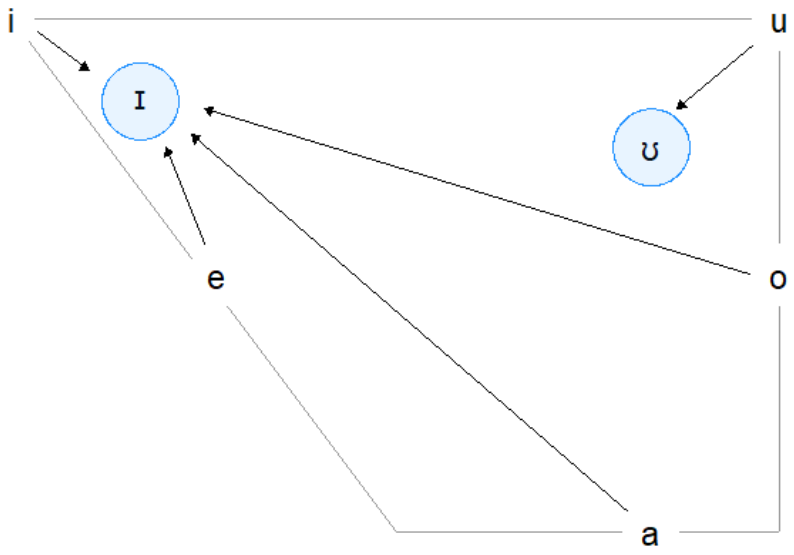
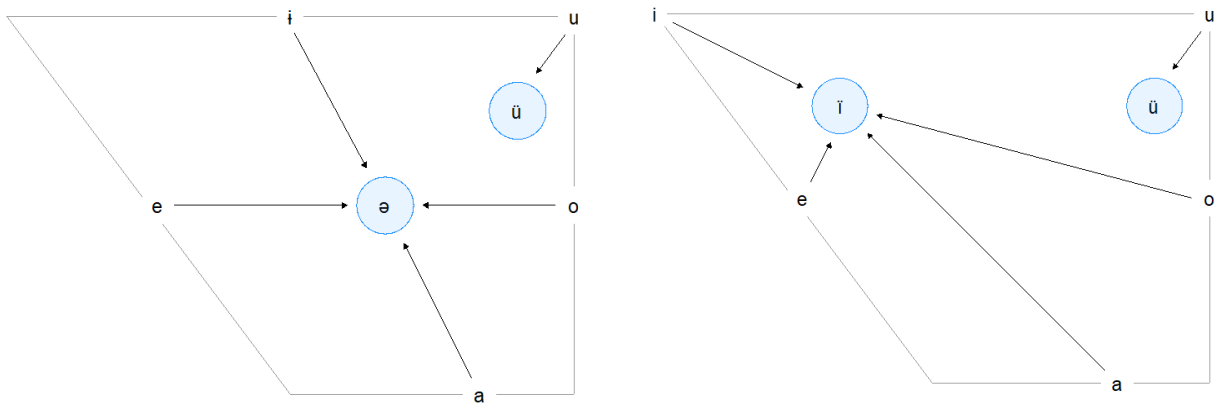


Figure 2. The moderate reduction in the palatalized context (based on Iosad, 2012, p. 6).

The representation shows the tendency to neutralize all the vowels to the [ɪ] sound (except for /u/, it still tends to become centralized and fronted due to the coarticulatory effects).

The radical reduction, another approach to the vowel reduction, is interpreted as a neutralization of all the vowels except for /u/, and, additionally, more contrasts are neutralized. When the vowel is located after non-palatalized consonants, it is pronounced as schwa [ə].

Furthermore, there is no distinction between non-palatalized consonants, in case whether they are paired or unpaired (i.e. [ʂʷ], [zˌʷ], and [ts]). When the consonant prior to the unstressed vowel is palatalized, all the vowels except for the /u/ neutralize the identical way as it is in the moderate reduction scheme – to the [ɪ] sound:



a) Non-palatalized context b) Palatalized context

Figure 3. Radical reduction in both contexts (based on Iosad, 2012, p. 8).

Two-pattern vowel reduction systems, or the occurrence of two sets of neutralizations, also take place in further study by Crosswhite (Hayes et al., 2004). According to the researcher, moderate reduction appears in specific unstressed syllables, whereas an extreme reduction form comes up in the remaining syllables. For instance, in most Russian dialects /o/ and /a/, when unstressed, are neutralized as [a] when the syllable goes in front of the stresses syllable immediately, or as [ə] when they are found in any other unstressed syllable. The neutralization is demonstrated in the following Table 1:

In stressed σ	In immediately pre-stress σ	In other unstressed σ	gloss
ˈdom (nom.sg.)	daˈma (nom.pl.)	dəmaˈvoj (adj.)	‘house’
ˈgoləvu (acc.)	gaˈlofka (diminutive)	gəlaˈva (nom.sg.)	‘head’
ˈkamʲinʲ (nom.sg.)	kamʲˈnʲej (gen.pl.)	kəmʲiˈnʲistəj (adj.)	‘stone’
ˈdalʲiji (comp.)	daˈlʲokʲij (adj.)	dəlʲiˈko (adverb)	‘far’

Table 1. Two-pattern vowel reduction in Russian where (σ) represents syllable (Hayes et al., 2004, p.222).

There is a similar pattern revealed in the southern Russian dialects. The unstressed /e/ and /o/ are neutralized to [a] in the syllable preceding the stressed one, but underlying /e/ and underlying /o/ and /a/ that go after a palatalized consonant are neutralized to [i], while /o/ and /a/ in any other position are reduced to [ə]:

Language	Moderate reduction	Extreme reduction
Southern Russian	Unstressed /e, o/ both neutralize to [a] in the syllable immediately preceding the stress.	In all remaining unstressed syllables, /o, a/ reduce to [ə] (or [i] following a palatalized consonant) and unstressed /e/ reduces to [i].
Contemporary Standard Russian	Unstressed /o/ neutralizes to [a] in the syllable immediately preceding the stress	Unstressed /o/ and /a/ neutralize to [ə] in the remaining unstressed syllables.

Table 2. Two-pattern vowel reduction in Southern Russian and Contemporary Standard Russian (Hayes et al., 2004, p.222).

The extreme vowel reduction is described by the common characteristics: the sonority is decreasing with this type of neutralization (it contrasts with moderate reductions, which can lead to sonority increase, as in the shift that could be observed from /o/ to [a]); the extreme vowel reduction targets the most durationally impoverished unstressed syllables that are based on prominence reduction. The moderate vowel reduction, in turn, occurs in the unstressed syllables that have slightly greater duration in comparison to other unstressed syllables. Thus, the immediate pretonic syllables in Russian have a longer duration than other unstressed

syllables (in some cases even greater than the stressed syllable) and the duration could be noticed even by just listening to the speaker. When listening to Russian speech at the ordinary conversational speech tempo, the immediately pretonic unstressed vowels are never completely or almost completely reduced as contrasted with non-immediately pretonic ones (i.e. the word /xoro'ʃo/ 'good' is often pronounced as [xəra'ʃo] or [xra'ʃo], but never *[xər'ʃo]).

The choice of the neutralized variation of the vowels can also depend on the region the language is spoken (Kasatkina, 2005). The pronunciation of [ɐ] is distinctive to Moscow and its nearby areas, as well as to Standard Russian varieties spoken in places where local dialects neutralize the contrast between /a/ and /o/ in certain positions. Conversely, the pronunciation of [ʌ] is typical of Standard Russian spoken in regions where local dialects lack neutralization between /a/ and /o/, including regions like Northern Russia (St. Petersburg), vast parts of the Urals and Siberia, and among Russian speakers in Ukraine (Kasatkina, 2005).

The Russian vowel reduction data reveals distinct classes that can be classified into a contrastive hierarchy. Regardless of the context, /u/ stays distinct and does not merge with any other phonemes. It may lose such characteristics as labialization or can be neutralized with other vowels in a [ə]- or [ɨ]-like sound. Despite the fact that this vowel rarely undergoes merger and still maintains some little amount of labiality, it is assigned to its contrastive feature [+round]. Vowels /i/ and /e/, both front vowels that occur in their non-neutralized forms, are marked by the feature [+front]. They merge contrastively when they appear in moderate non-palatal reduction contexts; however, they are differentiated by the [±high] feature in non-reducing contexts. The remaining vowels /o/ and /a/ form another group where they are classified as [-front] and merge categorically in unstressed contexts. Additionally, they are distinguished by the [±low] feature:

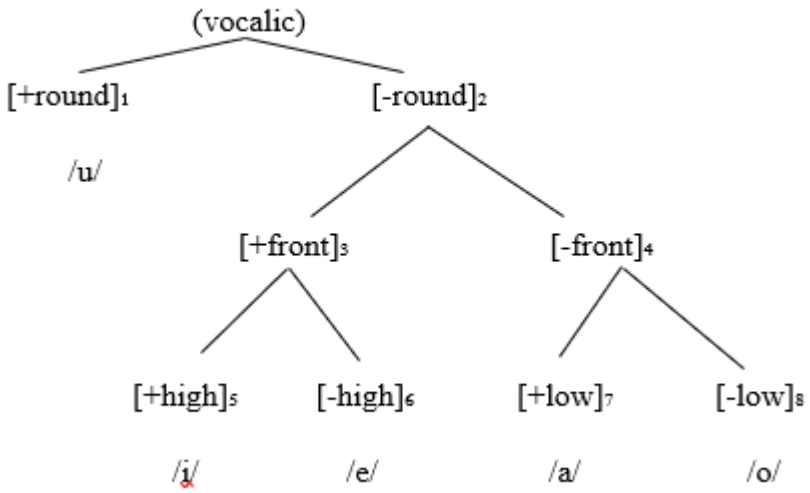


Figure 4. Contrastive hierarchy for the Russian language (Spahr, 2012, p.19).

It is proposed that the vowel reduction is described as not one single phenomenon, but two separate phenomena, namely contrast enhancement and prominence reduction. One of the cases of contrast enhancement is the asymmetrical reduction if /o/ > [a] where the reduction generates a corner vowel, however, the sonority is not decreased.

Iosad (2012) in his research primarily works within the Parallel Structure Model (PSM), where only phonologically active features are specified, thus by utilizing the privative features, the author defines the Russian vowel inventory. He employs privative [closed] features for mid vowels representing non-palatal reduction expressed by the removal of this specific [closed] feature. Accordingly, /e/ originally specified as [closed, coronal], is simplified to [coronal], which makes it share features with /i/ and essentially turning to /i/. Iosad adopts a direct subset approach to vowel reduction, where positional neutralization involves moving from one member of the complete vowel inventory to another one (Table 3):

	V-manner		V-place	
Vowel	[open]	[closed]	[labial]	[coronal]
/a/	✓			
/o/		✓		
/e/		✓		✓
/i/				✓
/u/			✓	

Table 3. Russian vowel feature specifications (Iosad, 2012, p. 14).

Hermans (2008) presents his view on Russian vowel reduction by using Element Theory and constraints related to sonority, as previously offered by de Lacy (2006). This approach considers mid-vowels as complex segments consisting of several primes, or elements, while the peripheral vowels are seen as simpler with just one single element. Nevertheless, Hermans suggests that vowel features are assigned based on phonetic properties rather than language-specific phonological behavior. The study considers the distinction between moderate and radical reduction, adopting Crosswhite's (2001) approach and its assumptions, and states that /a/ cannot occur in unstressed syllables outside of the first pretonic position. Hermans claims that Russian mid vowels, such as [ɛ] and [ɔ], are the most sonorous due to their lax quality and, thus, are more prone to reduction. By contrast, de Lacy disagrees with the statement and considers these sounds less sonorous in comparison to [a] due to their position and height. Hermans believes that highly sonorous elements are not preferable in non-head positions, therefore, it results in either stress attraction or easy reduction.

In Kasatkin's (2006) work, the Russian vowel system encompasses both accented and unaccented syllables and, in addition, the phonological contexts in which every vowel can be used (the phonemes and their allophones), which makes this system one of the most profound. It is stated that the vowels in stressed syllables, specifically when the vowel often constitutes the initial and, occasionally, the only segment, are considered to be the vowels with true

characteristics. Moreover, the canonical quality of the vowel can be acquired when the preceding consonant remains hard (i.e., non-palatalized) and the vowel duration is sufficiently extended. The Russian vowel system is presented in Table 4, where the dots demonstrate the articulation characterized by the preceding consonant's palatalization:

Phoneme			/u/	/i/	/e/	/ɔ/	/a/
In an accented syllable	In V, VC syllables		u	i	e	ɔ	a
	After non-palatalized consonants		u	ɨ	e	ɔ	a
	After palatalized consonants		u	i	e	ɔ	a
In unaccented syllables	In V, VC syllables		u	ie	ie	aə	aə
	After a non-palatalized consonant	1st degree reduction	u	ɨə	ɨə	aə	aə
		2nd degree reduction	u	ɨə	ə	ə	ə
	After a palatalized consonant	In all syllables but for open final	u	ie	ie	ie	ie
		In final open syllables	u	ie	ie	ə	ə

Table 4. Russian vowel reduction system by Kasatkin (2006, p.151).

So far most of the suggested vowel reduction systems that are presented as phonological phenomena have 2 degrees of reduction and the reduction itself happens taking no notice of speaking rate. Nevertheless, Barnes (2006) looks into the 2nd-degree reduction and shows that the vowel [a] does not necessarily reduce to schwa even though the placement of the vowel presupposes its changing to schwa in the context, i.e. the reduction to schwa does not occur before another [a], as in *соотношение* 'relationship' which phonetic transcription looks the following [saatnaˈʃʲeɲijə] and not [səatnaˈʃʲeɲijə]. Even though the speaking rate could be fast or [a] could be reduced to schwa in final syllables, the reduction still does not result in schwa in both these cases. Therefore, after conducting the experimental study and confirming that the articulatory target for [a] is reached by the additional duration in case of the [aa] hiatus or phrase-final lengthening, Barnes (2006) makes a conclusion that there is only one phonological vowel reduction process (which is the 1st-degree reduction) and, moreover, one phonetically

motivated process which does not take place if the unstressed vowel's duration is above of 60 ms.

Jaworski (2010) confirms Barnes' vowel reduction theory by doing his own experiment where the author asks four Russian-speaking participants to read out 137 meaningful sentences to do an analysis of the formant values of different target vowels (accented [a], 1st and 2nd degree reduction, accented [u], unaccented [u], accented [i], unaccented [i]). "The data indicate that [i] and [u] are susceptible to phonetic change, as the vowels were regularly undershot by the subjects in unstressed syllables… These data strongly suggest that accented high front and back vowels differ both qualitatively and quantitatively from their unaccented counterparts. It is by no means surprising that sounds which require relatively long lingual gestures are not fully articulated in prosodically weak positions." (Jarowski, 2010, p. 59). With regard to the low vowel [a], the data revealed that two of the speakers applied two degrees of vowel reduction, while two other speakers utilized only one. The distinction between the accented [a] and the 1st-degree reduction is minor, however, the unaccented low vowels that are exposed to 2nd-degree reduction and pronounced as [ə] considerably stand out from both accented [a] sounds and the ones that are located in the pre-tonic syllable. Besides, the two participants did not succeed in producing major vowel height differences which convincingly shows that some speakers can only have one degree of vowel reduction, and, consequently, the duration of the vowel becomes the only phonetic indication in terms of 2nd-degree reduction.

2.1.2. Norwegian vowels in unstressed position

According to Øverland (2000, p.15), there are 3 variations of Norwegian vowels:

1) the stressed, long and tense ('eː)
2) the unstressed, short and lax (ɛ)

3) the unstressed and tense (eː), that could be used in the suffixes such as *-het, -skap, -bar, -vis, -tiv*; or the vowel within grammatical compound words that could be spotted in the original single word with the identical syllable that has been designated with primary or secondary stress (*vennskap* 'friendship'– *vennskapsbånd* 'bond of friendship', *landbruk* 'agriculture' – *landbruksminister* 'minister of agriculture')

The author notes that long vowels, in general, are not present in the syllables preceding the main stress, however, there might occur in some derivations ending with a long and stressed /i:/ sound which itself carries the primary stress within the word. That could only apply to the original words that are featured with a long and stressed vowel (*reder* 'shipowner'- *rederi* 'ship company').

Considering these variations of Norwegian vowels, it is difficult to establish whether they undergo any kind of vowel reduction process or not. Kristoffersen (2000) admits that in some dialects the neutralization could be traced, i.e. some rural dialects of southern Norway tend to neutralize both long and short /i/ and /y/ into /i/, other dialects from the southern part of the western coast blend /y/ and /ʉ/ (Kristoffersen, 2000, p.18). He also points out that vowels in unstressed syllables are always short, but there is a possibility to neutralize vowels to schwa [ə]. Nevertheless, it is important to understand that not all vowels may be neutralized in schwa, as they do, for example, in English or Dutch. Only unstressed /e/ can be pronounced as schwa in Norwegian. The variation between /e:/, /e/ and /ə/, or syllabic sonorant are dependent upon metrical position and environment, and the distribution is influenced by stress level and syllable structure (Kristoffersen, 2000, p.19-21).

2.1.3. Vowel reduction in borrowings

According to Iosad (2012), all the sources that cover the topic of neutralization in loanwords come to the same conclusion: the borrowings that contain unstressed /o/ consistently

show /a/ as an outcome of the reduction. There are only a few cases of unstressed /o/ or /a/ when they are preceded by /ts/, so it is complicated to make any generalizations in this regard, nevertheless, [ɐ] seems to be becoming more common. The author admits that even though all the complex details could be not fully understood, the larger picture is very clear. In situations where there is a mismatch between phonetic properties and the phonological behavior of "unpaired" palatal consonants, the behavior of vowel reduction is more directly determined by their phonetic properties. In addition, loan words, especially those less integrated into the language or associated with technical jargon, may avoid vowel reduction entirely. As a result, the vowel of this word retains its properties (e.g., labialization of /o/) even in unstressed syllables. Nonetheless, they are still "reduced" in the sense of having a shorter duration under normal circumstances (Iosad, 2012, p.8).

The low vowel /a/ commonly appears after hard strident consonants ([š], [ž], and [c]) in the immediately pretonic position in borrowed words (*šofer* [šaˈfjor] ‘driver’, *žokej* [žaˈkʲei] ‘jockey’). The vowel /e/ appears after hard consonants and in the initial position of the word in borrowed words. The vowel reduction occurs in fully integrated borrowed words following the prescriptive norms; however, it is important to mention that the presence of the vowel reduction in the loanwords considerably varies among different native speakers, e.g. the word *fonetika* ‘phonetics’ can be both pronounced as [foˈnɛtʲikə] or [faˈnɛtʲikə], where the immediate pretonic /o/ may be reduced to [a], but not necessarily. It is worth noting that the vowel [e] never reduces to [a] in fully integrated borrowings, unlike [o]; the words like *etaž* [ɛˈtaš] ‘floor’, *sentencija* [sɛnˈtɛnɕʲə] ‘maxim’ will never be pronounced like *[aˈtaš] and *[sanˈtɛnc ʲə] by native speakers.

There is variability in the pronunciation of word-internal schwa sequences that are followed by another vowel in the loanwords. Some researchers believe that the sequences with /io/ and /ia/ (*diagonal* ‘diagonal’, *nacionalizacija* ‘nationalisation’) can be represented with

[ɪa] and [ɪə] as [dʲiagaˈnalʲ]/[dʲiəgaˈnalʲ] and [nəcɨənalʲiˈzacɨə] respectively (Kalenčuk & Kasatkina, 2013). Others hold the view that the sequence could be transcribed as [iə], [ɨə] and [ᵘa] for different contexts (i.e. *nacionalizacija* [nəcɨənalʲiˈzacɨə]) (Avanesov, 1984). This transcription is explained by the hiatus sequence that involves a non-high vowel preceding the high vowel and consequently is pronounced as centering diphthongs. Moreover, the schwa within the diphthongs like [iə], [ɨə] are not found in the syllables without onset (Mołczanow, 2015).

The Norwegian language, in turn, has adopted some English words as well. However, Norwegians have not implemented phono-semantic matching to these borrowings, instead "many Norwegianized words simply have a changed orthography so that the word looks more Norwegian, but is in fact written quite similar" (Kuitert, 2013, p.5). Despite the fact that about 30% of Norwegian words are loanwords, Sandøy (2000) mentions that countries like Norway promote to preservation of their linguistic heritage, thus, maintaining national identity. When it comes to English borrowings in Norwegian, the words exhibit three diverse pronunciation sources:

1) wholly oral, where a person does not know or consider the correct spelling (*kuli* 'coolly', *skvær* 'square');

2) pseudo-oral, where a person knows or thinks that they know the correct way of pronunciation and the English spelling, thus uses this knowledge (*pilot* [ˈpailåt]);

3) non-oral, where a person relies only on the spelling and pronounces the words according to Norwegian spelling rules (*standard, dollar, klan, trapper*) (Haugen, 1949, p.65).

As regards the vowel reduction in the borrowed words in Norwegian, there is no relevant information found on this topic; thus, it may be assumed that the unstressed vowels in these words follow the same pronunciation rules as the words from the language of origin (English) or they are pronounced in Norwegianized manner.

2.2. Stress position

2.2.1. Russian stress position

Many admit that one of the most difficult parts of learning the Russian language is its flexible stress. The stress placement in Russian could cause a lot of doubts, as well as some errors in speech. If nouns are considered, the presence of cases and stress mobility depending on which case the word is in in Russian makes everything much more complicated. While it is impossible to classify the Russian nouns in the nominative case considering their stress placement, there are some stress patterns that were singled out if all the noun cases and the number of the nouns are taken into account (see Bloomfield & Petrova, 1945; Zaliznjak, 1967). In this study, we will examine Russian nouns, but only in their nominative case and singular number.

However, there is a stress pattern that could be observed in English borrowings that came into Russian. The recent borrowings that entered the language feature the retention of the stress of the original English word. For example, the words English *biker* ['baɪkə] – Russian байкер [ˈbaɪ̯kʲɪr], English *online* [ˌɔn'laɪn] – Russian *онлайн* [onˈɬaɪ̯n], and English *engineering* [ˌɛndʒɪ'nɪərɪŋ] – Russian *инжиниринг* [ɪnʐɨˈnʲirʲɪnk] have their stress placed on the first, second and third syllable respectively, as in their English version.

Some English loanwords demonstrate some variation in their stress position. This group of words in their source language are compound words and they consist of two morphemes, which makes it possible to pronounce these words with stress on either the first morpheme or the second one in Russian (English *overtime* ['oʊvəˌtaɪm] – Russian овертайм [ˈovʲɪrtəɪ̯m] or [ʁvʲɪrˈtaɪ̯m]). Still, there are some cases when both parts of the compound word are stressed (English *second hand* [ˌsɛkənd'hænd] – Russian секонд-хенд [ˌsɛkənt ˈxɛnt]).

The last word group display some shift in the stress position. Stress can be moved to the second part of the compound word (English *copywriter* ['kɔpɪˌraɪtə] – Russian копирайтер

[kəpʲɪˈraɪ̯tɛr]), towards the end of the borrowed word since the original word contains such suffixes or suffix-like elements as *-ball, -ism, -oid* (English *volleyball* ['vɑːlɪˌbɔːl] – Russian волейбол [vəlʲɪɪ̯ˈboł]; English *ageism* ['eɪdʒɪzm] – Russian эйджизм [ɛɪ̯d͡ʒˈʑɨzm]; English *factoid* ['fæktɔɪd] – Russian фактоид [fɐˈktoɪt]). The English borrowed words that end with *-ing* get penultimate stress in Russian (English *advertising* ['ædvəˌtaɪzɪŋ] – Russian адвертайзинг [ɐdvʲɪrˈtaɪ̯zʲɪnk]). Another class of loanwords have their stress placed closer to the end of the word due to the fact that the loanword was introduced to the language earlier, thus it has an influence on the loanword with another new meaning; therefore, the earlier loanword абстрактный [ɐpˈstraktnɨɪ̯] 'theoretical' influenced pronunciation of the word English *abstract* ['æbstrækt] – Russian абстракт [ɐpˈstrakt] 'short summary'. Lastly, if the stress is meant to be changed, as a general rule, it moves to the place where the secondary stress in an English word is found (English *insider* ['ɪnˌsaɪdə] – Russian инсайдер [ɪnˈsaɪ̯dɛr]) (Janurik, 2010, pp.53-54).

2.2.2. Norwegian stress placement

Concerning the stress position in Norwegian, Rice (1999,2006) presents a broad analysis both for native Norwegian words and the borrowed from other languages words. The monosyllabic words exhibit a pattern of complementary distribution of vowel and consonant length. They can be characterized by having either a long vowel followed by a short consonant, or a short vowel followed by a long consonant or a consonant cluster (*hat* [haːt]'hatred' – *hatt* [hatː] 'hat', *tak* [taːk] 'ceiling' – *takk* [takː] 'thanks', *ren* [reːn] 'clean' – *renn* [renː] 'ski competition', *steg* [steːg] 'step' – *stegg* [stegː] 'male quail'). It is stated that native disyllabic words, as a rule, have stress on the first syllable that is followed by an unstressed open syllable that contains schwa. It is observed that long vowels in the initial syllable cannot coexist with coda consonants. More specifically, when the initial syllable contains a bimoraic (long) vowel,

it cannot tolerate any coda consonants, while if there is a monomoraic (short) vowel, it can have only one coda consonant at most. The described phonological pattern can result in numerous examples of word pairs where the only difference between them lies in the vowels' length in the initial stressed syllables, leading to a variety of vowel and consonant combinations (*tape* [ˈtaːpə]'to lose' – *tappe* [ˈtapːə]'to tap', *hete* [ˈheːtə] 'heat'– *hette* [ˈhetːə]'hood', *mine* [ˈmiːnə]'mine' – *minne* [ˈminːə] 'to remind', etc.). As we can see, the early native Norwegian words conform to the stress oriented to the left.

Øverland (2000) gives a more detailed overview of the Norwegian language's prosody, including information about stress position in polysyllabic words, words' secondary stress and tonemicity. It is suggested that if the stress falls on the word-final syllable in a polysyllabic word, it gets only the primary stress (*nasjonal* [naʃʊˈnaːl] 'national'); otherwise, if the polysyllabic word has stress on a word-initial or word-internal syllable, the stressed syllable gets primary stress and either toneme 1 or toneme 2 (*over* [ˈùvər]'over'; *alene* [aˈlêːnə]'alone'). The secondary stress occurs only in compound words, thus, the primary stress falls into the first constituent of the compound while the secondary stress is attributed to the other compound constituent (*telefonkatalog* [telәˈfoːnkataˌloːg] 'telephone directory'). In cases where a word possesses both primary and secondary stress and is incorporated into a compound word, the secondary stress is allocated to the final component of the compound (*landbruk* [ˈlaːnˌbruːk] 'agriculture' - *landbruksminister* [ˈlaːnbrʊksmiˌnistər]'minister of agriculture'). Compounding through affixation introduces different stress patterns: some affixes can receive primary stress (*<u>opp</u>dage* [ˈopdaːgə] 'discover'), and some affixes get secondary stress (*kjærlig<u>het</u>* [ˈçæːrliˌhet] 'love'), and some remain unstressed (*<u>be</u>handle* [beˈhandlə] 'treat'). Norwegian compound words, lastly, can portray a shift of stress within the second constituents to avoid a clash between two stressed syllables. It could happen when a word with primary stress in a constituent receives secondary stress on the following syllable when it becomes the second part

of the compound (*utstyr* [ˈutsty:r] ‘equipment’, *kontorutstyr* [konˈturˌutst:r] ‘office equipment’).

Nonetheless, the words in modern Norwegian have acquired more stress patterns because a plethora of loanwords was introduced to the language. Thus, words can have primary stress on the final (*buffet, gelé, alfabét, electrón, agúrk, trafikk*), penultimate (*álbum, appéndiks, bikíni*), or antepenultimate syllable (*Amérika, álgebra, léksikon*). The author points out that the words were borrowed while preserving the original stress position from the source language when incorporated into Norwegian. Finally, Rice (2006, p.24) claims that the stress placement in loanwords in Norwegian is defined by the grammar of the language, the reason for this is that currently there is no justification to classify loanwords separately from the rest of the vocabulary. However, there’s no denying that the loanwords have influenced the structure of Norwegian grammar, which allowed it to develop from the stage where only penultimate stress was allowed to the diverse range of stress that could be observed today.

Dresher (2013) bases his study on Rice’s unified analysis of Norwegian word stress and explores the impact of loanwords both in Norwegian and English and explains the phenomenon of loanwords’ ability to change the grammar by drawing the following conclusion: “Because the Norwegian native word patterns were very restricted, they were compatible with a relatively simple set of new loanword patterns, which were able to change the grammar. The English native word patterns were also relatively restricted, but not as much as the Norwegian” (Dresher, 2013, p.64)

2.3. The interference of L1/L2 on L3 acquisition

This paper tackles a complex subject such as language acquisition, the interference and negative transfer of L1 and L2 pronunciations on L3 pronunciation. Thus, it is important to

understand the mechanism behind the acquisition of any language and how all these languages can influence each other.

First and foremost, it should be established what we mean by L1, L2 and L3. As a rule, L1 refers to the mother tongue that the person starts to learn from the very beginning and acquires naturally, and later he/she uses this language as their main means of communication. When it comes to L2, there are two terms that should be differentiated in their definitions – second language acquisition (SLA) and foreign language acquisition. SLA indicates that the language is learned and spoken in the local community that uses that language extensively, e.g. when a non-English speaker comes to the UK or the US and learns English by interacting with the native speakers. However, foreign language acquisition happens only in artificial school conditions, when the person is not integrated into the local community. L3 has the same distinction, nevertheless, it is not clear how to differentiate between L1, L2 and L3 sometimes. Some researchers claim that the acquired languages are ranked by the level of proficiency (Mazur, 2014, p. 49), while others think that the time of acquisition should be considered (chronological order of acquisition) in addition to cognitive maturity, meaning the cognitive development of the language that goes with age during early childhood (Hammarberg, 2014, p. 5).

Undoubtedly, the first acquired language can influence any aspect of the second language and transfer some of the structures of one into another. That phenomenon is known as cross-linguistic influence or language transfer. Odlin (1989) mentions two types of language interference: borrowing transfer (the influence of a target language on the native language or previously acquired language) and substratum transfer (the influence of the native language or acquired language on the target language). Both transfers are characterized by specific results; borrowing transfer affects lexical semantics and syntax, while substratum transfer has an impact on pronunciation. Interference is seen as the result of the established habits in the first

language and it should be overcome before acquiring new habits in the second language in order to avoid producing errors in phonology, vocabulary and grammar (Dulay et al., 1982).

It is worth noting that language transfer is a consequence of similarities and differences between the languages that the person acquired before and the target language that this person masters now. The following classification portrays the effects of cross-linguistic influence:

1. Positive transfer:

The positive transfer takes place when the similarities in both acquired and target languages aid in learning, e.g. shared vocabulary or similarities in the writing systems;

2. Negative transfer:

The negative transfer results in errors when attempting to transfer any kind of habits from one language into another. The errors that appear in the language can be further classified as follows:

1. Underproduction:

Learners may have limited use of target language structures, often resulting in few errors. However, if these structures are rarer in the target language compared to the native language, this is a deviation from language norms. One form of underproduction, known as avoidance, is controlled by language distance. When learners see that certain structures in the target language differ significantly from their native language counterparts, they may try to avoid using those structures. For example, Chinese and Japanese students learning English as a foreign language used fewer subordinate clauses, in contrast to students whose native languages shared more features with subordinate clause structures in English.

2. Overproduction:

Overproduction may result from underutilization. For example, in American English the frequency of use of apologies is higher than in Hebrew. Therefore, native English speakers

learning Hebrew may unintentionally overuse apologies while following the norms of their native language.

3. Production errors:

i. Substitutions (use of the native language's aspects in the target language);

ii. Calques (errors that reflect a native language structure);

iii. Alternations of structures (referred to hypercorrections – overreactions to a particular influence from the native language)

4. Misinterpretation:

Structures of the native language can distort the understanding of utterances in the target language, sometimes leading to conclusions that are very different from what native speakers of the target language would make. These differences in interpretation, for example, may arise due to misperception of the sounds of the target language, which is determined by the phonology of the native language.

3. Differing lengths of acquisition:

There is a specific length of time that it takes a person to acquire a language to the proficient level. It requires different amounts of time of dedication to the language if a person wants to master it, and in this case, the specific mastery level of a specific language should be considered (see Odlin, 1989).

According to Swan (1997:167), there is a greater chance of successful transfer between languages that are closely related than between languages that have no linguistic connections. Cultural distance, like linguistic distance, can significantly influence the level of ease or difficulty of learning.

It is also important to note that transfer can occur in situations when a person knows and speaks more than two languages. As Odlin (1989:141) points out, research into trilingualism shows that the more similar the linguistic structures of two languages are, the

higher the likelihood of successful transfer. Additionally, Swan (1997:163) emphasizes that differences in phonological structure also influence vocabulary learning. Foreign words that are close to the phonetic and spelling patterns of the native language are much easier to learn.

Mazur (2014) conducted research where the influence of L2 English on L3 Russian was examined. The participants were Polish-speaking people. It was presupposed that Polish, as a related language to Russian, would influence more efficiently, thus, the transfer would occur between them rather than unrelated English and Russian. Yet English played an important role in the acquisition of Russian due to its wider use all over the world.

Fleg (1987, 2005) proposes the Merge Hypothesis that involves phonetic acquisition. The hypothesis states that merging phonetic characteristics of sounds that are similar in the native and target languages can affect not only the target language but also the native language. Students learning a second language may experience pronunciation difficulties in both their L1 and L2. Thus, they have three options: maintain their L1 pronunciation but not achieve native L2 pronunciation; lose native pronunciation and achieve L2-like pronunciation; or lose native pronunciation in both L1 and L2.

Researchers have sought to identify sources of pronunciation errors that can significantly improve pronunciation skills and tried to come up with methods to do so. One of the first methods undertaken in this direction was contrast analysis. The essence of this approach is to compare students' native language with the target language, which allows them to predict possible difficulties (Dalton, 1994). However, Liu (2011) mentions that it is rather important to include a hierarchy of complexity in phonological acquisition in a contrastive analysis. Such a hierarchy can predict not only which sounds language learners will have difficulty with, but also which problems will be more difficult for linguistically homogeneous groups of learners.

In the 2015 study, Lipinska examined how L1 and L2 phonology influence the acquisition of L3 phonology. The participants were Polish students who spoke English and studied German as a second foreign language. The author noted that in 70 cases experts identified the influence of the second foreign language (English) on the speech of the subjects, while the influence of the native language (Polish) on the second foreign language, German, was identified in only 40 cases.

2.4. Summary

In conclusion of this section, we can emphasize the importance of studying the phenomenon of vowel reduction and stress placement in the context of two different languages: Russian and Norwegian. By analyzing different types of vowel reduction and examining the patterns of reduction in borrowed words, we find clear differences in the idea of how vowels are pronounced in a particular language, as well as the importance of taking into account their phonological system and patterns.

Particular attention should be paid to the study of stress in native and borrowed words, especially the adaptation of borrowings to the systems of host languages.

The impact of a first language (L1) and a second language (L2) on third language (L3) acquisition is a complex process. Research shows that both languages can influence L3 acquisition. Similarity between L1 or L2 and L3 may facilitate learning but also cause pronunciation problems. The strength of influence depends on the linguistic connections between these languages and the student's level of proficiency in each of them. Understanding these interactions is critical to research in language acquisition and teaching techniques.

This section is an important step in the research, and the data obtained from past studies will be useful in analyzing the influence of Norwegian and English on the pronunciation of Russian words, which will be discussed in further sections.

3. Data and methods

In this section, we turn to the data collection process and the methodology of the analysis of English loanwords in the Russian language. This section presents methods for selecting target and control words, their perception and pronunciation by native speakers of Norwegian and subsequent analysis in an audio context. We delve deeper into the annotation and data preprocessing and explore the impact of the loanwords on cross-linguistic relations.

3.1. Data

3.1.1. The Dictionary of Anglicisms of the Russian Language

The data that was used during the experiment appears to be a wordlist at first and was compiled from scratch. The words for the wordlist were picked from The Dictionary of Anglicisms of the Russian Language (Diakov, 2021).

The Dictionary of Anglicisms of the Russian Language is an extensive lexicographical project and a unique resource in which Anglicisms in the Russian language are collected and analyzed. It includes about 20,000 dictionary entries, each of which contains information about the origin of the word, its meanings, methods of formation, and many other aspects.

Each entry in the dictionary is provided with information about the frequency of use of borrowed words and expressions. The *част.*. chast. label that comes from *частотное употребление* chastotnoje upotrʲeblʲenʲie ‘frequent use’ means that the word is found in more than a million texts and documents, the редк. rʲedk. label comes from *редкое употребление* rʲedkoje upotrʲeblʲenʲie ‘rare use’ and marks the words that were used less than 10 000 times (Diakov, 2021, p. 10). This allows us to cover not only widely used Anglicisms, but also rare cases when Anglicisms are poorly adapted in the Russian language.

The dictionary contains Anglicisms that are actively used in various professional, social and age groups. It is possible to find borrowings from the language of computer experts, car enthusiasts, office workers, fishermen, musicians, designers, financiers, youth and many others. These words and expressions are usually expressive and emotional, and they often deviate from the established literary norms of the Russian language. The dictionary also pays considerable attention to slang anglicisms. It contains a variety of terms and expressions from sociology, politics, economics, art, religion, sports and many other areas. The author of the dictionary assures that this dictionary also presents measures of measurement, historical names and extensive vocabulary from specialized fields such as advertising, fishing, toy production, card games and even magic tricks.

Overall, the Dictionary of Anglicisms of the Russian Language is an extensive research resource covering many aspects of the use of Anglicisms in the Russian language.

3.1.2. Data Preparation

In order to find the loanwords that could be considered suitable for the research, it was decided to go through the whole dictionary and pick the words manually. The reason for this decision is that, as already mentioned in the previous part, this dictionary is full of words from various fields which have various characteristics. The goal was to choose the words that were frequent enough in the speech or could be found frequently in the texts. For this study, I am interested in the words with high-frequency values which are marked as *част*. chast 'frequent'. The next step was to go through each and every entry and to pick the words. There are 3 types of words that I came across while compiling the wordlist:

1. The words that are used in everyday speech and are completely included in the Russian language (Russian *фитнес* ['fʲitnɛs] 'fitness', *смузи* ['smuzʲɪ] 'smoothie').

These words are mostly considered the ones that introduce a new concept to the language.

2. The English loanwords that represent the same concept as the native words in Russian. They are not likely to be seen in official papers or written in any texts, except for in social media, but they could be heard in spoken language often. They could be divided into two categories:
    a. The loanwords seem to be gaining more and more popularity and appearing more often in speech, but it is not yet clear whether they will be able to completely replace Russian words or will simply coexist with each other (Russian *анбоксинг* [ʋnˈboksʲɪnk] – *распаковка* [rəspɐˈkofkə] ‘unboxing’; *ивент* [ɪˈvɛnt] – *мероприятие* [mʲɪrəprʲɪˈjætʲɪɪ̯ə] ‘event’).
    b. The loanwords that came from English to Russian and that could, theoretically, be used in the speech, however, these words seem to be “trendy” and a bit unnatural if they appear in one’s speech (Russian *постпонить* [pɐstˈponʲɪtʲ] ‘to postpone’; *флейвор* [ˈflɛɪ̯vər] ‘flavor’).

It was decided that the study would focus on the first category of loanwords that could be found in the dictionary for two reasons. First, the loanwords from the first category are integrated and have gained foothold in the Russian language, thus, they have totally become a part of Russian everyday life. Second, the examples that contain these words could be found more frequently in the corpus and the frequency value is considerably higher. Therefore, it was essential to go through the dictionary and choose the words manually. The first wordlist that I came up with had around 100 words in it. I reduced the number of loanwords that I was going to use for the experiment because some of the words that were chosen were pronounced virtually identically to the English version (*барбекю* [bərbʲɪˈkʲu] ‘barbeque’). Moreover, some words gained shortened versions in the original language, while the loanwords in Russian still

have the original version of the word (Russian *автобус* [ɐˈftobʊs] ‘bus’). Most of the words that were primarily picked had 2 syllables, but it was considered to include words with 3-5 syllables in the loanwords. Thus, the wordlist was reduced to 25 loanwords and 5 toponyms that had different stress positions in different languages, as well as vowel neutralization, in the Russian version of the words.

In addition, a list of 25 control words and 5 control toponyms was added, and each control word corresponds to the specific target loanword. The control word needed to coincide with the target word in the number of syllables, stress position, with the presence of vowel reduction, and be roughly equivalent to its paired target word in terms of frequency that was checked on the Russian National Corpus (ruscorpora.ru). All the words are nouns, were translated, transcribed and transliterated, and all the stress positions of the words were noted in all 3 languages. Furthermore, the number of syllables and whether the stress in Russian coincides with the position in Norwegian or English (or they are all completely different) were noted in Table 5, Table 6 and Table 7 along with the aforementioned criteria:

#	Target word	Target word in Cyrillic	Rus transliteration	Rus transcription	Eng translation	Eng transcription	Nor translation	Nor transcription
1	admiral	адмирал	admʲiral	ɐdmʲɪˈraɬ	admiral	ˈædmərəl	admiral	admiraːˊl
2	anesteziia	анестезия	anestʲezʲia	ɐnɛstɛˈzʲiɪ̯ə	anesthesia	ˌænəsˈθiːziə	anestesi	anestəsiːˊ
3	badminton	бадминтон	badmʲinton	bədmʲɪnˈton	badminton	ˈbædmɪntən	badminton	bæˊdmint(ə)n
4	golografiia	голография	golografʲia	gəɬɐˈgrafʲɪɪ̯ə	holography	hoʊˈlɑːgrəfi	holografi	holografiːˊ
5	detektiv	детектив	dʲetʲektʲiv	dɛtɛˈktʲif	detective	dɪˈtektɪv	detektiv	deˊtːektiv
6	imperializm	империализм	impʲerʲialʲizm	ɪm⁽ʲ⁾pʲɪrʲɪɐˈlʲizm	imperialism	ɪmˈpɪriəlɪzəm	imperialisme	imperialiˊsmə
7	ingaliator	ингалятор	ingalʲator	ɪngɐˈlʲatər	inhaler	ɪnˈheɪlɚ	inhalator	inhalaːˊtor
8	intellekt	интеллект	intʲellʲekt	ɪnʲtʲɪˈlʲekt	intellect	ˈɪnt̬əlekt	intellekt	inteleˊkt
9	intensivnost	интенсивность	intʲensʲivnostʲ	ɪntɛn⁽ʲ⁾ˈsʲivnəsʲtʲ	intensity	ɪnˈtensət̬i	intensitet	intensiteːˊt
10	interaktivnost	интерактивность	intʲeraktʲivnostʲ	ɪntɛrɐˈktʲivnəsʲtʲ	interaction	ˌɪnt̬ɚˈrækʃən	interaksjon	intərakʃoːˊn
11	interv'iu	интервью	intʲervʲu	ɪntɛrˈvʲju	interview	ˈɪnt̬ɚvjuː	intervju	intərvjuːˊ
12	kardigan	кардиган	kardʲigan	kərdʲɪˈgan	cardigan	ˈkɑːrdɪgən	kardigan	kaːˊrdig(ə)n
13	kompetentsiia	компетенция	kompʲetʲen͡tsia	kəm⁽ʲ⁾pʲɪˈtʲen͡tsɨɪ̯ə	competence	ˈkɑːmpət̬əns	kompetanse	kompətaˊŋsə
14	kontseptualizm	концептуализм	kon͡tseptualʲizm	kən͡tsɨptʊɐˈlʲizm	conceptualism	kənˈseptʃuəlɪzm	konseptualisme	kånseptualiˊsmə
15	kreativnost	креативность	krʲeatʲivnostʲ	krʲɪɐˈtʲivnəsʲtʲ	creativity	ˌkriːeɪˈt̬ɪvət̬i	kreativitet	kreativeːˊt
16	loial'nost	лояльность	loalʲnostʲ	ɬɐˈjælʲnəsʲtʲ	loyalty	ˈlɔɪəlt̬i	lojalitet	låjaliteːˊt
17	maneken	манекен	manekʲen	mənʲɪˈkʲen	mannequin	ˈmænəkɪn	mannekeng	manəkeˊŋː
18	manipuliator	манипулятор	manipulʲator	mənʲɪpʊˈlʲatər	manipulator	məˈnɪpjəleɪt̬ɚ	manipulator	manipulaːˊtor
19	monitor	монитор	monitor	mənʲɪˈtor	monitor	ˈmɑːnət̬ɚ	monitor	moːˊnitor
20	parlament	парламент	parlamʲent	pɐrˈɬamʲɪnt	parliament	ˈpɑːrləmənt	parlament	parlameˊnt
21	psikhologiia	психология	psʲihologʲia	psʲɪxɐˈɬogʲɪɪ̯ə	psychology	saɪˈkɑːlədʒi	psykologi	sykologiːˊ
22	revol'ver	револьвер	rʲevolʲvʲer	rʲɪvɐlʲˈvʲer	revolver	rɪˈvɑːlvɚ	revolver	revåˊlvər
23	refleksiia	рефлексия	rʲeflʲeksʲia	rʲɪˈflʲeksʲɪɪ̯ə	reflection	rɪˈflekʃən	refleksjon	reflekʃoːˊn
24	elektrichestvo	электричество	elʲektrʲi͡tɕʲestvo	ɨlʲɪkˈtrʲi͡tɕɪstvə	electricity	ɪˌlekˈtrɪsəti	elektrisitet	elektrisiteːˊt
25	empatiia	эмпатия	empatʲia	ɛmˈpatʲɪɪ̯ə	empathy	ˈempəθi	empati	empatiːˊ
26	Golivud	Голливуд	golʲivud	gəlʲɪˈvut	Hollywood	ˈhɑːliwʊd	Hollywood	håːˊlivud
27	Birmingem	Бирмингем	bʲirmʲingʲem	bʲɪrmʲɪnˈgʲem	Birmingham	ˈbɜːmɪŋhæm	Birmingham	bɜːˊmɪŋæm
28	Liverpul	Ливерпуль	lʲivʲerpulʲ	lʲɪvʲɪrˈpulʲ	Liverpool	ˈlɪvɚpuːl	Liverpool	liverpuːˊl
29	Rejk'iavik	Рейкьявик	rʲejkʲjavik	rɛɪ̯ˈkʲjævʲɪk	Reykjavík	ˈreɪkjəvɪk	Reykjavík	ræjʃəviːˊk
30	Florida	Флорида	florʲida	fɬɐˈrʲidə	Florida	ˈflɔːrɪdə	Florida	floriˊdə

Table 5. Target words with their transliteration and transcription in Russian, English and Norwegian.

#	Target word	Target word in Cyrillic	Stress position	Rus stress	Eng stress	Nor stress	Syllable number	Rus&Nor stress
1	admiral	адмирал	rus=nor	ultimate	intial	ultimate	3	same
2	anesteziia	анестезия	rus=eng	penultimate	penultimate	ultimate	5	different
3	badminton	бадминтон	eng=nor	ultimate	initial	initial	3	different
4	golografiia	голография	all different	antepenultimate	peninitial	ultimate	5	different
5	detektiv	детектив	all different	ultimate	peninitial	initial	3	different
6	imperializm	империализм	all different	ultimate	peninitial	penultimate	5	different
7	ingaliator	ингалятор	rus=nor	penultimate	peninitial	penultimate	4	same
8	intellekt	интеллект	rus=nor	ultimate	initial	ultimate	3	same
9	intensivnost	интенсивность	all different	penultimate	peninitial	ultimate	4	different
10	interaktivnost	интерактивность	rus=eng	penultimate	penultimate	ultimate	5	different
11	interv'iu	интервью	rus=nor	ultimate	initial	ultimate	3	same
12	kardigan	кардиган	eng=nor	ultimate	initial	initial	3	different
13	kompetentsiia	компетенция	all different	antepenultimate	initial	penultimate	5	different
14	kontseptualizm	концептуализм	all different	ultimate	peninitial	penultimate	5	different
15	kreativnost	креативность	all different	penultimate	antepenultimate	ultimate	4	different
16	loial'nost	лояльность	all different	peninitial	initial	ultimate	3	different
17	maneken	манекен	rus=nor	ultimate	initial	ultimate	3	same
18	manipuliator	манипулятор	rus=nor	penultimate	peninitial	penultimate	5	same
19	monitor	монитор	eng=nor	ultimate	initial	initial	3	different
20	parlament	парламент	all different	peninitial	initial	ultimate	3	different
21	psikhologiia	психология	all different	antepenultimate	peninitial	ultimate	5	different
22	revol'ver	револьвер	eng=nor	ultimate	peninitial	peninitial	3	different
23	refleksiia	рефлексия	rus=eng	peninitial	peninitial	ultimate	4	different
24	elektrichestvo	электричество	rus=eng	antepenultimate	antepenultimate	ultimate	5	different
25	empatiia	эмпатия	all different	peninitial	initial	ultimate	4	different
26	Golivud	Голливуд	eng=nor	ultimate	initial	initial	3	different
27	Birmingem	Бирмингем	eng=nor	ultimate	initial	initial	3	different
28	Liverpul	Ливерпуль	rus=nor	ultimate	initial	ultimate	3	same
29	Rejk'iavik	Рейкьявик	all different	peninitial	initial	ultimate	3	different
30	Florida	Флорида	rus=nor	peninitial	initial	peninitial	3	same

Table 6. The comparison of the same loanwords' stress placement in Russian, English and Norwegian.

N	Target word	Target word in Cyrillic	Control word	Control in Cyrillic	Control transliteration	Control transcription	Control translation to Nor	Target/control word freq (token per million)
1	admiral	адмирал	magistral	магистраль	magʲistralʲ	məgʲɪˈstralʲ	hovedvei	2.1/20.8
2	anesteziia	анестезия	ognetushitel	огнетушитель	ognʲetuʃ͡ʃitʲelʲ	ɐgnʲɪtʊˈʂɨtʲɪlʲ	brannslukker	7.1/0.2
3	badminton	бадминтон	perezvon	перезвон	pʲerʲezvon	pʲɪrʲɪˈzvon	klokkespilling	0.2/2.2
4	golografiia	голография	ravnopravie	равноправие	ravnopravʲije	rəvnɐˈpravʲɪɟə	likhet	0.09/1.4
5	detektiv	детектив	grazhdanin	гражданин	graʒ͡ʒdanʲin	grəʐdɐˈnʲin	borger	1.08/15.2
6	imperializm	империализм	uglevodorod	углеводород	uglʲevodorod	ˌuglʲɪvədɐˈrot	hydrokarbon	3.1/0.3
7	ingaliator	ингалятор	chuzhezemets	чужеземец	t͡ɕʲuʒ͡ʒezʲemʲet͡s	t͡ɕʊʐɨˈzʲemʲɪt͡s	utlending	0.3/0.1
8	intellekt	интеллект	pereezd	переезд	pʲerʲeezd	pʲɪrʲɪˈjest	flytting	16.1/3.6
9	intensivnost	интенсивность	edinitsa	единица	jedʲinʲit͡sa	ɟɪdʲɪˈnʲit͡sə	enhet	3.2/7.7
10	interaktivnost	интерактивность	besperspektivnost	бесперспективность	bʲespʲerspʲektʲivnostʲ	bʲɪspʲɪrspʲɪˈktʲivnəsʲtʲ	fåfengthet	3.3/0.3
11	interv'iu	интервью	uchenik	ученик	ut͡ɕʲenʲik	ʊt͡ɕɪˈnʲik	student	35.4/23
12	kardigan	кардиган	velikan	великан	vʲelʲikan	vʲɪlʲɪˈkan	gigant	0.1/0.6
13	kompetentsiia	компетенция	prokhozhdenie	прохождение	prohoʒ͡ʒdʲenʲije	prəxɐˈʐdʲenʲɪɟə	gjennomreise	4.6/12.1
14	kontseptualizm	концептуализм	molnieotvod	молниеотвод	molnʲieotvod	ˌmoɫnʲɪ(ɟ)ɪɐˈtvot	lynavleder	0.1/1.2
15	kreativnost	креативность	viktorina	викторина	vʲiktorʲina	vʲɪktɐˈrʲinə	spørrelek	3.8/3.6
16	loial'nost	лояльность	botinok	ботинок	botʲinok	bɐˈtʲinək	støvel	4.4/4.2
17	maneken	манекен	dvorianin	дворянин	dvorʲanʲin	dvərʲɪˈnʲin	adelsmann	2.5/5.6
18	manipuliator	манипулятор	gostepriimstvo	гостеприимство	gostʲeprʲiimstvo	gəsʲtʲɪprʲɪˈimstvə	gjestfrihet	0.5/1.5
19	monitor	монитор	chemodan	чемодан	t͡ɕʲemodan	t͡ɕɪmɐˈdan	koffert	14.7/4.08
20	parlament	парламент	pekarnia	пекарня	pʲekarnʲa	pʲɪˈkarnʲə	bakeri	5.05/0.5
21	psikhologiia	психология	predislovie	предисловие	prʲedʲislovʲie	prʲɪdʲɪˈsɫovʲɪɟə	forord	3.04/11.2
22	revol'ver	револьвер	zherebets	жеребец	ʒ͡ʒherʲebet͡s	ʐɨrʲɪˈbʲet͡s	hingst	1.7/2.4
23	refleksiia	рефлексия	stremlenie	стремление	strʲemlʲenʲie	strʲɪˈmlʲenʲɪɟə	aspirasjon	37.7/31
24	elektrichestvo	электричество	ob''iavlenie	объявление	objavlʲenʲie	ɐbɟɪˈvlʲenʲɪɟə	kunngjøring	7.8/9.8
25	empatiia	эмпатия	soglasie	согласие	soglasʲie	sɐˈgɫasʲɪɟə	samtykke	6.7/12.4
26	Golivud	Голливуд	Piatigorsk	Пятигорск	pʲatʲigorsk	pʲɪtʲɪˈgorsk	Pjatigorsk	2.1/1.8
27	Birmingem	Бирмингем	Kislovodsk	Кисловодск	kʲislovodsk	kʲɪsɫɐˈvot͡sk	Kislovodsk	0.2/0.4
28	Liverpul	Ливерпуль	Orenburg	Оренбург	orʲenburg	ɐrʲɪnˈburk	Orenburg	1.08/0.5
29	Rejk'iavik	Рейкьявик	Arkhangel'sk	Архангельск	arhangʲelʲsk	ɐrˈxangʲɪlʲsk	Arkhangelsk	0.1/1.8
30	Florida	Флорида	Voronezh	Воронеж	voronʲeʒ͡ʒh	vɐˈronʲɪʂ	Voronezj	1.08/3.6

Table 7. Target and control words used in the experiment, transcribed, transliterated and translated into Norwegian.

In Table 5, both the Russian and English transcriptions are done according to the IPA (International Phonetic Alphabet) system's rules and are taken from Wiktionary (n.d.) – a free multifunctional and multilingual dictionary and thesaurus which is one of the projects of the Wikipedia Foundation and is based on wiki engine. It was decided to take into account the American English pronunciation as American English is considered to be the dominant pronunciation among Norwegian speakers due to the influence of the American media (Rindal & Piercy, 2013). The Norwegian transcription is taken from Det Norske Akademis Ordbok (n.d.). The dictionary gives an orthographic transcription as the pronunciation of the words in Norwegian is idiosyncratic and highly influenced by the location where the person lives/spends a considerable amount of time.

According to Table 6, the stress position in the target words is mostly different from one language to another (12 examples out of 30), based on the relative syllables, 8 words have the same stress position in Russian and Norwegian, 6 words are pronounced with the same stress placement in Norwegian and English, and only 4 words share stress position in Russian and English. The stress placement is defined by the chronological placement, thus, there are initial (first) syllable, peninitial (second) syllable, the antepenultimate (third-to-last) syllable, penultimate (second-to-last) syllable and ultimate (the last) syllable (Gordon, 2011, p. 144). The stress both in Russian and Norwegian seems to be placed at the end of the word (ultimate and penultimate stress), while English is characterized with mostly initial and peninitial stress. Most of the target words contain 3 syllables (16 words).

Table 7 presents the list of the target words along with the corresponding list of the control words. The control words do not resemble any words in either Norwegian or English. Nevertheless, the control words are frequency-matched to the target words, moreover, the control words match the other features as well but being a non-cognate word (i.e. a non-cognate word *викторина* vʲiktorʲina 'quiz' matches the target word *креативность* krʲeatʲivnost'

‘creativity’ as they both have 4 syllables, penultimate stress, reduced vowels and their word frequency is 4.2-4.4 units per million). The word frequency value is taken according to a panchronic corpus that considers word forms in history. The values that are shown in the diagram for the year 2021 were regarded in this study. The target toponyms have received their matched control toponyms that happened to be cities in Russia the names of which could be treated as primordially Russian.

3.2. Methodology

3.2.1. The experiment procedure

The experiment was designed after the wordlist was completed. All the words, target and control words, were randomized twice to create 2 lists with different word order. I have created two PowerPoint presentations with two different randomized word orders that I initialized in Excel. Moreover, I have added a feature of the carrier sentence, so the participants were not reading just the words, but the carrier sentence with the target or control word in a focus position between other words. This results in the word being said plainly as read aloud and with the prosodic emphasis due to the position. The carrier phrase has come to be *Я говорю … три раза* ‘I’m saying … three times’. The carrier phrase is always the same, only the words in the focus position change when they are done with one slide and go on with another.

Before the start of the experiment, I gave precise instructions on what was going to happen to the participants, and the consent forms were signed (see Appendix A). Additionally, the participants could read the instructions on the screen as well. The instructions were written in Norwegian in order to enhance the priming effect of L1 Norwegian. As can be understood from the phrase itself, the participants read the carrier phrase that contained one of the words from the list three times in a row. As a result, I have 60 similar sentences with different words

in the middle of them, consequently, a participant had to pronounce 180 sentences out loud. There were three sentences on top that were presented before the main experiment; they were added so the participants had an opportunity to go through them and familiarize themselves with the forthcoming experiment. These three extra sentences contained Russian nouns from different levels of Russian acquisition: *Я говорю* ***«работа»*** *три раза* 'I say «work» three times' – A1; *Я говорю* ***«отношение»*** *три раза* 'I say «attitude/relation» three times' – B1; *Я говорю* ***«свидетель»*** *три раза* 'I say «witness» three times' – C1. After the participant read the test carrier sentence, they could see a definition of the word in Norwegian, which was also done to induce priming. During the test session, they could ask the researcher any question they had. Then they went through the main experiment where they were convinced that I did not examine their understanding of the word, but only their pronunciation; thus, they did not see the explanations of the words in the focus position anymore. They were also allowed to have a break in the middle of the experiment. When they approached the middle of the experiment, the researcher saved the first half of the experiment and let the participants rest if they wanted to; then the new recording started whenever the participant was ready to continue. They proceeded with the second half of the experiment and, when they were finished with it, another audio file was saved.

The participants were recorded in an isolated soundproof phonetic laboratory equipped with a mic recording pack Sontronics STC-3X and headphones Beyerdynamic DT 770 Pro 80 which were connected to the USB audio interface Steinberg UR22. The audio recordings were performed in Praat version 6.2.23 (October 8, 2022) and saved on the researcher's laptop.

3.2.2. Participants

There were nine L1 Norwegian speakers who learned English as their second language and are learning Russian as their third language who participated in the experiment. Most of them responded to the announcement that was posted at the Department of Foreign Languages at the University of Bergen. The participants were taking courses in Russian and/or doing their Bachelor's degree in Russian. Before the experiment, the participants were encouraged to answer some questions from a questionnaire designed together with the consent form (see Appendix B). The responses to the questions from the questionnaire can be found in Table 8:

Participant	**Age**	**Studied Russian (in years)**	**Level of proficiency**	**How often a participant speaks Russian**	**How often a participant listens to Russian**	**Place**
1	26	1.5	A2	daily	daily	Bergen
2	22	5	B2	once a week	daily	Bergen
3	32	2	A1	once a week	once a week	Bergen
4	26	11	B2	once a year	once a week	Trondheim
5	33	1.5	A1	once a week	daily/once a week	Bergen
6	64	1.5	A2	once a week	once a week	Bergen
7	35	1	A1	once a week	daily	Bergen
8	43	5	B2	once a month	once a month	Bergen
9	34	1.5	A2	once a year	once a month	Kristiansand

Table 8. The metadata of the participants.

The participants' mean age is 35 years old, and the mean value of the years they have already spent mastering Russian is 3.3 years. All the participants began learning Russian in their adulthood and most of them started learning the language in Bergen. The level of proficiency ranges from the beginner's level A1 to upper intermediate level B2, according to the CEFR scale that was presented to the participants; they assessed their Russian proficiency themselves using the description of the levels taken from CEFR. The participants improved their language ability by listening to the speech in the Russian language more often than trying to speak on it. 7 out of 9 participants were born and raised in Bergen, and participants 4 and 9 are from Trondheim and Kristiansand respectively. All of them agreed to take part in the present research willingly and anonymously.

3.2.3. Annotation of the collected data

The audio files were processed in Praat after all the participants were recorded. It took around 10-15 minutes for each participant to complete the experiment. It was mentioned in Section 3.2.1. that I have saved 2 audio files, the first one was saved during the break, and the second one was saved after the experiment was completed. However, the audio files needed to be divided in two once again due to the fact that the script that would be used further did not manage to work for longer than 2.5-3 minutes audio files. Thus, the audio files were preprocessed before the annotation by having 4 separate audio files for each participant (15 words were pronounced in the carrier sentence, three times each) and edited by shortening the pauses between and inside of each try to pronounce the carrier sentence with the target or control word in it. In addition, the unsuccessful attempts to pronounce the carrier sentences, meaning when the participants have already pronounced some parts of the sentence, but then stopped and started over again for any reason (they stuttered or did not like the way they

pronounced the word, etc.) were removed as well, leaving only 3 attempts of sentence's pronunciation.

Therefore, I obtained 36 audio files of 2.5-3 minutes in length each, totalling over 1 hour and 30 minutes in total recorded audio. Each file was marked according to the participant number, whichever part of the experiment the audio was taken and the subdivision of the audio (e.g. if the audio file's name is "5-2-1", it means that it is the 5th participant who was recorded in this audio, they go through the second part of the experiment (after a break) and it is the first 15 words of this part that were recorded).

When the audio files were preprocessed, they were ready to be annotated. Only the words in the focusing position were the subjects for annotation. All the words were annotated manually. The process of recordings' annotations consisted of putting the boundaries and included marking the exact phoneme, the word itself, if the word target or control, if the pronounced phoneme was reduced by the participant, the placement of the stress by the participant, and if the stress placement was right. The overview of the annotation in Praat can be seen below (Figure 5):

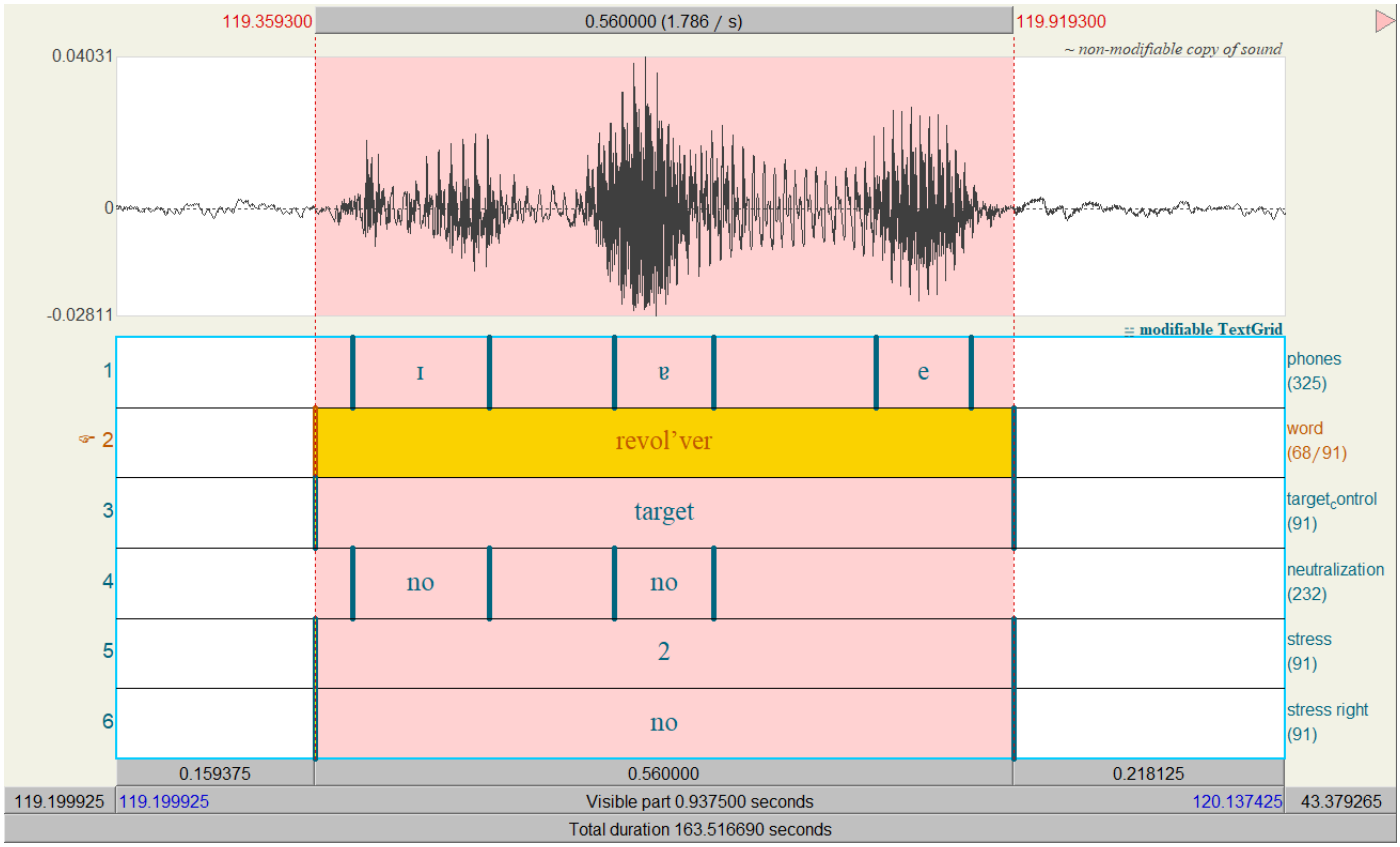


Figure 5. The overview of the annotation in Praat.

In the overview, I wrote the phonemes that were expected to be pronounced by the participants in the "phones" tier. I have managed to annotate all the vowel sounds that could be found in each target and control words, both stressed and unstressed vowels. The second tier contains the whole word and establishes the initial and ending boundaries of the word. It is followed by the "target_control" tier that, as the name implies, indicates whether the word is from the list of the target or control words.

The next tier is closely related to the first tier, as it demonstrates whether the reduction takes place in this specific vowel phoneme in the word (the area is noted as "yes") or was pronounced as if it was stressed with the full articulation or pronounced with a completely different phoneme (it is labelled as "no") (see Section 4.1.1). The classifications were done by the author of this thesis (I speak Standard Russian, English is one of my second languages, my

level of English acquisition is C1 according to the CEFR by the time I am writing this paper; my level of Norwegian skills is B1-B2 as I have finished the Norwegian course Trinn 3 in December 2022).

The “stress” tier implies the placement of the stress, but not where it is supposed to be put in the word by the Russian rules, but instead where the participant has decided to put it. The number illustrates which syllable was stressed by the participant counting from the very start of the word (e.g. number “1” would mean the initial stress). The last tier is called “stress right” which also has a binary evaluation. If the participant puts stress in the word correctly, it is tagged as “yes”, but if the participant has placed the stress on any other syllables but the right one, it is labelled as “no”.

As a result, 1620 words were annotated manually for multiple things resulting in numerous datapoints throughout the study. After the data was annotated, I extracted each tier with the annotations inside Praat and merged specific tiers for the purpose of studying vowel reduction and stress. Thus, the phones, target_control and neutralization tiers were extracted and saved as a separate txt file in order to examine the participants’ ability to reduce vowels in borrowed and native Russian words. The same procedure has been undergone with the word, target_control, stress and stress right tiers to get the necessary values for further research connected to stress.

In addition, measurements were made of F1 and F2 values for each vowel in every word in order to study the placement of the phonemes in the formant dispersion. F1 stands for the formant that is inversely related to vowel height, and F2 illustrates the degree of backness of the vowel.

Stanley & Lipani (2019) proposed a method to extract formant values automatically directly from Praat. Their approach is to process transcription at the phoneme level and extract

formant measurements at the midpoints of each phoneme interval in Praat using a script (Appendix E). The proposed script in Praat extracts F1, F2, F3 and duration from phonemes in an audio file (the F3 value is not taken into consideration in this study). According to the script, the phonemes and the words they were taken from should be pre-annotated before extracting any data. It is recommended to put phonemes at tier 1 and words at tier 2. The script identifies the selected audio and TextGrid files. Next, it calculates the number of phoneme intervals, creates a formant object and loops through each phoneme. After that, it extracts its label, duration, midpoint, associated word, and formant measurements (F1, F2) at the midpoint. The extracted data is written and stored in a CSV file with all the results. The examples of the data from the txt files and the CSV file are shown below in Tables 9, Table 10 and Table 11:

tmin	**tier**	**text**	**tmax**
92.590400	target_control	control	93.570400
92.650400	phones	ɪ	92.900400
92.650400	neutralization	no	92.900400
93.000400	phones	ɪ	93.100400
93.000400	neutralization	no	93.100400
93.160400	phones	o	93.210400
95.956800	target_control	target	96.876800
96.106800	phones	ə	96.156800
96.106800	neutralization	yes	96.156800
96.226800	phones	ʁ	96.296800
96.226800	neutralization	yes	96.296800
96.366800	phones	a	96.516800

Table 9. The sample data from the vowel reduction data.

tmin	**tier**	**text**	**tmax**
92.590400	stress	2	93.570400
92.590400	target_control	control	93.570400
92.590400	stress right	no	93.570400
92.590400	word	piatigorsk	93.570400
95.956800	stress	3	96.876800
95.956800	target_control	target	96.876800
95.956800	stress right	yes	96.876800
95.956800	word	golografiia	96.876800

Table 10. The sample data from the stress placement data.

time	phoneme	F1	F2
96.1318	ə	560.297919036889	1080.7678390626895
96.2618	ɐ	411.04009586086624	1777.2847873429612
96.4418	a	591.4734677398959	1280.59118479124

Table 11. The sample data from the formant data.

3.2.4. Data Preparation and Cleaning

The data preparation and cleaning are the last steps after all the data is acquired. It is an important step in the process of preparing data for analysis since the quality and accuracy of the analysis results depend on the quality of the original data.

The collected data was preprocessed by using R (version 4.3.1) and RStudio (version 2023.06.2) (see Appendix E). First, I put all the files into one specific directory and set a path to the files. First and foremost, the metadata file was uploaded, the column names were tidied and standardized, and a unique participant ID was created (p01, p02, etc.). After that, I proceeded with the wordlist file. From the original word list, firstly it was necessary to extract target words, their transliterations and transcriptions in different languages, tidy and rename the column for ease of use and extract item metadata (stress position, syllable number, word frequency). The control word list and their metadata thereupon were retrieved and processed. Both the target and control words have got their ID and were paired (i.e. the 1st target word *адмирал* admʲiral ‘admiral’ (target_01) and the appropriate 1st control word *магистраль* magʲistralʲ ‘highway’ (control_01) were paired (pair_01)).

The next step was to process the data about stress. I iterated through the stress data files. When the data was read, it was pivoted into a wide format for more effective analysis. The repetition value and participant ID were added, and some columns were renamed, once again,

for better readability. The stress information was combined with the participants' metadata and wordlist.

Moreover, the code iterated through the files containing the information about the vowels' neutralization and the data was converted into a wide format as well. In addition, I got the word-level data points as keys: the name of the file, neutr_condition (target or control), start and end (the position in the audio files, i.e. starting and finishing time stamp when the word was pronounced). The resulting data is combined with the stress and metadata about words and the participants.

Next, the script processes the formant data by reading it from files that were generated from Stanley & Lipani's script (2019). It was also significant to adjust some files and data by solving possible problems with incorrect column headers, converting the data to a numeric format and connecting it with stress and neutralization data via timestamps. Formant data is combined with stress and neutralization data using time intervals.

Finally, all processed data is combined into one file and saved in CSV format. The entire process is represented as a sequence of commands that process various aspects of the data and structure it for more detailed examination. As a result, the structured data frame includes 37 total columns and 4956 entries that will be used in the further analysis. In addition, I have created two TSV files. The first file specifies if the target word matches their stress with Norwegian, English or none of them (L1, L2, none respectively), and the second file demonstrates the position of the stress in Norwegian and English chronologically. Table 12 and Table 13 shows a snippet of the data from both data:

Target word in Cyrillic	Transliteration	English Translation	Match
империализм	impʲerʲialʲizm	imperialism	L1
кардиган	kardʲigan	cardigan	none
рефлексия	rʲeflʲeksʲia	reflection	L2

Table 12. A sample of the Russian stress placement that matches with Norwegian (L1), English (L2) or none.

Target word in Cyrillic	Transliteration	English Translation	Stress position in Norwegian	Stress position in English
империализм	impʲerʲialʲizm	imperialism	5	2
кардиган	kardʲigan	cardigan	1	1
рефлексия	rʲeflʲeksʲia	reflection	3	2

Table 13. A sample of the stress placement of the target words in Norwegian and English.

3.3. Summary

In this section, the processes involved in the analysis of Anglicisms in Russian and their perception by Norwegian speakers learning Russian as a third language (L3) were described in detail. Starting with a review of the Dictionary of Anglicisms of the Russian Language, which is one of the key tools in this study, I provided a thorough overview of the process of its compilation and the criteria for selecting target words and control words.

I designed an experiment in which I audio-recorded the pronunciation of sentences containing the target and control words. These recordings were further annotated in Praat which analyzed the sound and pronunciation of words allowing me to gain valuable data on the perception of words in a focus position.

After collecting the data and annotating it, I moved on to processing and analyzing it in the R programming language. The results, which will be presented in detail in the following sections, allow us to understand the influence of loanwords more deeply on language perception.

To summarize, this section presented the main stages of the research starting with the selection of target and control words and ending with data preparation and cleansing. The resulting methodological framework and detailed description of the processes allow the reader to better understand my approach and rationale for further analysis and interpretation of the results which will be presented in subsequent parts of the study.

4. Results

The results of the data analysis will be shown in this section. This section is divided into two subchapters that cover the topics of reduction/neutralization and stress placement in target words (loanwords) and control words. The section includes a phonological analysis of reduction processes and what difficulties Norwegians encounter when pronouncing Russian words. The study also includes general trends in the placement of stress in the pronunciation of loanwords and control Russian words. The analysis includes cases where the reduction and stress placement correspond to the structure and rules of the L1 Norwegian language, as well as cases where it remains closer to the L3 Russian language.

4.1. Vowel reduction of target and control words

4.1.1. The choice of the phonemes and their evaluation

Throughout the experiment, there were different vowel phonemes encountered and annotated, however, it was agreed to concentrate on the phonemes that were the most frequently encountered. They turned out to be 4 reduced vowels – [ɐ], [ə], [ɛ] and [ɪ]. The [ɐ] and [ə] can be seen in the case of the neutralization of /a/ and /o/. The [ɛ] can be found in the reduction of /e/ when it is found in target words, and [ɪ] is used in the palatalized context mostly when the palatalized consonant precedes /e/ or /i/. All these phonemes were evaluated in terms of the realization of the reduction and marked accordingly in the neutralization tier in Praat.

I will now focus on the reasons why the phonemes could be labelled as non-reduced vowels in more detail. The main reason is the stress placement, namely, a vowel is not reduced if it is stressed, that is, it is fully pronounced and articulated. If the stress is placed in the wrong position, it makes an expected reduced vowel a stressed vowel and, conversely, a stressed vowel is pronounced as a reduced vowel in most cases.

Nevertheless, there could be different reasons for each particular phoneme when they are assessed as non-neutralized in specific cases. When it comes to the [ɐ] and [ə], it is important to remember when and where these phonemes could appear in the word. The [ɐ] can be found in the first pretonic syllable, while the vowel could be reduced to the [ə] when the vowel is located in any other position (especially in the syllable prior to the pretonic syllable or in the post-tonic syllable). It is quite easy to estimate the reduction from /o/ to these phonemes as they are very distinctive, even though they share the [-front] feature, the [ɐ] and [ə] are placed much lower than /o/. Yet it can be complicated sometimes to differentiate the stressed [a] from the reduced [ɐ] and [ə]. Thus, it was noticed that the vowels that took more time for the participant to pronounce ended up being pronounced more clearly and articulated.

The [ɛ] is found when the /e/ is reduced in the non-palatalized context, specifically in target words. That could be explained by the adaptation of the phoneme directly from English. Cho & Jeong (2016, p. 378) state that the factors affecting the adaptation of loanwords of English /ɛ/ were found to be perception, standardization (or cross-language phoneme-to-phoneme correspondence), and orthography. The phoneme is found in 7 loanwords, however, the phoneme [ɛ] was not discovered in the English words that the loanwords derived from to Russian. The pattern could be identified that could explain the appearance of the phoneme, if the hard consonant is followed by /e/, it is pronounced as [ɛ] in loanwords exclusively (e.g. *интерактивность* intʲerakt̪ʲivnostʲ ‘interaction’, *интенсивность* intʲens̪ʲivnostʲ ‘intensity’). In other cases, the [ɛ] sound could occur in the initial position before hard consonants (e.g. *эмпатия* empat̪ʲia ‘empathy’).

As it was mentioned in Section 2.1.1, the [ɪ] can be seen in the palatalized context after the palatalized consonants. If the context is non-palatalized, then /i/ reduces to [ɨ], but this phoneme is not taken into consideration in this study, as there were very few examples. It is /e/ and /i/ that reduce to [ɪ] in most cases of the experiment. Yet again, it is quite simple to perceive

the reduction of /e/ that turns into [ɪ] by ear. When /i/ is not in a stressed position and goes after a palatalized consonant, I share the Iosad's (2012) vision of neutralization and consider [ɪ] to be its neutralized version.

Now that I have chosen the phonemes to which I will turn my attention and have understood the criteria for how the reduction of vowel sounds has been annotated, I can begin to analyze the reduction itself, understand its influence on language processes and see whether there are factors that influence the vowel reduction in the cognate and non-cognate words.

4.1.2. The analysis of the vowel reduction

The data was also analyzed in RStudio (version 2023.06.2) using tidyverse (Wickham et. al., 2019) package after it was pre-processed and cleaned. The ability to use the vowel reduction by the participants was estimated from different perspectives from the data collected. In order to measure how well the participants reduce vowels in a non-stressed position, the overall participants' performance and the performance of each participant during the experiment were taken into account.

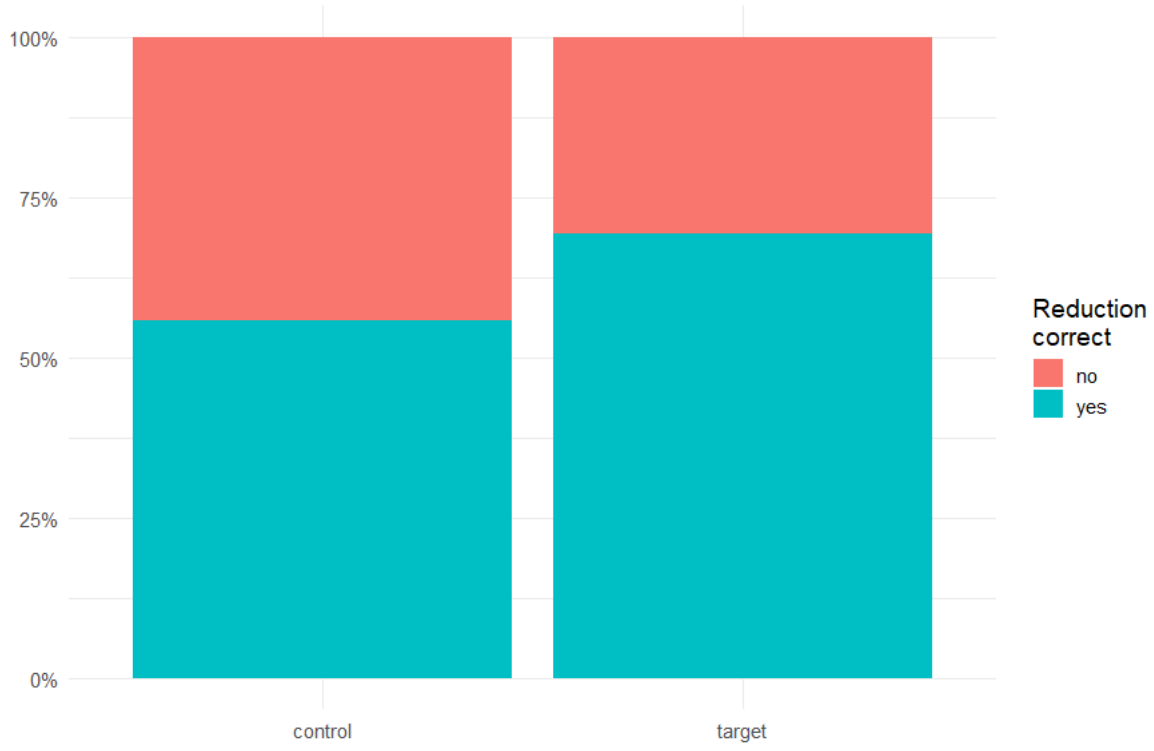


Figure 6. The proportion of correct and incorrect usage of reduction for all the participants.

Figure 6 shows the percentage ratio between target and control words for all participants and how well they managed to deal with the reduction of all unstressed phonemes that I am focusing on. According to this figure, the participants handled the vowel reduction in the target words better than in the control words.

Figures 7 and 8 illustrate more detailed results that demonstrate the ratio between each reduced vowel - [ɐ], [ə], [ɛ] and [ɪ] – for each participant when they pronounced target words (7a) and control words (except for [ɛ]) (7b):

Figure 7. The vowel reduction in the target words for each participant.

Figure 8. The vowel reduction in the control words for each participant.

One can have a closer look at the distribution of the correct usage of every reduced phoneme. From Figure 7, we learn that the distribution is relatively even throughout all the phonemes, with some exceptions to the [ə] sound for some participants. However, Figure 8 shows more varied distribution patterns. The [ə] phoneme seems to be the easiest for them to pronounce in control words, and the [ɐ] phoneme had fairly high accuracy as well in general. Nevertheless, both figures demonstrate that the participants experienced some challenges while reducing the vowel to the [ɪ] phoneme, as it could be noted with the control words. All in all, the results illustrate that the participants are more likely to neutralize the target (borrowed) words than control words.

The analysis of the vowels that were not reduced by participants confirms the previous findings and shows that the [ɪ] and [ə] have more chances not to be pronounced as they are supposed to in the target words. The percentage ratio of incorrect pronunciation of both these phonemes is quite similar - 35.3% and 34.7% (Figure 9). While looking at the Figure 10, it becomes clear that the phoneme that causes the most difficulty to pronounce is [ɪ]:

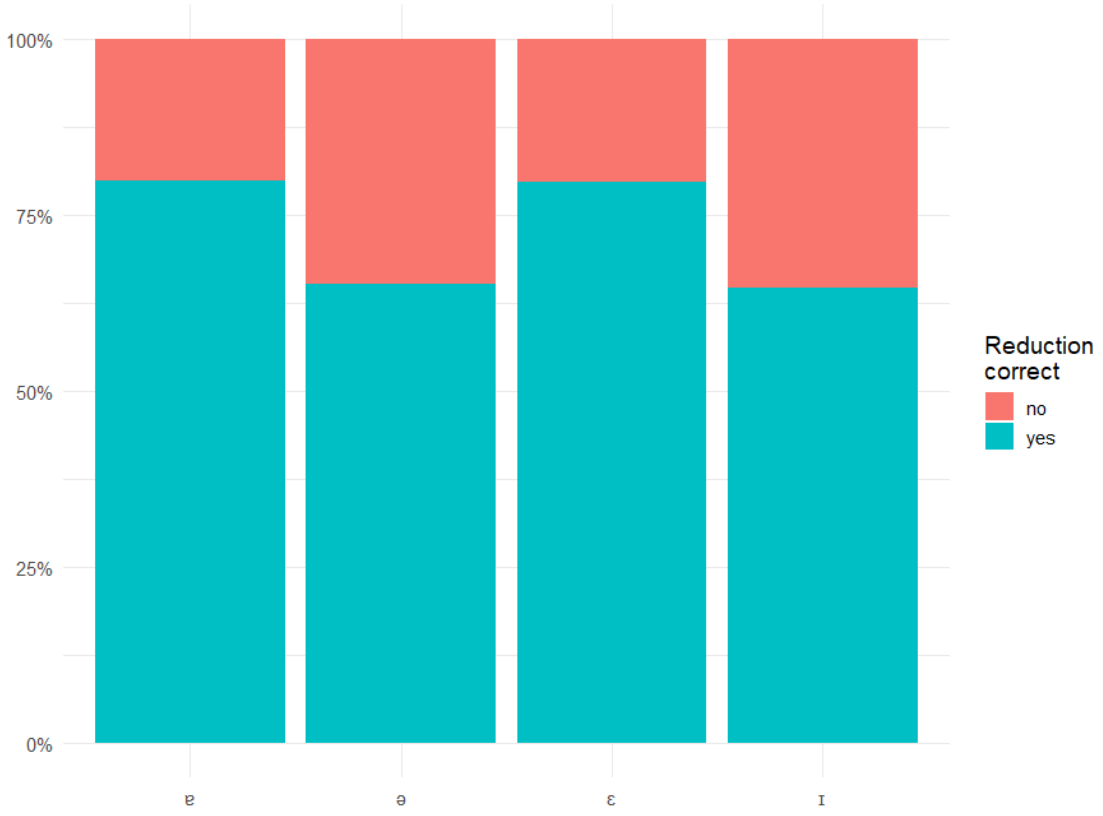


Figure 9. The percentage ratio of the cases when the phoneme was reduced in the target words.

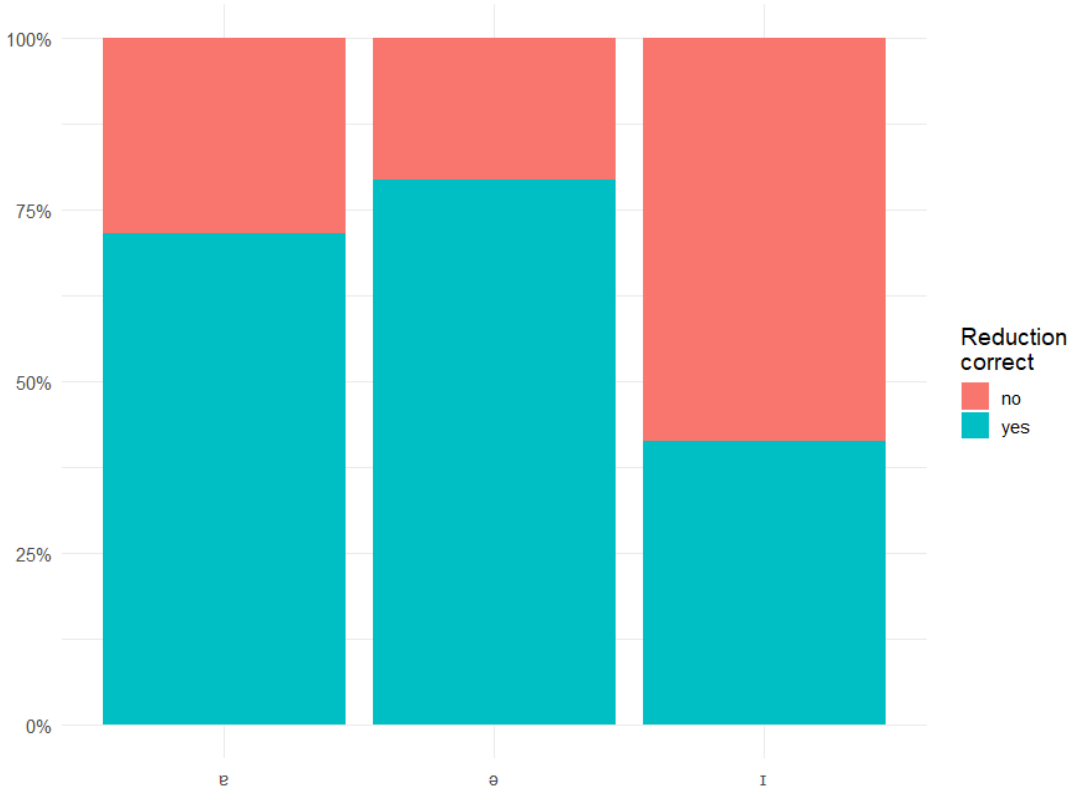


Figure 10. The percentage ratio of the cases when the phoneme was reduced in the control words.

The next thing to be considered and to look at is the words that caused more difficulties to pronounce with the reduction in comparison to the words that were found not that complicated. It can be inferred from Table 14 that there are more control words than target words that were pronounced with the incorrect pronunciation of the vowels where the reduction was expected. Moreover, most of the words on the top of the list contain such vowels as /o/ and /e/ that typically should be reduced to either [ə] or [ɐ], and [ɪ] respectively.

Target word	**n target**	**Control word**	**n control**
elektrichestvo	9	besperspektivnost	9
kompetentsiia	9	ognetushitel	9
kreativnost	9	orenburg	9
imperializm	8	pereezd	9
liverpul	8	predislovie	9
monitor	8	uglevodorod	9
refleksiia	8	velikan	9
rejk'iavik	8	arkhangel'sk	8
revol'ver	8	chemodan	8
golivud	7	chuzhezemets	8
intellekt	7	dvorianin	8
loial'nost	7	gostepriimstvo	8
maneken	7	perezvon	8
parlament	7	grazhdanin	7
empatiia	6	molnieotvod	7
florida	6	stremlenie	7
intensivnost	6	uchenik	7
kardigan	6	voronezh	7
ingaliator	5	zherebets	7
interaktivnost	5	botinok	6
birmingem	4	piatigorsk	6
detektiv	4	edinitsa	5
psikhologiia	4	pekarnia	5
badminton	3	prokhozhdenie	5
golografiia	3	viktorina	5
anesteziia	2	ravnopravie	3
manipuliator	2	kislovodsk	2

interv'iu	1	soglasie	2
kontseptualizm	1	magistral	1
admiral	0	ob"iavlenie	1

Table 14. The ratio of how many participants pronounced the target and control words without vowel reduction, where n target and n control are referred to the number of participants.

In addition, it is interesting to learn whether the non-reduced vowels' articulation is similar to the articulation of the stressed vowels. As it is shown in Figure 11, the articulation and the F1 and F2 values of [o], [ə] and [ɐ] are similar to each other. In addition, the articulation of [ɪ] is more similar to [e], but [ɛ] is located rather closer to [i] articulation than [e].

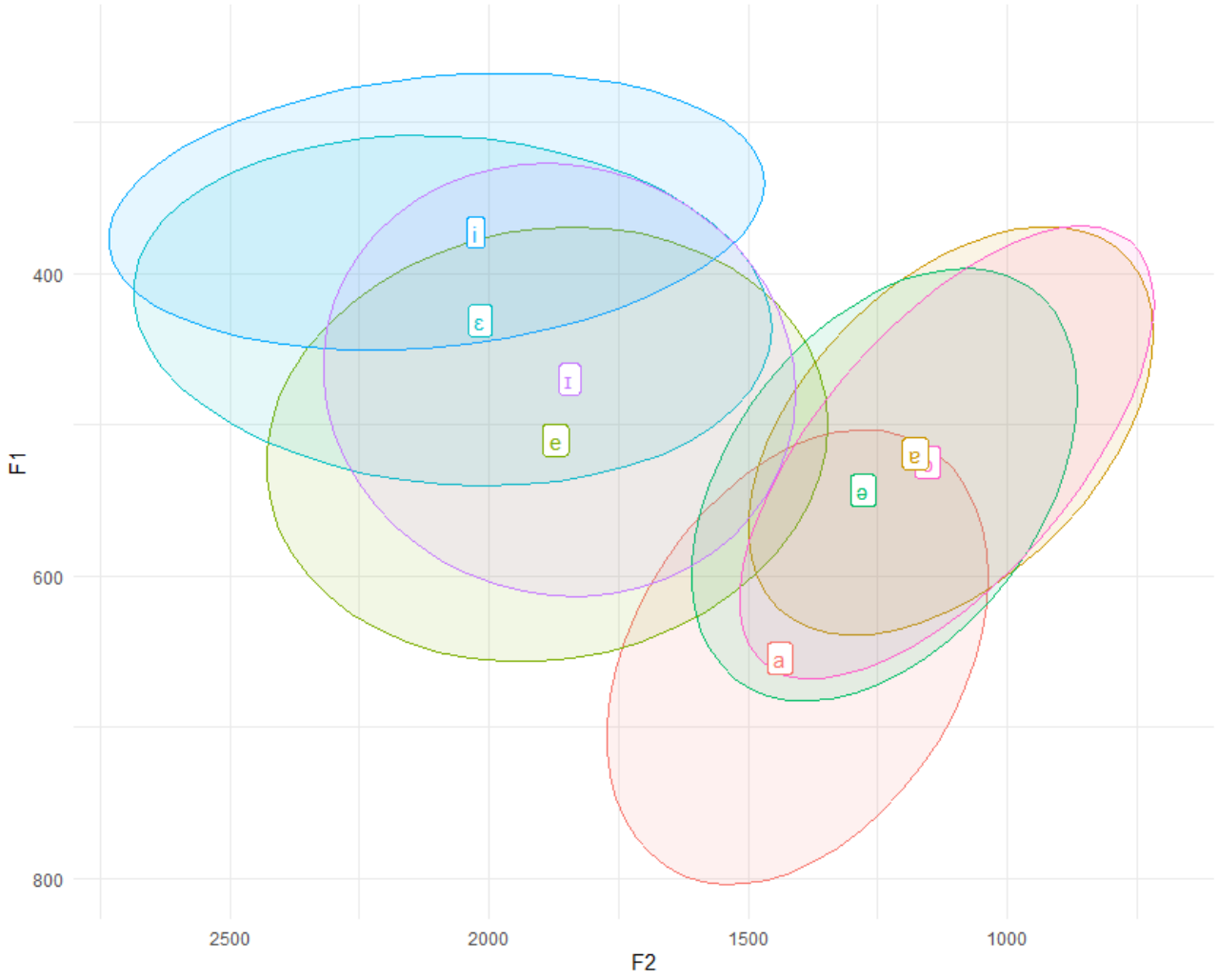


Figure 11. The comparative analysis of the stressed vowels' articulation and the non-reduced vowels.

Finally, the statistical tests were conducted to evaluate the significance of the condition (target or control words) on reduction. Table 15 depicts the distribution of the values based on the condition and reduction:

Reduction	Condition	
	Control	Target
no	757	561
yes	953	1268

Table 15. The distribution of reduced and non-reduced words based on the condition (target or control) of the words.

The Pearson's Chi-squared test with Yates' continuity correction was performed to test the distribution in numbers from Table 15 and showed a significant difference in this distribution:

$\chi^2(1) = 69.32, p < 0.001$

According to the Chi-squared test, the effect of the condition is statistically significant and positive, as the p-value is considerably low, and the X-squared value is much higher. Figure 12 illustrates the distribution more vividly adding the word frequency to it. The frequency was defined as low or high depending on whether the word frequency is below the median log frequency or not:

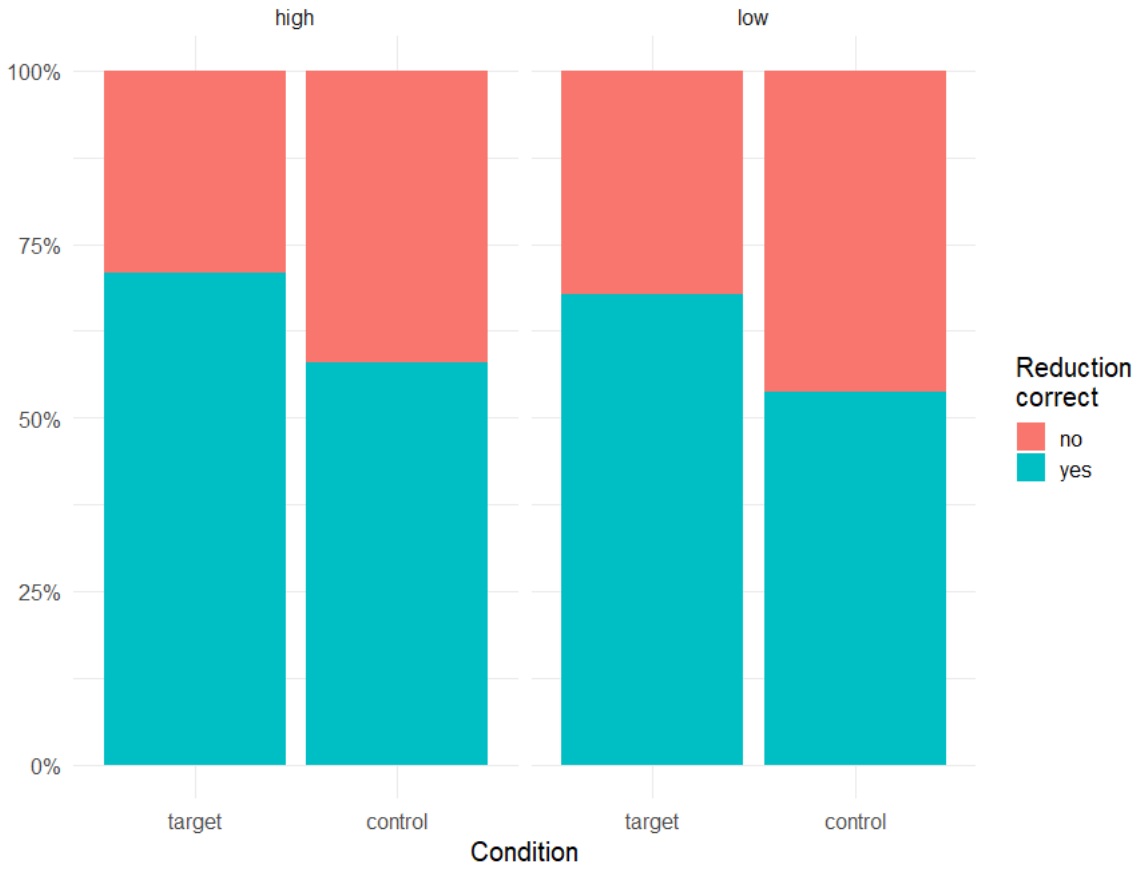


Figure 12. The distribution of the vowel reduction depending on the condition and word frequency.

4.2. The analysis of the stress placement

In this section, I will pay attention to the position of stress in words, especially in cases where errors were made. I considered the placement of stress both from the point of view of each repetition of a word because each word was pronounced 3 times, and generalizing the participants' results as a whole, for example, determining how many participants made a mistake in placing stress in a given word. A detailed analysis of each repetition will reveal patterns and features in the placement of stress in individual participants, and generalized results will help highlight general trends in the group that can tell us about possible difficulties in the correct placement of stress.

It is worthy of note that stress should be considered not only from the chronological point of view but also depending on the word form and their corresponding syllables across the languages. For example, if we take a look at the word *империализм* impʲerʲialʲizm ‘imperialism’, the ultimate syllable is stressed in Russian and it is a penultimate syllable that gets stressed in Norwegian in terms of the relative stress position and word syllable order. Though the position in the words is chronologically different, the same syllable that contains /i/ is stressed in two languages which denotes that there still could be influence from L1 Norwegian. That is why it is important to take 2 TSV files that were mentioned in the section 3.2.4 into consideration in order to get more precise results.

The final point that I would like to highlight is that some Norwegian words could align with Russian stress placement, but the part of speech in Norwegian would be different. For instance, the Norwegian adjective *lojal* ‘loyal’ has the same stress position with Russian *лояльность* loalʲnostʲ ‘loyalty’ in terms of the word form. However, the Norwegian noun *lojalitet* ‘loyalty’ has its stress on the last ultimate syllable, which is completely different from the previous two. Thus, there might be a chance that the participants could borrow the stress position from another part of speech associated with the same root and apply it to the Russian noun, but this study will only focus on nouns in these languages.

Now when we settled on the stress criteria and combined the data presented above (Table 13, Table 14) with the previous data, the stress position can be aligned properly which allows us to analyze the data more efficiently.

Figure 13 shows the participants’ overall performance on stress placement of the target and control words. The participants have put the correct stress in control words slightly better than in target words, but the distribution is still generally balanced.

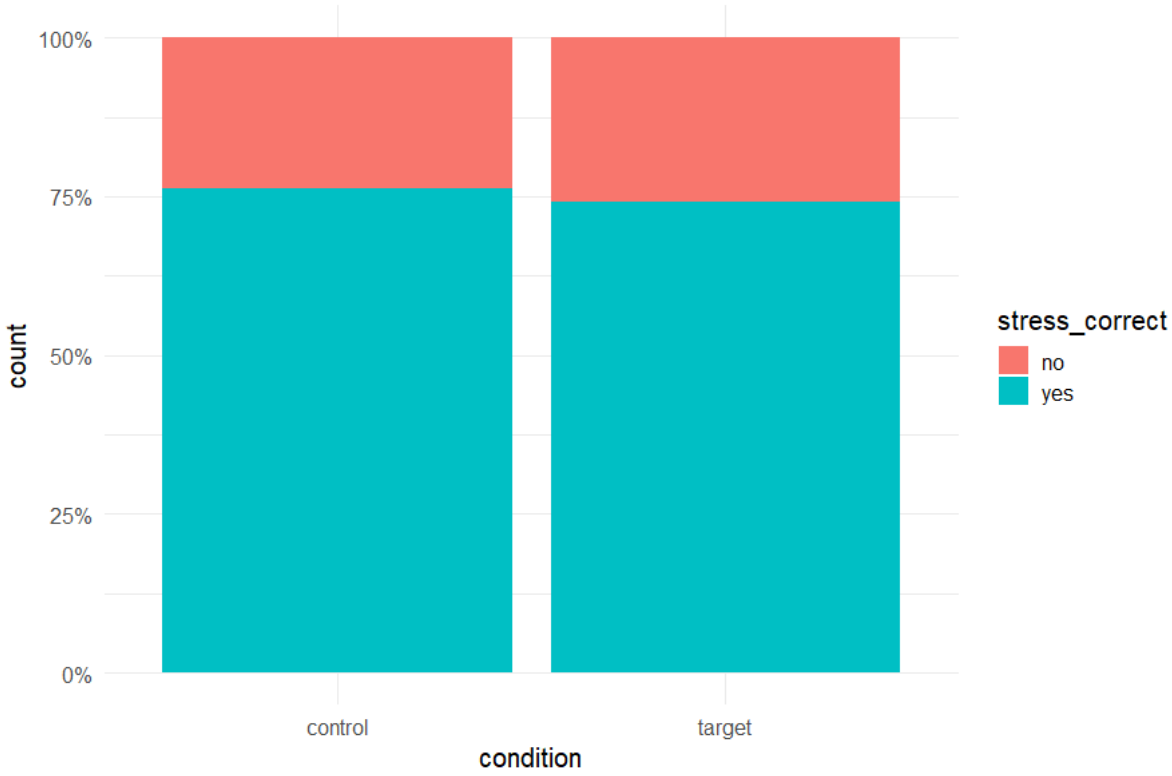


Figure 13. The distribution of the correct/incorrect stress placement in target and control words.

Figure 14 depicts the cases when the participants used the incorrect stress in the word, not considering every repetition they have done, but as incorrect stress placement made by one participant in general, and which language (L1 Norwegian, L2 English or both L1 and L2) this stress placement pattern might have come from. Some words share the stress position in Norwegian and English, and these words seem to be pronounced more often with the incorrect stress. The words that were pronounced with the stress derived from English are commonly the toponyms. There are not so many cases of words that got the Norwegian stress pattern (except for the word *парламент* parlam[j]ent ‘parlament’), along with the cases when the stress did not come from any of three languages:

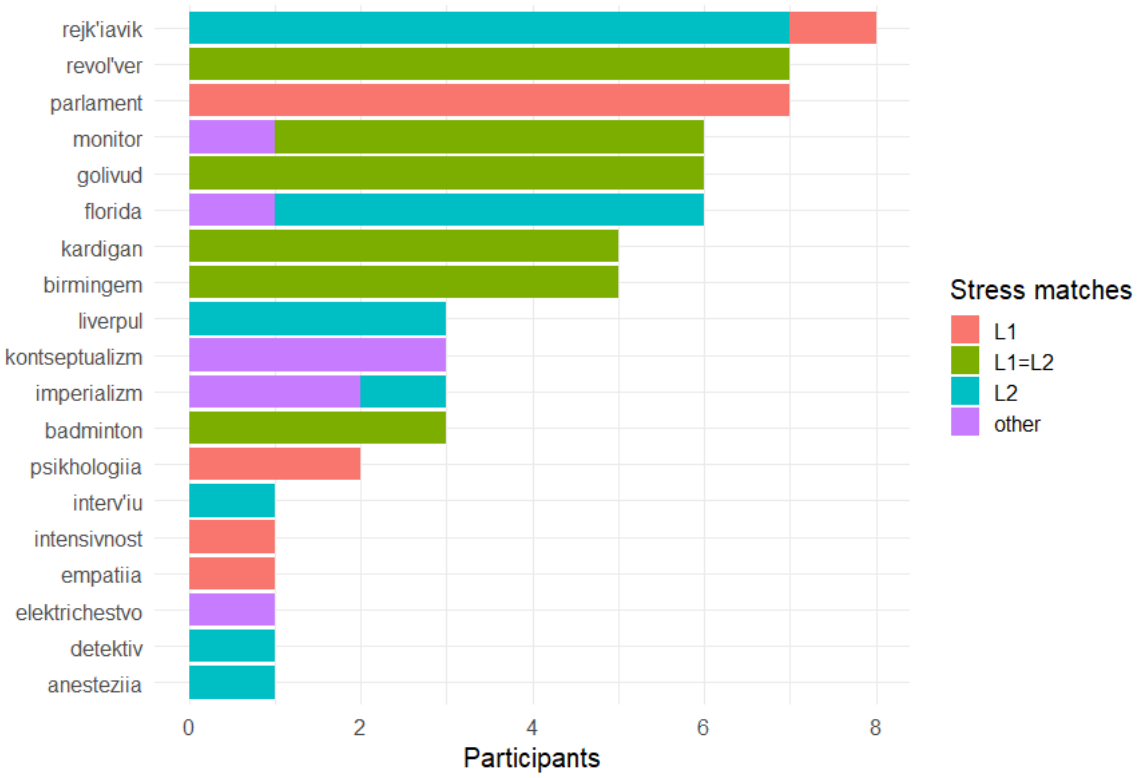


Figure 14. Stress patterns in target words in case of incorrect stress placement.

We will now look at cases where a word was pronounced with the wrong stress, taking into account each repetition of the word. Each word was said 27 times. This allowed us to identify specific words where the greatest difficulty was observed (Figure 15). All the control words are labelled as “other” as there is no language stress pattern that can be compared to these words:

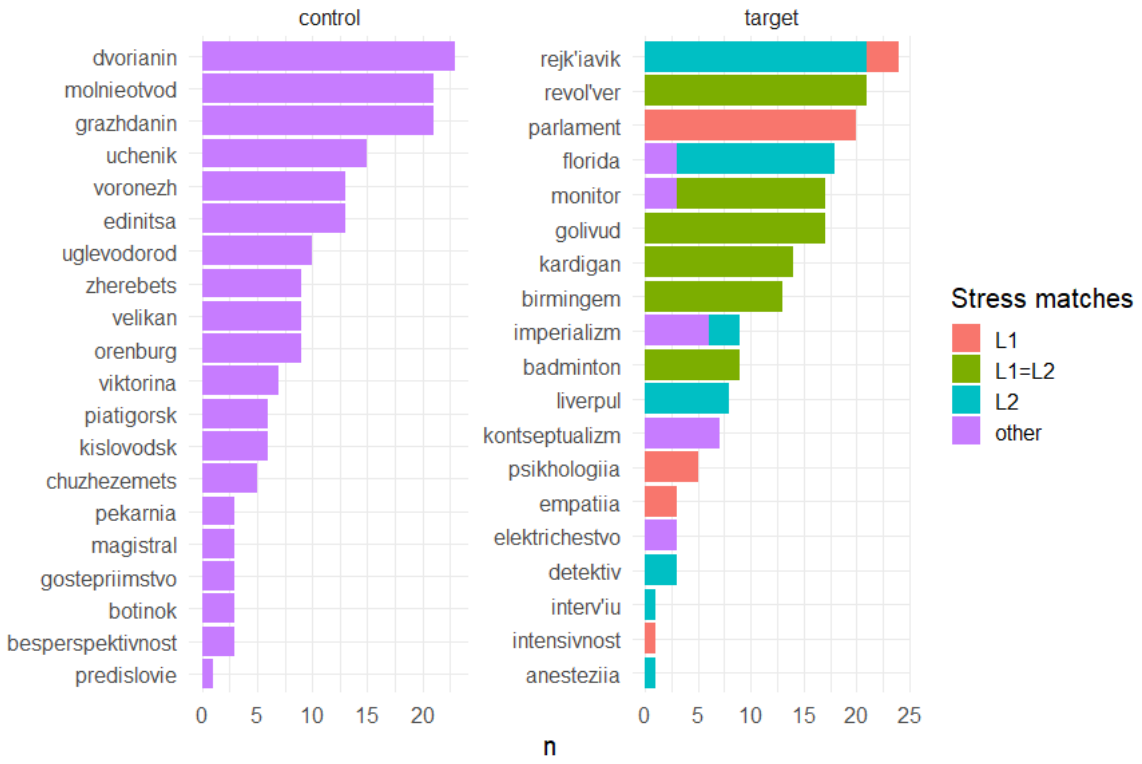


Figure 15. The number of cases of target and control words with incorrect stress placement, where n refers to how many repetitions were made with incorrect stress position.

It was assumed that whenever the participants did not know the control word, they made a guess and followed a specific stress pattern. Figure 16 reveals that in case of incorrect usage of the stress in control words, the participants tend to place stress in the middle of the word: on peninitial (the second) syllable in the words with 3 or 4 syllables in total, and on antepenultimate (the third) or penultimate (the fourth) syllables when the word contained 5 syllables:

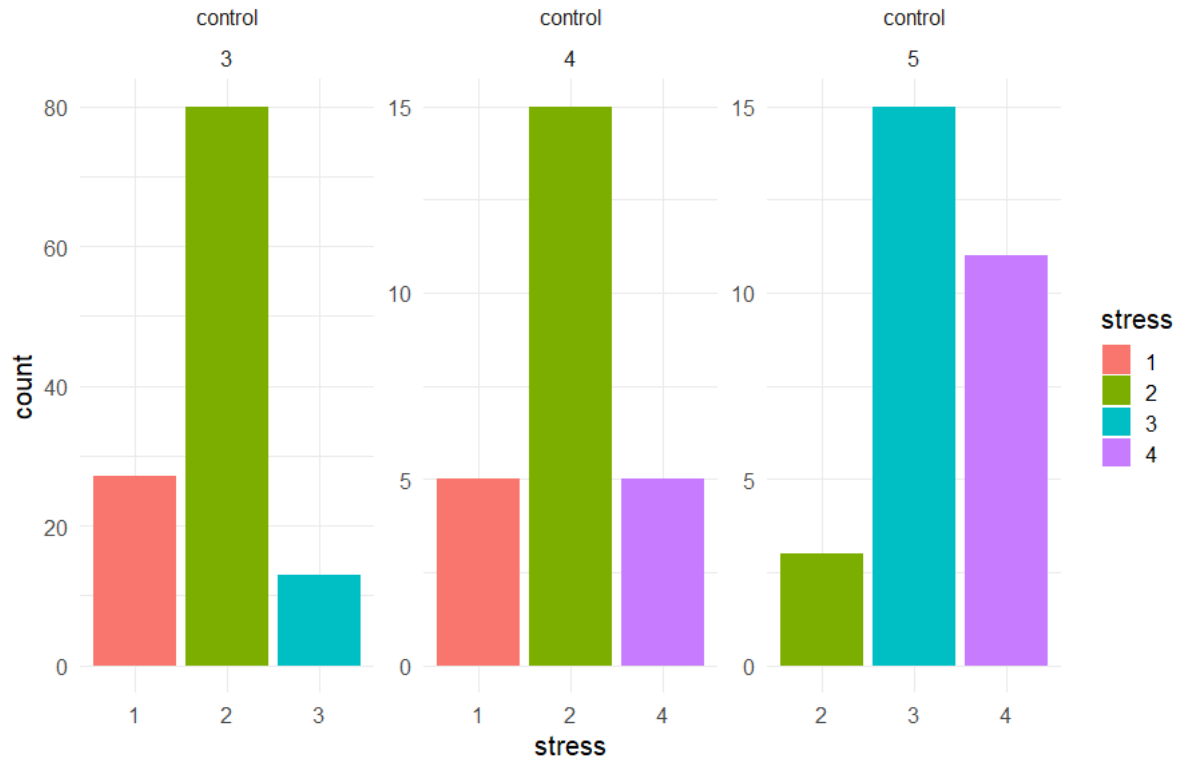


Figure 16. Stress placement in 3-, 4- or 5-syllable control words when participants did not know the right stress position.

Sometimes loanwords in Norwegian and Russian or in English and Russian get the same stress placement, but some of them differ from each other. Table 16 illustrates the distribution of the cases that include whether the Norwegian/English and Russian stress position is the same in the target words and whether the participants have pronounced the word with the correct stress placement:

The same stress in two languages	Correct pronunciation of the stress	
	no	yes
no	147	222
yes	47	337

Table 16. The distribution of the correct stress placement by participants and whether the same stress position is shared in Norwegian/English and Russian.

Pearson's Chi-squared test with Yates' continuity correction was performed to find out whether there is a distributional difference between words with and without the same stress position and whether or not the word is pronounced with the correct stress position in Russian based on Table 16 results. The results are the following:

$\chi^2(1) = 73.5, p < 0.001$

The statistical test has revealed that there is a significant difference in the distribution of correct vs. incorrect stress placement with whether the target word has the same stress placement in the L1/L2.

In Table 17, I considered the frequency dimension and checked the distribution of the values proceeding from the correct placement of the stress in Russian and word frequency. The table shows that the high frequency words are more often correct than the low frequency ones:

Correct pronunciation of the stress	Word frequency	
	low	high
no	147	222
yes	47	337

Table 17. The distribution of correct/incorrect stress placement based on the word frequency.

The Chi-squared test verifies the distribution from Table 17 and the test result reveals that the distribution is significantly different between categories:

$\chi2(1) = 46.925, p < 0.001$

The way in which the L1 Norwegian speakers benefitted from the identical stress placement in target words is illustrated in Figure 17. It shows that the participants significantly benefitted from the same stress position in both languages, especially when the word frequency is high:

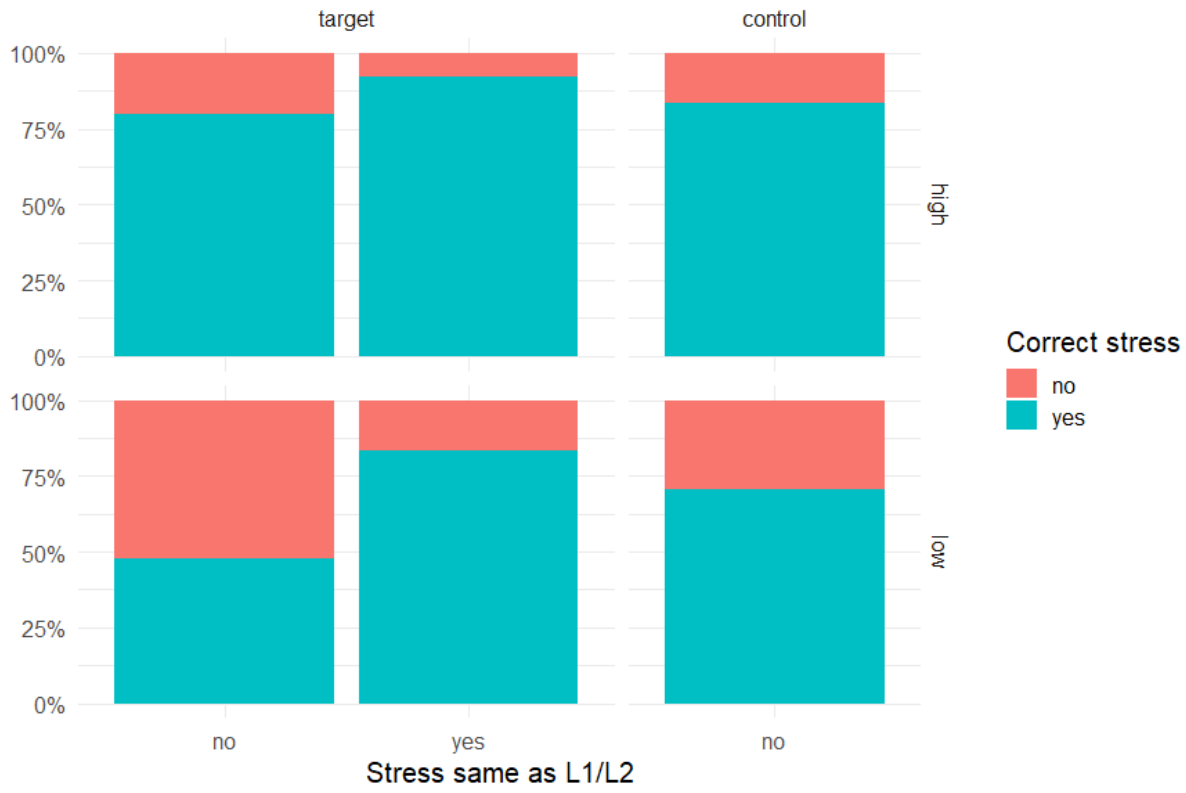


Figure 17. The stress matching categorization in target and control words considering relative word frequency.

4.3. Summary

This section presented the results of our analysis, which consisted of descriptive statistics and statistical tests. Here are detailed data visualizations that helped answer the questions asked earlier in section 1.1. In the next section, we turn to these results to interpret the results and understand the reasons for the observed patterns.

5. Discussion

The results of this study provide an in-depth understanding of the phonological difficulties that native speakers of Norwegian have with Russian as their L3. The main emphasis was placed on the pronunciation of vowels and stress position, specifically in the context of loanwords from English to Russian. In this section, we will discuss the key aspects of our results and their significance for understanding the process of Russian language acquisition by Norwegian speakers.

5.1. Vowel reduction

The results of this study show that the participants find it more difficult to reduce the vowels in the control words rather than in target words. This contradiction with the assumption that control words should undergo vowel reduction more often raises questions about the influence of knowledge of word meaning on articulation processes. It should be noted that the target and control words were carefully selected and compared in terms of such parameters as stress position, number of syllables, and approximately equal frequency of occurrence. This suggests that the difficulties experienced by participants are likely not related to the linguistic characteristics of the words themselves. It seems like the participants found it easier to perform the vowel reduction in the words the meaning of which they were familiar. Knowledge of the meaning of the word, the approximate position of stress and the frequency of use allowed the participant to better reduce vowels. This highlights the importance of the role of semantic context and lexical experience in word production and also raises questions about what other factors may influence articulatory processes in the perception of cognates and non-cognates.

If we turn directly to phonemes, then the data show that the most difficult is the reduction of vowels into the phoneme [ɪ]. The main errors in reduction to the [ɪ] were based on

two factors: non-reduction of /e/ and pronunciation of this vowel with its full stressed articulation, and pronunciation of the consonant that comes before the reduced vowel as a hard consonant rather than a soft consonant. In the first case, an excellent example is the control word *бесперспективность* bʲesʲpʲerspʲekt̪ʲivnostʲ ‘futility’, where each /e/ should be reduced to [ɪ], but the participants said *[besperspekt̪ʲivnəsʲt̪ʲ] instead. In the second case, the phoneme is pronounced as [ɨ], since participants pronounce a hard consonant before it. For example, in the words *великан* vʲelʲikan ‘giant’ and *Голливуд* golʲivud ‘Hollywood’ /l/ is pronounced as a hard consonant, which makes /i/ be pronounced closer to the phoneme [ɨ] (see Figure 1). This can indicate phonetic assimilation or the influence of surrounding sounds on vowel articulation.

As in the case with the reduction of /e/ to [ɪ], another challenge for the participants tends to be the reduction of the vowel /o/ into [ə] or [ɐ]. Even if the participants do not put the stress on /o/, it is rather difficult to pronounce it in a reduced way. This could be witnessed especially in case if the last syllable contains /o/ (*креативность* krʲeat̪ʲivnostʲ ‘creativity’, *лояльность* loalʲnostʲ ‘loyalty’, *интенсивность* int̪ʲensʲivnostʲ ‘intensity’). Moreover, if the word contains both /o/ and /e/ in the unstressed positions, it tends to be pronounced incorrectly more often (see Table 14).

The theory that /o/ and /e/ in unstressed syllables, if they are not reduced, are similar to their stressed phonemes, is confirmed by Figure 9. One can clearly see how the articulation of [ə] and [ɐ] coincides with the articulation of [o]. The articulation of [ɪ] when it is reduced incorrectly overlaps over the articulation [e] as well coinciding with it in most of the area, but not that explicitly as it happens with [o].

In addition to the above factors, the Chi-squared test revealed significant effects of the word condition on vowel reduction. Data analysis shows that this parameter has a significant impact on vowel reduction processes. Figure 10 shows a clear pattern where the probability of

both high and low-frequency target words getting reduced is higher than with the control words. In summary, the Chi-square test adds to the understanding of the influence of various factors on vowel reduction by highlighting the word condition.

5.2. Stress position

As mentioned in section 4.2., it is important to consider the chronological stress position and the stress position based on the word form in different languages. The analysis demonstrates that usually the control words were pronounced with the correct stress slightly more often than the target words.

The detailed analysis of the incorrect stress placement in each word considering every repetition or the participants, in general, showed the patterns for the words that were pronounced with the stress that derived from Norwegian (e.g. парламент parlamʲent 'parlament' – the last syllable is stressed), English (e.g. *Рейкьявик* rʲejkʲjavik 'Reykjavik' – the first syllable is stressed) or both languages as they share the same stress position in the word (e.g. *револьвер* rʲevolʲvʲer 'revolver'), or an absolutely different pattern that could not be explained (e.g. *империализм* impʲerʲialʲizm 'imperialism' with the stress on the fourth syllable, *монитор* monʲitor 'monitor' with the stress on the second syllable). It can be confidently asserted that positive transfer is clearly visible, in that matching stress across languages facilitates accuracy in L3 Russian. However, when the stress placement is wrong, it tends to overlap with L1, L2 or both.

When the participants saw a target word, the stress pattern from L1 and L2 could help them to guess which syllable could be stressed. However, it was more challenging to do so when a control word came up on the screen, as they could not borrow the knowledge about this word and its potential stress position from another language. Therefore, the participants were

trying to guess using a specific stress position pattern, where they tended to place stress in the middle of the word when they had not encountered a control word before. The pattern seems to not follow Norwegian or English stress placement patterns, as the Norwegian stress system is drawn to the last two syllables, while the English one inclines to the beginning of the word. Thus, the results of this aspect of the study highlight the influence of linguistic context on the perception and placement of word stress, especially in situations where participants are exposed to unfamiliar control words that have no counterparts in their native languages.

A Chi-square test was also conducted to identify the relationship between the stress position of these words and the correct stress position. Statistical analysis of the data confirmed the statistical significance of the coincidence of stress position. The range between the target words that have the same stress placement in Norwegian/English and Russian and those that differ in those two languages is relatively large. Moreover, the distribution of the stress placement for the control words is lower than for the target words with the same stress and significantly higher than for the target words with different stress positions, which significantly increases the importance of such a factor as the same position of the stress. Another factor that is statistically significant to the research on the stress position is turned to be word frequency. Therefore, if the target word has a high word frequency, it is most likely to be pronounced with the right stress. The difference between the target words that have different stress in L1/L2 and L3 and different word frequencies is much greater. The word frequency seems to lightly affect the stress placement of the control words. The statistically significant agreement between stress position and word frequency suggests that L1 Norwegian speakers successfully apply their linguistic expertise to correct stress in L3 Russian, especially in the case of high-frequency words.

5.3. Conclusion

In conclusion, our study of the phonological difficulties experienced by Norwegian speakers when using Russian as a third language (L3) provides valuable evidence of the influence of L1 Norwegian and L2 English on the articulatory processes. The results indicate the importance of these factors in Russian language acquisition and highlight the difficulties of vowel reduction, especially in control words. Open questions about the influence of word meaning knowledge on articulation processes add a new dimension to the understanding of language acquisition.

The results of the analysis highlight the importance of the influence of stress structure in native (L1) and second languages (L2) on Russian language acquisition and support the idea of the relationship between the native and second languages when mastering the third language. Norwegian speakers successfully use their linguistic knowledge to place stress when the stress position in Russian coincides with the one from Norwegian or English, especially in the case of high frequency words.

5.4. Further research

This study represents a significant contribution to the understanding of language dynamics, but additional research could deepen our understanding of phonological aspects and expand the scope of the findings.

This research involved the development of data that included a huge number of data points and measurements that were successfully used and analyzed. The data obtained from the participants of the experiment represent a valuable resource and can also be used in subsequent studies that examine vowel reduction and stress placement in the Russian language. The format

of the study itself can also be used as a basis for new studies, where the results can be tested against new data obtained.

Expanding the scope of the survey to other aspects of phonology, such as palatalization of consonants before vowels, represents one promising direction. The lack of palatalization before vowels can significantly affect the articulation and pronunciation of vowels and, therefore, have important implications for the process of vowel reduction. Therefore, palatalization may be one of the factors considered in this type of research. In this study, each target and control word have a palatalized consonant; that allows the data provided in this research to be used to examine this aspect in the future.

List of Appendices

A. The consent forms

The following consent forms were provided to the participants before the start of the experiment:

CONSENT TO AUDIO RECORDING & TRANSCRIPTION

(Olga Lisova, University of Bergen)

This study involves the audio recording of your pronunciation. Neither your name nor any other identifying information will be associated with the audio or audio recording or the transcript. Only the research team will be able to listen to the recordings and the audio recordings will not be made available in any report of the results.

The recordings will be transcribed by the researcher and erased once the transcriptions are checked for accuracy. Transcripts of your recordings may be reproduced in whole or in part for use in presentations or written products that result from this study. Neither your name nor any other identifying information (such as your voice) will be used in presentations or in written products resulting from the study.

By signing this form, I am allowing the researcher to record audio of me as part of this research. I also understand that this consent for recording is effective until the following date: 31.12.2023. On or before that date, the recordings will be permanently deleted.

Participant's Signature: _____Date:_____

CONSENT TO TAKE PART IN RESEARCH

I…… voluntarily agree to participate in this research study.

- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I have had the purpose and nature of the study explained to me and I have had the opportunity to ask questions about the study.
- I understand that participation involves being audio-recorded and that these recordings will be further transcribed and analyzed in the research and I agree to that.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous.
- I understand that only the audio recordings are stored and transcribed and no original recordings will be used after they have been transcribed.
- I understand that signed consent forms and original audio recordings will be retained until the exam board confirms the results of the master thesis.
- I understand that under freedom of information legalization, I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Researcher – Olga Lisova (olga.lisova@student.uib.no)
Academic supervisor - Carl Börstell (carl.borstell@uib.no)

Signature of research participant

---------- ----------
Signature of participant Date

Signature of researcher
I believe the participant is giving informed consent to participate in this study

---------- ----------
Signature of researcher Date

B. Questionnaire

The participants are asked to fill out the following questionnaire before they do the experiment:

QUESTIONNAIRE

1. Your age:

2. How long have you been studying Russian for?

3. How do you rate your proficiency level in Russian on the CEFR scale?

- CEFR A1: Can understand and use familiar everyday expressions and very basic phrases. Can interact in a simple way provided the other person talks slowly and clearly and is prepared to help.
- CEFR A2: Can understand sentences and frequently used expressions related to areas of most immediate relevance. Can communicate in simple and routine tasks requiring a simple and direct exchange of information on familiar and routine matters.
- CEFR B1: Can understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc. Can describe experiences and events, dreams, hopes & ambitions and briefly give reasons and explanations for opinions and plans.
- CEFR B2: Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialisation. Can interact with a degree of fluency and spontaneity.
- CEFR C1: Can understand a wide range of demanding, longer texts, and recognise implicit meaning. Can express him/herself fluently and spontaneously without much obvious searching for expressions.
- CEFR C2: Can understand with ease virtually everything heard or read. Can express him/herself spontaneously, very fluently and precisely.

4. How often do you **speak** Russian with other people:

    - daily
    - once a week
    - once a month
    - once a year

5. How often do you **listen to** Russian (from other people, on TV, online, etc):

    - daily
    - once a week
    - once a month
    - once a year

C. Instructions for the participants

The following instructions were suggested to read before the start of the testing part and experiment itself:

Text 1. The introduction and instructions

Velkommen!

Du er i ferd med å se en rekke med setninger. Setningen vil alltid være den samme, unntatt ett ord som vil endre seg. Du må lese hele setningen som du ser tre ganger. Tiden måles ikke, så du har lov til å lese gjennom setningen stille så mange ganger du vil, og når du føler deg forberedt **leser du setningen høyt tre ganger på rad**.

De tre første setningene er bare en test for å gjøre deg kjent med eksperimentet. De inneholder en forklaring på ordet som endres, trykk på → på tastaturet for å se en tolkning av ordet og trykk på den igjen for å se neste setning.

Husk at når du er ferdig med de tre testsetningene, vil du ikke se en forklaring på ordene du vil se videre.

All deltakelse er frivillig og anonym. Du kan stoppe eksperimentet når som helst uten konsekvenser for deg eller si «pass» dersom du ikke kan lese ordet.

Trykk på → på tastaturet for å fortsette.

Text 2. The instructions before the main experiment

Hovedeksperimentet er i ferd med å starte.

Du vil ikke lenger se en oversettelse av ordet, men husk at vi vil ikke fokusere på forståelsen av ordene: oppgaven er bare å lese setningen høyt så godt du kan.

Sørg for å uttale hele setningen tre ganger på rad i det tempo du ønsker.

Trykk på → på tastaturet for å fortsette.

When the participant completes the first half of the experiment part, the following message will pop up signaling the middle of the experiment and offering to have a break:

Text 3. The middle of the experiment and time for the break

Du er ferdig med halvparten av eksperimentet.

Du kan ta en liten pause nå.

Vennligst be forskeren komme og lagre opptaket av den første delen av eksperimentet.

Trykk på → på tastaturet for å fortsette.

When the experiment is completed, the participant sees the next message:

Text 4. The end of the experiment

Du er ferdig med eksperimentet!

Takk for din deltagelse!

Ha en fin dag videre ;)

D. The carrier sentences with target and control words in them

The carrier sentences that include target and control words and which are placed into the focus position are presented below in Table 18:

N	Sentence	Target/control
1.	Я говорю **«адмирал»** три раза	target_01
2.	Я говорю **«анестезия»** три раза	target_02
3.	Я говорю **«бадминтон»** три раза	target_03
4.	Я говорю **«голография»** три раза	target_04
5.	Я говорю **«детектив»** три раза	target_05
6.	Я говорю **«империализм»** три раза	target_06
7.	Я говорю **«ингалятор»** три раза	target_07
8.	Я говорю **«интеллект»** три раза	target_08
9.	Я говорю **«интенсивность»** три раза	target_09
10	Я говорю **«интерактивность»** три раза	target_10
11	Я говорю **«интервью»** три раза	target_11
12	Я говорю **«кардиган»** три раза	target_12
13	Я говорю **«компетенция»** три раза	target_13
14	Я говорю **«концептуализм»** три раза	target_14
15	Я говорю **«креативность»** три раза	target_15
16	Я говорю **«лояльность»** три раза	target_16
17	Я говорю **«манекен»** три раза	target_17
18	Я говорю **«манипулятор»** три раза	target_18
19	Я говорю **«монитор»** три раза	target_19
20	Я говорю **«парламент»** три раза	target_20

21	Я говорю **«психология»** три раза	target_21
22	Я говорю **«револьвер»** три раза	target_22
23	Я говорю **«рефлексия»** три раза	target_23
24	Я говорю **«электричество»** три раза	target_24
25	Я говорю **«эмпатия»** три раза	target_25
26	Я говорю **«Голливуд»** три раза	target_26
27	Я говорю **«Бирмингем»** три раза	target_27
28	Я говорю **«Ливерпуль»** три раза	target_28
29	Я говорю **«Рейкьявик»** три раза	target_29
30	Я говорю **«Флорида»** три раза	target_30
31	Я говорю **«магистраль»** три раза	control_01
32	Я говорю **«огнетушитель»** три раза	control_02
33	Я говорю **«перезвон»** три раза	control_03
34	Я говорю **«равноправие»** три раза	control_04
35	Я говорю **«гражданин»** три раза	control_05
36	Я говорю **«углеводород»** три раза	control_06
37	Я говорю **«чужеземец»** три раза	control_07
38	Я говорю **«переезд»** три раза	control_08
39	Я говорю **«единица»** три раза	control_09
40	Я говорю **«бесперспективность»** три раза	control_10
41	Я говорю **«ученик»** три раза	control_11
42	Я говорю **«великан»** три раза	control_12
43	Я говорю **«прохождение»** три раза	control_13
44	Я говорю **«молниеотвод»** три раза	control_14

45	Я говорю **«викторина»** три раза	control_15
46	Я говорю **«ботинок»** три раза	control_16
47	Я говорю **«дворянин»** три раза	control_17
48	Я говорю **«гостеприимство»** три раза	control_18
49	Я говорю **«чемодан»** три раза	control_19
50	Я говорю **«пекарня»** три раза	control_20
51	Я говорю **«предисловие»** три раза	control_21
52	Я говорю **«жеребец»** три раза	control_22
53	Я говорю **«стремление»** три раза	control_23
54	Я говорю **«объявление»** три раза	control_24
55	Я говорю **«согласие»** три раза	control_25
56	Я говорю **«Пятигорск»** три раза	control_26
57	Я говорю **«Кисловодск»** три раза	control_27
58	Я говорю **«Оренбург»** три раза	control_28
59	Я говорю **«Архангельск»** три раза	control_29
60	Я говорю **«Воронеж»** три раза	control_30

Table 18. The carrier phrases containing target and control words.

E. The Praat script for the automatic formants' value extraction

```
writeInfoLine: "Extracting formants..."

# Extract the names of the Praat objects

thisSound$ = selected$("Sound")

thisTextGrid$ = selected$("TextGrid")

# Extract the number of intervals in the phoneme tier.

# This is so that we know how many iterations to do in the for loop.

select TextGrid 'thisTextGrid$'

numberOfPhonemes = Get number of intervals: 1

appendInfoLine: "There are ", numberOfPhonemes, " intervals."

# Create the Formant Object

select Sound 'thisSound$'

To Formant (burg)... 0 5 5000 0.025 50

# Create the output file and write the first line.

outputPath$ = " formants.csv"

writeFileLine: "'outputPath$'", "time,phoneme,F1,F2"

# Loop through each interval on the phoneme tier.

for thisInterval from 1 to numberOfPhonemes

   #appendInfoLine: thisInterval

# Get the label of the interval
```

```
    select TextGrid 'thisTextGrid$'
    thisPhoneme$ = Get label of interval: 1, thisInterval
    #appendInfoLine: thisPhoneme$
# Find the midpoint.
    thisPhonemeStartTime = Get start point: 1, thisInterval
    thisPhonemeEndTime   = Get end point:   1, thisInterval
    duration = thisPhonemeEndTime - thisPhonemeStartTime
    midpoint = thisPhonemeStartTime + duration/2
# Extract formant measurements
    select Formant 'thisSound$'
    f1 = Get value at time... 1 midpoint Hertz Linear
    f2 = Get value at time... 2 midpoint Hertz Linear
    # Save to a spreadsheet
    appendFileLine: "'outputPath$'",
                    ...midpoint, ",",
                    ...thisPhoneme$, ",",
                    ...f1, ",",
                    ...f2
endfor
appendInfoLine: newline$, newline$, "Whoo-hoo! It didn't crash!"
```

F. The script for Data Preparation and Cleaning

```
# Load libraries -------------------------------------------------------

library(tidyverse)
library(scales)
library(readxl)
# Read files -----------------------------------------------------------
# Set path to all files
dir_path <- " ./Neutralization and stress position experiment/"

# Get metadata
### Participants
metadata <- read_xlsx(paste0(dir_path, "metadata about the participants.xlsx"))

# Tidy column names
metadata<- metadata %>%
  rename("participant" = `Participant n`,
         "age" = Age,
         "level" = Level,
         "place" = Place,
         "years_russian" = `Studied_russian(in_years)`,
         "speak_russian" = How_often_speak_russian,
         "listen_russian" = How_often_listen_to_russian) %>%
  mutate(participant = paste0("p", str_pad(participant, pad = "0", width = 2)))

### Wordlist
# Original wordlist
wordlist_original <- read_excel(paste0(dir_path, "final_wordlist.xlsx"))

# Extract targets and tidy column names
```

```
targets <- wordlist_original %>%
  select(c(target:rus_nor_stress,word_frequency_)) %>%
  mutate(item = paste0("target_", str_pad(row_number(), pad = "0", width = 2))) %>%
  mutate(pair = paste0("pair_", str_pad(row_number(), pad = "0", width = 2))) %>%
  relocate(item:pair, 1:2) %>%
  rename("word" = target,
         "rus_orthographic" = rus_target,
         "nor_orthographic" = norwegian,
         "word_frequency" = word_frequency_)

# Extract item metadata
word_meta <- targets %>%
  select(stress_position:word_frequency)

# Extract controls and tidy column data and add metadata
controls <- wordlist_original %>%
  select(control:fillers_translation) %>%
  mutate(item = paste0("control_", str_pad(row_number(), pad = "0", width = 2))) %>%
  mutate(pair = paste0("pair_", str_pad(row_number(), pad = "0", width = 2))) %>%
  relocate(item:pair, 1:2) %>%
  rename("word" = control,
         "rus_orthographic" = rus_control,
         "rus_transliteration" = fillers_transliteration,
         "rus_transcription" = fillers_transcription,
         "nor_orthographic" = fillers_translation) %>%
  bind_cols(word_meta) %>%
  select(-c(stress_position, stress_rus, stress_eng, stress_nor, rus_nor_stress))

wordlist <- bind_rows(targets, controls)
```

```
### Stress files
# Iterate through stress files and pivot data to wide
stress <- list.files(dir_path, full.names = TRUE, recursive = TRUE, pattern = "stress.*\\.txt") %>%

  # Iterate and read files
  set_names(basename) %>%
  map(read_tsv) %>%
  list_rbind(names_to = "file") %>%

  # Pivot to wide format
  pivot_wider(names_from = tier, values_from = text) %>%

  # Add repetition count
  mutate(repetition = row_number(), .by = c(file, word)) %>%

  # Extract participant id from file name
  mutate(participant = str_extract(file, "\\d")) %>%
  mutate(participant = paste0("p", str_pad(participant, pad = "0", width = 2))) %>%
  relocate(participant, .after = file) %>%

  # Tidy column names
  rename("stress" = stress,
         "stress_correct" = `stress right`,
         "condition" = target_control) %>%

  # Extract the recording
  mutate(recording = gsub("stress|\\.txt", "", file)) %>%

  # Join stress data with metadata (wordlist and participants)
  left_join(wordlist, join_by(word)) %>%
```

```
  left_join(metadata, join_by(participant))

# Some items have NA values for stress_correct
#stress %>%
#filter(is.na(stress_correct))

### Neutralization
# Iterate through neutr files
neutr <- list.files(dir_path, full.names = TRUE, recursive = TRUE, pattern = "neutr.*\\.txt") %>%
  rlang::set_names(basename) %>%
  purrr::map(read_tsv) %>%
  purrr::list_rbind(names_to = "file") %>%
  pivot_wider(names_from = tier, values_from = text) %>%
  mutate(recording = gsub("neutr|\\.txt", "", file)) %>%
  rename("neutr_condition" = target_control)

# Get only the word-level data points as keys
neutr_words <- neutr %>%
  filter(!is.na(neutr_condition)) %>%
  rename("start" = tmin,
         "end" = tmax) %>%
  select(file, neutr_condition, start, end)

# Combine phone data with stress and metadata through keys
stress_neutr <- neutr %>%
  filter(is.na(neutr_condition)) %>%
  select(-neutr_condition) %>%
  left_join(neutr_words, join_by(file,
                                 tmin >= start,
                                 tmax <= end)) %>%
```

```
  left_join(stress %>% select(-file),
            join_by(recording,
                    start == tmin,
                    end == tmax),
            keep = FALSE)


a = c('b', 'c', 'd', 'f', 'g', 'h', 'ju', 'je', 'k', 'l', 'm', 'n', 'p', 'r', 's', 't', 'v', 'y', 'z', 'ɨ', 'ɪ̯ə','ɪ̯ɪ', 'ʊ','u',',',',jæ')
stress_neutr <-  stress_neutr[ !stress_neutr$phones %in% a, ] %>%
  drop_na(phones)


### Formants
# Iterate through formant files
formants <- list.files(dir_path, full.names = TRUE, recursive = TRUE, pattern =
"formants.*\\.xlsx") %>%
  rlang::set_names(basename) %>%
  purrr::map(read_xlsx) %>%
  purrr::list_rbind(names_to = "file") %>%

  # Adjust some files that have incorrect headers
  mutate(time = if_else(is.na(time), Column1, time),
         phoneme = if_else(is.na(phoneme), Column2, phoneme),
         F1 = if_else(is.na(F1), Column3, F1),
         F2 = if_else(is.na(F2), Column4, F2)) %>%
  filter(!is.na(as.numeric(time))) %>%
  select(-c(Column1, Column2, Column3, Column4)) %>%
  mutate(recording = gsub("formants|\\.xlsx", "", file)) %>%
  # Extract participant id from file name
  mutate(participant = str_extract(file, "\\d")) %>%
  mutate(participant = paste0("p", str_pad(participant, pad = "0", width = 2))) %>%
  select(-file) %>%
  mutate(time = as.double(time),
```

```
        F1 = as.double(F1),
        F2 = as.double(F2))



### All data
# Join formants with stress_neutr data by time stamp interval
stress_neutr_formants <- stress_neutr %>%
  left_join(formants, join_by(recording,
                              participant,
                              tmin <= time,
                              tmax >= time))
stress_neutr_formants <-  stress_neutr_formants %>%
  group_by(recording) %>%
  select(-c("word.x", "stress.x", "stress right", word_class, time, file, start, end)) %>%
  rename("stress" = "stress.y",
         "word" = "word.y")

write.csv(stress_neutr_formants, " tidy_data.csv", row.names=FALSE)
```

G. The script for the data visualizations

```
library(tidyverse)

dir_path <- "Neutralization and stress position experiment/"

df <- read.csv(paste0(dir_path, "tidy_data.csv"))

#Joining the data of stress match and which syllable was stressed in Norwegian and English in target words
stress_match <- read.delim("stress_match.tsv")
stress_num <- read.delim("stress_number.tsv")

tidy_data <- df %>%
  mutate(datapoint = consecutive_id(participant, word, repetition)) %>%
  mutate(freq = case_when(
    condition=="target" ~ str_extract(word_frequency, "(.*)(\\/)(.*)", group=1),
    .default = str_extract(word_frequency, "(.*)(\\/)(.*)", group=3)
  )) %>%
  mutate(freq = as.numeric(freq),
         log_freq = log10(freq)) %>%
  mutate(stress_correct = factor(stress_correct),
         condition = factor(condition),
         neutralization = factor(neutralization)) %>%
  mutate(proficiency = case_when(
    level=="A1" ~ 0,
    level=="A2" ~ 1,
    .default = 2
  )) %>%
  drop_na(word_frequency) %>%
  mutate(rel_freq = case_when(
```

```
    word_frequency < median(freq) ~ "low",
    .default = "high"
  )) %>%
  mutate(rel_freq = factor(rel_freq, levels=c("low", "high"))) %>%
  drop_na(neutralization) %>%
  left_join(stress_match, by = join_by(rus_orthographic)) %>%
  left_join(stress_num, by = join_by(rus_orthographic)) %>%
  mutate(stress_same = case_when(
    match %in% c("L1", "L2") ~ "yes",
    .default = "no"
  )) %>%
  mutate(stress_interference = case_when(
    stress == nor_number & stress == eng_number  ~ "L1=L2",
    stress != eng_number & stress == nor_number ~ "L1",
    stress == eng_number & stress != nor_number ~ "L2",
    .default = "other"
  )) %>%
  mutate(stress_same = factor(stress_same))

stress <- tidy_data %>%
  slice(1, .by = datapoint)

###NEUTRALIZATION###

neutr_per_part <- df %>%
  drop_na(neutralization)

#show the percentage of correct and incorrect reduction cases for all the participants
ggplot() +
  geom_bar(neutr_per_part, mapping = aes(x = neutr_condition, fill = neutralization), position
= "fill") +
```

```
  scale_y_continuous(labels = scales::percent_format()) +
  labs(y="", x="", fill="Reduction\ncorrect") +
  theme_minimal(base_size=14)

#get the reduction of only target words
neutr_target <- neutr_per_part[neutr_per_part$neutr_condition == 'target',]

#plot the percentage of the cases when the reduced phonemes from target words were pronounced
#correctly/incorrectly per participant
ggplot() +
  geom_bar(neutr_target, mapping = aes(x = phones, fill = neutralization), position = "fill") +
  scale_y_continuous(labels = scales::percent_format()) +
  labs(y="", x="", fill="Reduction\ncorrect") +
  facet_wrap(~participant, scales = "free") +
  theme_minimal(base_size=14)

#number of cases when the reduced phoneme in target words was pronounced correctly/incorrectly for all participants
ggplot() +
  geom_bar(neutr_target, mapping = aes(x = phones, fill = neutralization), position = "fill") +
  scale_y_continuous(labels = scales::percent_format()) +
  labs(y="", x="", fill="Reduction\ncorrect") +
  theme_minimal(base_size=14)

#same procedures go for the control words
#In both cases the "ɪ" is non-reduced most of the times, meaning it's hard to pronounce "e" in one of its reduced versions
neutr_control <- neutr_per_part[neutr_per_part$neutr_condition == 'control',]
ggplot() +
  geom_bar(neutr_control, mapping = aes(x = phones, fill = neutralization), position = "fill")
+
```

```
  scale_y_continuous(labels = scales::percent_format()) +
  labs(y="", x="", fill="Reduction\ncorrect") +
  facet_wrap(~participant, scales = "free") +
  theme_minimal(base_size=14)

ggplot() +
  geom_bar(neutr_control, mapping = aes(x = phones, fill = neutralization), position = "fill")
+
  scale_y_continuous(labels = scales::percent_format()) +
  labs(y="", x="", fill="Reduction\ncorrect") +
  theme_minimal(base_size=14)

#Now I want to see if the non-reduced vowels' articulation is similar to the stressed vowels
#So we leave only stressed and the phonemes that were not reduced by the participants
neutr_stressed <- df %>%
  mutate(neutralization = coalesce(neutralization, "stressed"))

no_neutr_stressed <- subset(neutr_stressed, neutralization != "yes" & phones != "V" &
phones != "æ")

#Calculate the mean value of every phoneme
no_means <- no_neutr_stressed %>%
  group_by(phoneme) %>%
  summarize(mean_F1 = mean(F1),
            mean_F2 = mean(F2))

#Plot the range of every phoneme
#Interestingly, the "ɐ" and "ə" are indeed pronounced more likely to the stressed "o" as
expected
#however, the "ɪ" articulation is more like stressed "e", and "ɛ" is rather closer in articulation
to "i"
ggplot(no_neutr_stressed, aes(x = F2, y = F1, color = phoneme, label = phoneme)) +
```

```
  #geom_point() +
  coord_cartesian(xlim = c(2700,700), ylim = c(800,250)) +
  stat_ellipse(level = 0.67, geom = "polygon", alpha = 0.1, aes(fill = phoneme)) +
  geom_label(data = no_means, aes(x = mean_F2, y = mean_F1)) +
  scale_x_reverse() +
  scale_y_reverse() +
  scale_color_discrete() +
  theme_minimal() +
  theme(legend.position = "none")


#The number of times when the words that were pronounced incorrectly by participants (all the cases of
#incorrect reduction is summed up, so if the participant made 1 or 4 mistakes in a particular word,
#it counts as 1). There are words that all the participants made mistakes in and, vice versa, almost no mistakes
no_neutr_target <- neutr_target %>%
  filter(neutralization == "no")


no_neutr_target_n_per_every_participant <- no_neutr_target %>%
  group_by(word, participant) %>%
  summarize(count = n_distinct(phones), .groups = "drop") %>%
  group_by(word) %>%
  count() %>%
  arrange(desc(n)) %>%
  ungroup() %>%
  subset(word != "kreaivnost")


x <- data.frame(word = c("admiral"),
                n = c(0))
no_neutr_target_n_per_every_participant <- rbind(no_neutr_target_n_per_every_participant, x)
```

```
no_neutr_control <- neutr_control %>%
  filter(neutralization == "no")

no_neutr_control_n_per_every_participant <- no_neutr_control %>%
  group_by(word, participant) %>%
  summarize(count = n_distinct(phones), .groups = "drop") %>%
  group_by(word) %>%
  count() %>%
  arrange(desc(n)) %>%
  ungroup() %>%
  rename(control_word = 1, n_control = 2)

no_neutr <- cbind(no_neutr_target_n_per_every_participant,
no_neutr_control_n_per_every_participant)

# Reduction data subset
neutr <- tidy_data %>%
  filter(!is.na(neutralization))

# You can get this distribution in numbers (looking at target items only)
with(neutr, table(neutralization, condition))

# Chi-square test based on condition and reduction
with(neutr, table(neutralization, condition)) %>%
  chisq.test()

# Plot the reduction accuracy with frequency added
neutr %>%
  ggplot() +
  geom_bar(aes(x=fct_rev(condition), fill=neutralization), position="fill") +
```

```
  scale_y_continuous(labels=scales::percent_format()) +
  labs(x="Condition", y="", fill="Reduction\ncorrect") +
  facet_wrap(~fct_rev(rel_freq))

###STRESS###

# You can see that the new stress matching categorization is quite impactful!
stress %>%
  ggplot() +
  geom_bar(aes(x=stress_same, fill=stress_correct), position="fill") +
  scale_y_continuous(labels=scales::percent_format()) +
  labs(x="Stress same as L1/L2", y="", fill="Correct stress") +
  facet_grid(~fct_rev(condition), scales="free", space = "free")

# You can get this distribution in numbers (looking at target items only)
with(filter(stress, condition=="target"), table(stress_same, stress_correct))

# ... and even pipe it to a Chi-square test!
with(filter(stress, condition=="target"), table(stress_same, stress_correct)) %>%
  chisq.test()

# Here it is cross-tabulated with relative frequency (high or low)
stress %>%
  ggplot() +
  geom_bar(aes(x=stress_same, fill=stress_correct), position="fill") +
  scale_y_continuous(labels=scales::percent_format()) +
  labs(x="Stress same as L1/L2", y="", fill="Correct stress") +
  facet_grid(fct_rev(rel_freq)~fct_rev(condition), scales="free", space = "free")

# You could look at the frequency separately here
```

```
with(filter(stress, condition=="target"), table(stress_correct, rel_freq))

# ... and run a chi-square test
with(filter(stress, condition=="target"), table(stress_correct, rel_freq)) %>%
  chisq.test()

stress %>%
  filter(condition=="target" & stress_correct=="no") %>%
  add_count(word) %>%
  ggplot() +
  geom_bar(aes(x=fct_reorder(word, n), fill=stress_interference)) +
  labs(x="n", y="", fill="Stress matches") +
  coord_flip() +
  labs(y="n", x="")

stress %>%
  filter(stress_correct=="no") %>%
  add_count(word) %>%
  ggplot() +
  geom_bar(aes(x=fct_reorder(word, n), fill=stress_interference)) +
  coord_flip() +
  labs(x="", y="n", fill="Stress matches") +
  facet_wrap(~condition, scales="free")

stress %>%
  filter(condition=="target" & stress_correct=="no") %>%
  slice(1, .by = c(participant, word)) %>%
  add_count(word) %>%
  ggplot() +
  geom_bar(aes(x=fct_reorder(word, n), fill=stress_interference)) +
```

```
  coord_flip() +
  labs(x="", y="Participants", fill="Stress matches")


stress %>%
  filter(stress %in% as.character(1:6)) %>%
  filter(stress_correct=="no") %>%
  filter(condition=="control") %>%
  ggplot() +
  geom_bar(aes(x=stress, fill = stress)) +
  labs(x="Stressed syllable", y="n") +
  facet_wrap(condition~syllable_number, scales="free")
```

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